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About the University

New Jersey Institute of Technology

Welcome to New Jersey Institute of Technology. As the state’s public polytechnic university, we continue to invest in the renewal of our existing facilities in addition to adding new spaces, with the goal of providing an exceptional teaching, learning and living environment.

Continuing a fourfold mission of instruction, research, economic development and public service, NJIT is among the leading comprehensive polytechnic universities in the nation. With well over 11,000 students, NJIT is the largest technological university in the New York metropolitan region.

The university has state-of-the-art facilities with more than 2 million square feet located on a 48-acre campus in Newark, and a solar observatory in Big Bear Lake, California. With robust distance education programs, NJIT's degree and non-degree programs are available throughout the world.

Learning at NJIT

NJIT, a top-ranked public research university, offers undergraduate and graduate students over 125 degree programs ranging from the STEM disciplines to architecture and design, as well as management and humanities.

Our interdisciplinary approach to learning offers students the ability to study in fields beyond their major. We continue to invest in our faculty and facilities so that our students learn in state-of-the-art classrooms and have access to the latest technology in our labs.

NJIT’s research is founded on collaboration with students, faculty, staff, external researchers, and partners. We are committed to providing interdisciplinary research and scholarship with the utmost professional integrity.

Our six colleges enroll more than 11,400 students, preparing them for the workplace as well as continuing on to advanced degrees.

Our extensive Continuing Professional Education programs and online courses offer important training for professionals already on the job, and our competitive industry internships help land you one of your own.

NJIT, Rutgers-Newark and Rutgers University Biomedical and Health Sciences (RBHS), New Jersey's university of the health sciences, offer 10 joint master's or doctoral degree programs, placing them as leaders in development of programs to prepare individuals for a world increasingly multidisciplinary and technological in nature.

Each year, thousands of students from NJIT, Rutgers-Newark and Rutgers University Biomedical and Health Sciences take courses at the institutions.

Our Campus Community

Our campus has doubled in size in the past decade to include new residence halls, a 190,000-square-foot Campus Center, a $102 million Wellness and Events Center and the $19 million state-of-the-art Life Sciences and Engineering Center.

NJIT is located in Newark, New Jersey's largest city. Newark is also New Jersey's cultural and economic capital, boasting performance spaces, professional sports, great food, and five other nearby colleges. We're also 20 minutes by train to New York City.

We also have remarkable students from all over the world, and are ranked #1 nationally for student upward economic mobility (*The New York Times*). NJIT gives you more than a world-class education. It gives you a community. The friends and contacts you'll make at NJIT, whether in one of over 130 student clubs and organizations (not including Greeks), or in dozens of community service projects, will enhance your life and impact your future.

Academic Calendar

Fall 2022 Academic Calendar

Month	Day	Day of Week	Description
September	5	Monday	Labor Day, University Closed
September	6	Tuesday	First Day of Classes
September	12	Monday	Last Day to Add/Drop a Class
September	12	Monday	Last Day for 100% Refund, Full or Partial Withdrawal
September	13	Tuesday	W Grades Posted for Course Withdrawals
September	19	Monday	Last Day for 90% Refund, Full or Partial Withdrawal - No Refund for Partial Withdrawal after this date

October	3	Monday	Last Day for 50% Refund, Full Withdrawal
October	24	Monday	Last Day for 25% Refund, Full Withdrawal
November	14	Monday	Last Day to Withdraw from Classes
November	22	Tuesday	Thursday Classes Meet
November	23	Wednesday	Friday Classes Meet
November	24	Thursday	Thanksgiving Recess Begins (No Classes)
November	26	Saturday	Saturday Classes Meet
November	27	Sunday	Thanksgiving Recess Ends
December	14	Wednesday	Last Day of Classes
December	15	Thursday	Reading Day
December	16	Friday	Final Exams Begin
December	22	Thursday	Final Exams End
December	24	Saturday	Final Grades Due

Spring 2023 Academic Calendar

Month	Day	Day of Week	Description
January	16	Monday	Martin Luther King, Jr. Day
January	17	Tuesday	First Day of Classes
January	21	Saturday	Saturday Classes Begin
January	23	Monday	Last Day to Add/Drop a Class
January	23	Monday	Last Day for 100% Refund, Full or Partial Withdrawal
January	24	Tuesday	W Grades Posted for Course Withdrawals
January	30	Monday	Last Day for 90% Refund, Full or Partial Withdrawal - No Refund for Partial Withdrawal after this date
February	13	Monday	Last Day for 50% Refund, Full Withdrawal
March	6	Monday	Last Day for 25% Refund, Full Withdrawal
March	13	Monday	Spring Recess Begins - No Classes Scheduled - University Open
March	18	Saturday	Spring Recess Ends
April	3	Monday	Last Day to Withdraw
April	7	Friday	Good Friday - No Classes Scheduled - University Closed
April	9	Sunday	Easter Sunday - No Classes Scheduled - University Closed
May	2	Tuesday	Friday Classes Meet
May	2	Tuesday	Last Day of Classes
May	3	Wednesday	Reading Day 1
May	4	Thursday	Reading Day 2
May	5	Friday	Final Exams Begin
May	11	Thursday	Final Exams End
May	13	Saturday	Final Grades Due
May	16	Tuesday	MTSM & NCE Master's Commencement - WEC 10 A.M.
May	16	Tuesday	HCAD, CSLA, & YWCC Master's Commencement - WEC 1:30 P.M.

May	16	Tuesday	Ph.D. Hooding Ceremony - WEC 4 P.M.
May	19	Friday	Undergraduate Commencement - Prudential Center 9 A.M.

Accreditation

New Jersey Institute of Technology is accredited by the Middle States Commission on Higher Education, 3624 Market Street, Philadelphia, PA 19104. (267-284-5000) The Middle States Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

Most of NJIT's eligible professional programs, both graduate and undergraduate, are accredited by the respective accrediting agency for their field. Addresses and telephone numbers for all of these accrediting agencies are listed below.

Details about the accreditation of specific programs are included in the descriptions of those degrees.

NJIT is currently undergoing reaccreditation and should receive formal notification from the Middle States Commission on Higher Education by June of 2022. The university's last accreditation was in 2012.

Accreditation timeline (https://www.njit.edu/strategicplan/planning-accreditation-timeline/)

ABET
(CAC of ABET) Computing Accreditation Commission of ABET
(EAC of ABET) Engineering Accreditation Commission of ABET
(TAC of ABET) Technology Accreditation Commission of ABET
111 Market Place, Suite 1050
Baltimore, MD 21202
Tel. (410) 347-7700

AACSB International
777 South Harbour Island Boulevard
Suite 750
Tampa, FL 33602-5730
Tel. (813) 769-6500

Middle States Commission on Higher Education
3624 Market Street
Philadelphia, PA 19104
Tel. (215) 662-5606

National Architectural Accrediting Board, Inc. (NAAB)
1735 New York Avenue, NW
Washington, DC 20006
Tel. (202) 783-2007

Directory

Faculty at NJIT

Governing Boards

Board of Trustees

The NJIT Board of Trustees (p. 11) is the legal governing body of the university appointed by the governor and confirmed by the state senate.

Board of Overseers

The NJIT Board of Overseers (p. 12) serves as the governing body for the Foundation at NJIT and provides a key advisory link with a wide range of organizations in the business community.

Boards of Visitors

NJIT Advisory Boards (p. 15) serve in an advisory capacity to departments and programs, offering guidance on issues ranging from curricular matters to recruitment efforts to marketing activities.

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Steven Annunziato ’82
Financial Advisor
Merrill Lynch, Pierce, Fenner & Smith, Inc.

Siddhartha Bala ‘96H
Head of Product Management/Strategy, Public Cloud
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Atham P. Dhawan, Ph.D. ’77, ’79, ’85
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Vice President and District Manager
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J. Robert Hillier ‘17HON
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Sonya Kakkar, Ph.D.
Regional Quality head, Biotech Operating Unit
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Retired Executive, ExxonMobil Corporation

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Executive Vice President (Ret.)
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Robert Medina ’75
Founder
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BD

Advisory Boards

Newark College of Engineering

Emilio Sanchez '94
Stryker Orthopaedics

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Retired, CDPHP

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Bowman Consulting

Robert C. Cohen '83, '84, '87
Stryker Corp.

Jerry D'Alessio, Ph.D., '93, '95, '16
Stryker Orthopaedics

Angelo Del Russo '82
Del-Sano Contracting Corp.

Alfred A. De Seta '84, '86
Robin Hood Ventures

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Newark College of Engineering

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Retired, Mott MacDonald Group NA,

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Raia Capital Management

Joseph Stanley, P.E. '78, '85
Mott MacDonald Group NA,

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Weiss-Aug Group

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Neglia Engineering Associates

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Memorial Sloan Kettering Cancer Center

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Romolo Marcucci
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Bill Quinn
Johnson & Johnson

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Steve Rubin

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Goldman Sachs

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Clarke Caton Hintz

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J. Robert Hillier, FAIA, '17(HON)
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Aivars E. Krumins '75

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Senior Vice President for Real Estate Development and Capital Operations
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Matthew Golden, Ed.D.
Chief Communications and Marketing Officer,
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Faculty

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Ph.D. Operations Research, New York University, 1980
Diploma, National Planning Institute, Cairo, 1970
B.S., Cairo University, 1969

Abdi, Ali
Professor of Electrical and Computer Engineering (2001)
Ph.D., University of Minnesota, 2001
M.S., University of Teheran, 1996
B.S., University of Science and Technology, 1991

Abdou, George
Associate Professor of Mechanical and Industrial Engineering (1993)
Ph.D. Industrial Engineering, Iowa State University, 1987
M.S., Iowa State University, 1983
B.S., Helwan University, Cairo, 1977

Abichandani, Pramod
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Ph.D. Electrical and Computer Engineering, Drexel University, 2011
M.S. Electrical and Computer Engineering, Drexel University, 2007
B.E. Instrumentation and Controls Engineering, Nirma Institute of Technology, 2005

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Ph.D., Moscow Institute of Physics and Technology, 1988
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B.Sc., Moscow Institute of Physics and Technology, 1983

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Ph.D. Civil Engineering, Oregon State University, 2015
B.S. Civil Engineering, University of New Hampshire-Main Campus, 2015
M.S., Oregon State University, 2014
M.S. Civil Engineering, Oregon State University, 2012

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Ph.D. Mechanical Engineering, University of Toronto, 2007
M.S., University of Science and Research, Iran, 2007
B.S., Azad University of Tehran, Iran, 2007

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M.S. Structural Engineering, Sharif University of Technology, 2012
B.S. Civil Engineering, Sharif University of Technology, 2009

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B.B.A., Shahjalal University of Science & Technology, 2013

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B.S. Electronics and Communications, Technical University of Istanbul, 1980

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M.S., University of Guilan, Mechanical Engineering, 2010
Ph.D., University of Wyoming, Mechanical Engineering, 2015

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B.S. Electrical Engineering, Rutgers University-New Brunswick, 1994

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Diploma, FHM Munich University of Applied Sciences, 2000

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Ph.D., University of Michigan, 2010
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M.S. Mechanical Engineering, Iran University of Science and Technology, 2009
B.S. Mechanical Engineering, Sharif University of Technology, 2006

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D.Sc. Physics and Mathematics, Karpov Institute of Physical Chemistry, 2007
Ph.D. Chemical and Environmental Engineering, Moscow State University, 2004
M.S. Computer Science, New Jersey Institute of Technology, 2003
B.S. Computer Information Systems, SUNY, 2002

Porus, Jonathan J.
Director of Mathematics Tutoring

Potocki-Dul, Magdallena M.
University Lecturer, Mathematical Sciences (2012)

Qerimaj, Jertishta
University Lecturer of Computer Science (2019)
M.S. Computer Science, New Jersey Institute of Technology, 2002
B.S. Computer Science, New Jersey Institute of Technology, 2001

Rabie, Mohammad A.
University Lecturer, Engineering Technology (2014)

Rahman, Sahidur
University Lecturer, Engineering Technology (2010)
Ph.D. Mechanical Engineering, New Jersey Institute of Technology
M.S. Mechanical Engineering, New Jersey Institute of Technology
B.S. Mechanical Engineering, Regional Engineering College, India

Raj, Ratna
University Lecturer, Electrical and Computer Engineering (2014)
Master of Technology Power Electronics and Electrical Machines/Drives, Indian Institute of Technology, 1996
B.E. Electrical Engineering, BIT, 1992

Rankin, Rees B.
Lab Director, Department of Chemical & Materials Engineering

Rappaport, Karen D.
Senior University Lecturer, Mathematical Sciences (2004)
Ph.D., New York University, 1975
M.S., New York University, 1968
B.A., University of Pennsylvania, 1966

Reid, Nellone
Senior University Lecturer of Chemical & Materials Engineering (2018)

Riismandel, Kyle
Senior University Lecturer, History (2012)
Ph.D.

Rittenhouse, Michele R.
Producer and Creative Director, Humanities (1974)

Ratnaswamy, Jeyakumaran
Senior University Lecturer

Ro, Je Hyun
University Lecturer, Mathematical Sciences (2017)
M.S. Pure Mathematics, CUNY City College, 2014
B.A. Education, Hanyang University, 2003

Roman, Max
Director of Bio-Medical Engineering MS Program

Rutkowski, Wallace
Senior University Lecturer, Computer Science (2000)
Ph.D., University of Maryland, 1981
M.S., Stevens Institute of Technology, 1974
B.S., Stevens Institute of Technology, 1974

Ryan, Gerard W.
Senior University Lecturer, Computer Science (2012)

Ryduchowski, Michal
Professor of Practice

Samardzic, Veljko
University Lecturer, Mechanical and Industrial Engineering (2012)
Ph.D.

Santos, Stephanie R
University Lecturer, Civil and Environmental Engineering (2012)

Schesser, Joel
Senior University Lecturer, Biomedical Engineering (2004)
Ph.D., City University of New York, 1976
M.E., City University of New York, 1971
B.E., City University of New York, 1968

Schmidt, Donivyn C.
University Lecturer, Mathematical Sciences (2017)
M.S. Applied Mathematics, New Jersey Institute of Technology, 2014
B.A. Mathematics, William Paterson University of New Jersey, 2009

Schoenitz, Mirko
Associate Research Professor of Chemical and Materials Engineering (2001)
Ph.D., Princeton University, 2001
M.A., Princeton University, 1997
Diploma, RWTH Aachen, 1995

See, Adam
University Lecturer of Humanities (2019)
Ph.D., Philosophy, CUNY Graduate School and University Center, 2019
M.A., Philosophy and Humanities, Columbia University in the City of New York, 2010
B.A., Philosophy and English, University of Guelph, 2008

Senesy, Stanley J.
Senior University Lecturer, Information Technology (2001)
M.S., New Jersey Institute of Technology, 2000
B.A., McKendree College, 1994

Sequeira, Marc T.
University Lecturer, Information Technology (2002)
B.S., New Jersey Institute of Technology, 2002

Shen, Yao
University Lecturer Computer Science (2019)
Ph.D. Computational Chemistry, University of Notre Dame, 2011
M.S. Computer Science and Engineering, University of Notre Dame, 2011
B.S. Interdisciplinary training in Mathematics, Physics and Biology, Nanjing University DII:, 2004

Shneidman, Vitaly A.

Senior University Lecturer, Physics (1999)
Ph.D., Physico-Technological Institute of Metals and Alloys, 1987
M.S., Kharkov State University, 1979
B.S., Kharkov State University, 1977

Siemann, Catherine A.
University Lecturer, Humanities (2014)
Ph.D. English and Comparative Literature, Columbia University in the City of New York, 2008
J.D., New York University, 1988
B.A. English Literature, SUNY at Binghamton, 1983

Sieminska, Katarzyna M.
University Lecturer Mathematical Sciences (2012)
M.S. Statistics, Montclair State University, 2009
B.S. Mathematics, Montclair State University, 2007

Skotak, Maciej
Assistant Research Professor of Biomedical Engineering (2013)
Ph.D. Chemistry, Institute of Physical Chemistry, 2004
M.A. Chemistry, University of Podlasie, 1999

Slovis, Jake R.
Senior University Lecturer

Sodhi, Jaskirat S.
University Lecturer, Mechanical and Industrial Engineering (2014)
Ph.D. Mechanical Engineering, New Jersey Institute of Technology
B.S. Aeronautical Engineering, Punjab University

Soto Chavez, Angel R.
Assistant Research Professor, Center for Solar Research (2015)
Ph.D. Physics, The University of Texas at Austin, 2010
Diploma High Energy Physics, ICTP, 2003
B.S. Electrical Engineering, Universidad de San Carlos de Guatemala, 2001

Spirollari, Junilda
Senior University Lecturer, Computer Science (2007)
M.S., New Jersey Institute of Technology, 2003
B.S., New Jersey Institute of Technology, 2002

Stanko, Maria L.
Senior University Lecturer, Federated Biology (2010)
Ph.D.

Statica, Robert
Senior University Lecturer, Information Technology (1998)
M.S., New Jersey Institute of Technology, 2000
B.S., New Jersey Institute of Technology, 1996

Steele, Timothy W.
University Lecturer, Electrical and Computer Engineering (2012)

Surjanhata, Herli
Senior University Lecturer, Mechanical and Industrial Engineering (1988)
M.S., New Jersey Institute of Technology, 1984
B.S., Triskati University, 1976

Taher, Rima
Senior University Lecturer, Architecture and Design (1989)
Ph.D., Ecole Nationale des Ponts et Chaussees, 1986
M.S., Ecole Nationale des Ponts et Chaussees, 1983
B.S., Institut National des Sciences Appliquees de Lyon, 1982

Tamke, William R.
Senior University Lecturer (2016)

MBA Marketing, Rutgers University
MBA Finance, Rutgers University
B.S. Mathematics, St Peter's University

Thomson, Susan E.
Senior University Lecturer, Computer Science (2017)
Ph.D. Computer Science, University of Cambridge
M.S. Computer Science, University of Witwatersrand
B.S. Computer Science, University of Witwatersrand

Toegel, Matthew
University Lecturer Informatics (2019)
M.S. Information Systems, New Jersey Institute of Technology, 2014
B.S. Information Technology, New Jersey Institute of Technology, 2013

Tolboom, Ryan
University Lecturer Informatics (2019)
M.S. Computer Science, New Jersey Institute of Technology, 2019
B.S. Computer Science, New Jersey Institute of Technology, 2004

Tyrol, Katherine A
Senior University Lecturer

Vaish, Prabhat K
Senior University Lecturer

Varadarajan, Ravi
Professor of Practice Computer Science (2020)
Ph.D. Computer Science, University of Pennsylvania, 1987
M.S. Industrial Engineering, The University of Texas at Arlington, 1979
B.E. University of Madras, 1978

Varsik, John R.
Research Professor of Physics (1997)
Ph.D., University of Hawaii, 1987
M.S., University of Hawaii, 1981
B.S., Stanford University, 1979

Ward, Peter J.
University Lecturer, Mathematical Sciences (2017)
M.S. Mathematics, Ohio State University, 2012
B.A. Mathematics, Rutgers University, 2010

Watrous-deVersterre, Lori L.
Senior University Lecturer, Information Technology (2010)

Wells, Louis A.
University Lecturer, Humanities (2010)
M.F.A. Directing, Rutgers University, Mason Gross School of Arts, 2005
B.F.A. Acting, University of Central Missouri, 1998

Wendell, Augustus E.
University Lecturer, Architecture and Design (2009)

Wiggins, John
Senior University Lecturer, Engineering Technology (1993)

Williams, Keith A.
University Lecturer, Information System (2007)

Wolf, John M.
University Lecturer, Humanities (2012)
Ph.D.

Zhang, Xi
Senior University Lecturer, Management

Ph.D., Business Data Science, NJIT, 2022
M.B.A., NJIT, 2014
B.S. Economics, Xiamen University, 2012

Xu, Yan
Research Professor of Physics (2008)
Ph.D.

Yarotsky, John J.
University Lecturer, Federated Biology (2014)

Yurchyshyn, Vasyl
Research Professor of Physics (1998)
Ph.D., Main Astronomical Observatory, Kiev, Ukraine, 1998
M.A., L'viv Ivan Franko State University

Zaleski, Joseph
University Lecturer, Mathematical Sciences (1989)
M.S., New Jersey Institute of Technology, 1990
B.S., Rutgers University, 1982

Research Centers and Labs

Research is an integral part of a strong academic experience and a critical priority in NJIT's 2025 Strategic Plan. The university aims for national and international prominence in research through new discoveries in areas ranging from medical sensors and devices to robotics, to nanotechnology, to cybersecurity, to next-generation materials, among other topics of vital importance in basic, applied and translational research.

The 150 new faculty members we have hired over the past five years strengthen our efforts considerably. They include experts on topics such as biomedical sciences and engineering, sensors, energy, novel materials, machine learning, data analytics, and virtual reality. They arrive with impressive track records in securing grants from key funding agencies such as the National Science Foundation, the National Institutes of Health, the Department of Energy, and the U.S. Department of Defense. We are confident that their participation in our multidisciplinary centers will help NJIT reach its ambitious external funding benchmarks that has already more than doubled over the last five years.

To achieve our research and educational goals, the university's strategic plan calls for seamless multidisciplinary and transdisciplinary research collaborations and technology innovation-based entrepreneurship among faculty, staff and students, who all have a central part to play in advancing science, engineering and technology to fuel societal progress. NJIT's nexus of core research facilities involving York Center, Life Sciences and Engineering Center and Microfabrication Innovation Center is designed to accelerate game-changing collaborations with new teaching and research labs, rooms to conduct projects and common areas where faculty and students can socialize and share ideas.

The NJIT's 2025 Research Strategic Plan organizes five research clusters of high significance and societal impact aligned with the global trends in science and technology research and development. Comprised of core and transdisciplinary basic, applied and translational research interests, the five clusters in NJIT research enterprise include:

- Bioscience and Bioengineering (https://centers.njit.edu/research-areas/bioscience-and-bioengineering/)
- Data Science and Management (https://centers.njit.edu/research-areas/data-science-and-management/)
- Environment and Sustainability (https://centers.njit.edu/research-areas/environment-and-sustainability/)
- Material Science and Engineering (https://centers.njit.edu/research-areas/material-science-and-engineering/)
- Robotics and Machine Intelligence (https://centers.njit.edu/research-areas/robotics-and-machine-intelligence/)

Undergraduate Catalog

NJIT offers 122 degree programs (http://www.njit.edu/academics/degrees/) through six professional schools and colleges. You can double major, design an interdisciplinary major, opt for an accelerated bachelor's or master's degree program, and cross-register at nearby schools such as Rutgers University–Newark (http://www.newark.rutgers.edu/).

Academic Policies and Procedures

Registration

NJIT has an advance self-registration system that obligates all students currently enrolled in undergraduate degree programs to register in advance for their courses. Registration is required each semester for courses offered in the next academic session (fall, winter, spring, summer). Students are advised according to the curriculum for their major, as outlined in the degree program listing in the undergraduate catalog. Students are required to meet with their academic advisor prior to registration; an advisor hold on registration will be removed with advisor authorization only.

All students register online via Highlander Pipeline (http://my.njit.edu). An approved registration guarantees class seats until the first class meeting. Students who do not attend the first class meeting may lose their place in class.

The Office of the Registrar is located in the Student Mall, on the ground floor of the parking facility. During the Fall and Spring semesters, the office is open Monday, Tuesday, Thursday, and Friday from 8:30 am to 4:30 pm and Wednesday, 8:30 am to 6:00 pm.

Currently Enrolled Students

Currently enrolled students are informed of registration procedures via their NJIT email account for the fall and spring semesters by the Office of the Registrar during March and October respectively, and must then register during the advance registration period. Instructions for the summer session are provided with the fall registration materials. Priority registration is provided to Veteran and service member students. Please contact the Office of Military/ Veteran Students to confirm eligibility.

New and Readmitted Students

The Office of University Admissions informs prospective and readmitted students of registration procedures.

Non-Matriculated Students

Non-matriculated students should contact the Office of University Admissions for details of admission and registration procedures at least one month before the date of intended enrollment. Extension and distance learning students should contact the Division of Continuing and Professional Education.

Auditing a Course

Students who wish to audit a course must state their intention to do so at the time of registration. Change in auditing status is not permitted once a semester has begun. Students who audit are required to pay full tuition and fees for the course. Audited courses are not counted in determining full-time status. Students on probation are not permitted to audit.

Undergraduate Students Registration in Graduate Courses

Matriculated undergraduate students may register for graduate courses only in the final two semesters of their anticipated undergraduate degree completion, unless they are pursuing an accelerated baccalaureate/graduate dual degree program. Specifics are given in the below.

Undergraduate Registration in Graduate Courses as part of a Baccalaureate/Master's or Baccalaureate/PhD accelerated dual degree program

Undergraduate students who wish to take graduate level courses as part of a Baccalaureate/Master's or Baccalaureate/PhD accelerated dual degree program must formally apply through the Office of Admissions into one of the B.S./M.S, B.S./M.B.A., B.S./M.I.P, B.S./M.A.R, B.Arch./M.S., B.Arch./M.Arch., B.A./M.S., B.A./M.A. or B.S./Ph.D. Admission into an accelerated dual degree program is required before a student can enroll for a graduate course to be used as part of the program. If a student, admitted into an accelerated dual degree program, takes a graduate course as per the accepted application into the program and passes it with a grade of B or better, then the course applies towards both the undergraduate and graduate degree requirements. If a student admitted into an accelerated dual program takes a graduate course and passes it with a grade lower than B, then the course counts only towards fulfillment of the undergraduate degree requirements; this course – if required in the graduate program – will have to be repeated when the student is formally admitted to the graduate program.

Students enrolled in a baccalaureate/masters or baccalaureate/PhD accelerated dual degree program are billed at the undergraduate tuition rate for the classes allowed to fulfill accelerated dual degree requirements, irrespective of the grade received for the course. Graduate tuition rates will apply for additional graduate courses taken before completion of the undergraduate degree requirements. A graduate course cannot be repeated before the student completes the undergraduate degree requirements.

Once admitted into an accelerated dual degree program students must maintain a minimum cumulative GPA of either 3.0 (for BS/MS and all variations) or 3.5 (for BS/PhD and all variations) and achieve a grade of B or better in all graduate courses taken; failure to meet the foregoing conditions leads to the students losing admission into the dual program and they continue pursuing their undergraduate degree only. Additional provisions for the various accelerated dual degrees are given in the below.

Students admitted in accelerated dual degree programs still need to apply separately at a later time to get formal admission into the respective graduate program. Graduate courses are valid for up to seven years after having taken them as an undergraduate student in an accelerated dual degree program. For admission to the graduate program, the NJIT GER or GMAT requirements must be met as well.

BS/MS and BA/MA Criteria:

- Cumulative GPA of 3.0 or better for taking up to two courses in the BA/MA or BS/MS program
- Cumulative GPA of 3.5 or better for taking up to three courses in the BA/MA or BS/MS program

Before admission into an accelerated dual program, students must have at least junior standing or at least two full time semesters (24 credits) left before graduation, and at least five (5) major courses in the baccalaureate program completed

BArch/MS and BS/MBA Criteria:

- Cumulative GPA of 3.0 or better for taking up to four courses in the BArch/MS or BS/MBA program

Before admission into an accelerated dual program, students must have at least junior standing or at least two full time semesters (24 credits) left before graduation, and at least five (5) major courses in the baccalaureate program completed

BS/PhD and BA/PhD Criteria:

- Cumulative GPA of 3.5 or better for taking up to four courses in the BS/PhD or BA/PhD program
- Students must meet with the Vice Provost for Graduate Studies (go to the Contact Us (https://www.njit.edu/graduatestudies/contact.php) page to request an appointment) after receiving approval from the PhD academic advisor

Before admission into a BS/PhD or BA/PhD program, students must have at least junior standing or at least two full time semesters (24 credits) left before graduation, and at least five (5) major courses in the baccalaureate program completed

Accelerated dual degree program students who wish to take 500-level courses (500-G for Architecture) or 600-level courses must obtain written approval of the graduate advisor for the program that offers the course, their undergraduate advisor, and the Vice Provost for Graduate Studies via submission an UNDERGRADUATE STUDENTS TAKING GRADUATE COURSES AS PART OF A JOINT DEGREE (https://www.njit.edu/registrar/sites/njit.edu.registrar/files/lcms/forms/pdf/Approval%20for%20BSMS%20Courses_2020.pdf) form.

Undergraduates are not permitted to take 700-level courses, except in rare cases requiring explicit approval with justification from the Vice Provost for Graduate Studies.

The courses taken as part of an accelerated dual program will be considered as undergraduate credits for billing and financial aid purposes.

Undergraduate Registration in Graduate Courses (not part of a joint Baccalaureate/Master’s or Baccalaureate/PhD accelerated dual degree program)

Undergraduate (not in an accelerated dual degree) students in the final two semesters of their anticipated degree completion may opt to take up to three graduate courses, provided their cumulative GPA is at least 2.8. Successful completion of these graduate courses will not count towards their undergraduate degree requirements, will be billed at the graduate tuition rate, and cannot be covered by either an undergraduate scholarship award or financial aid.

Permission to take graduate credits as an undergraduate student cannot be viewed as guaranteeing admission into the graduate program. A student (not in an accelerated dual program) is allowed to take only a maximum of nine graduate credits (3 courses) before completion of their undergraduate degree.

Undergraduate students in an accelerated dual degree program, who have successfully completed the graduate courses allowed to be counted towards both their undergraduate and graduate degree, may in the last semester of their anticipated baccalaureate degree completion take up to three additional graduate courses. Successful completion of these additional graduate courses will not count towards their undergraduate degree requirements, will be billed at the graduate tuition rate, and cannot be covered by either an undergraduate scholarship award or financial aid. Before completion of the undergraduate portion of their dual degree, students cannot take more than three graduate courses beyond what their accelerated dual degree program allows for.

*Undergraduate students who wish to take 500-level courses (500-G courses for Architecture) or 600-level courses must obtain written approval of the graduate advisor for the program that offers the course and their undergraduate advisor via submission of an "*Approval for Undergraduates

Taking Graduate Courses *(*https://www.njit.edu/registrar/sites/njit.edu.registrar/files/lcms/forms/pdf/Approval%20for%20Undergraduates%20Taking%20Graduate%20Courses_2020.pdf*)" form.*

Course Additions and Schedule Changes

Students who add a course to their program will be charged the full tuition and fee for the course added. All schedule changes are completed via Highlander Pipeline ***(***http://my.njit.edu***).***

Courses cannot be added after the fifth day of the semester. Students cannot receive credit for courses if they are not registered. Attendance in a class without proper registration for that class is not permitted.

Withdrawal from Courses

Students who wish to withdraw from courses should first determine if the withdrawal would have an impact on full-time status, financial support, or academic standing and progress. They should consult their advisor in advance.

Students wishing to withdraw from courses may do so without academic penalty by the end of the tenth week of the semester only via ***Highlander Pipeline***. Failure to do so will result in grades other than W.

Discontinued attendance or verbal approval to withdraw alone will not result in a W and most likely will instead result in an undesirable final grade.

Withdrawing from courses does not necessarily lead to a refund and students should consult with their academic and financial aid advisor on the issue before they actually withdraw.

Withdrawal from NJIT

Students wishing to withdraw entirely from the university may do so without penalty by the end of the ninth week of the semester via ***Highlander Pipeline***. Failure to do so will result in grades other than W.

Withdrawing entirely from NJIT does not necessarily lead to a refund and students should consult with their academic and financial aid advisor on the issue before they actually withdraw.

Detailed information on Withdrawal policies can be found at the following link:

https://www.njit.edu/registrar/registration/

Continuity of Registration

A student must register each fall and spring semester continuously from the semester in which first registered until the semester in which graduated. Students who are voluntarily not taking classes, temporarily unable to attend class for one or more terms, or who have been granted a leave of absence will comply with this requirement by registering for "maintaining registration". Undergraduate students may maintain registration for a maximum of four main terms (fall and spring). Graduate students may maintain registration for a maximum of two main terms (fall and spring). Students are not required to maintain registration during summer or winter sessions.

Students who exceed the number of authorized maintaining registration terms or who allow their registration to lapse will have to apply for readmission on the same basis as new students, can be readmitted only with the consent of their department, and the university is under no obligation to readmit them. Students who are in academic suspension are an exception to this rule, and are governed by the policy on reinstatement after academic suspension.

Continuity of Registration – Veteran and Active Duty Students
A student must register each fall and spring semester continuously from the semester in which first registered until the semester in which graduated. Students who are voluntarily not taking classes, temporarily unable to attend class for one or more terms, or who have been granted a leave of absence will comply with this requirement by registering for "maintaining registration". Undergraduate students may maintain registration for a maximum of four main terms (fall and spring). Graduate students may maintain registration for a maximum of two main terms (fall and spring). Students are not required to maintain registration during summer or winter sessions.

Students who exceed the number of authorized maintaining registration terms or who allow their registration to lapse will have to apply for readmission on the same basis as new students, can be readmitted only with the consent of their department, and the university is under no obligation to readmit them. Active duty students or students who are deployed while enrolled at the University will not have to apply for readmission if their deployment exceeds the maximum number of terms, or who are unable to maintain matriculation due to service requirements. Students who are in academic suspension are an exception to this rule, and are governed by the policy on reinstatement after academic suspension. The policy associated with academic suspension applies to all students, including veteran and active service members.

Maintenance of Registration

Students enrolled in a degree program who find it necessary to temporarily discontinue their studies are permitted to maintain registration for a fee each semester they do not register. International students on F-1 and J-1 visa status may not maintain registration unless they have obtained prior written permission from the Office of International Students and the Office of Graduate Studies.

Students who maintain registration are emailed registration notices for the following semester and are not required to reapply for admission. To maintain registration, students must register for "Maintaining Registration" via ***Highlander Pipeline***.

Each semester, in which registration is maintained, is counted in the total time period allotted to complete degree requirements except for students with an approved leave of absence.

An undergraduate student may not opt for ‘maintaining registration” status for more than 4 consecutive academic semesters per leave from the university.

Responsibility for Registration

NJIT emails notices in advance to NJIT student email accounts. Students are expected to obtain all necessary information and comply with all registration procedures on time. New international students are only permitted to register after attending the required international student orientation program. Students who receive financial support must be in attendance at NJIT.

Course Cancellations

Courses listed in this catalog are offered at the discretion of each offering department. When there is inadequate registration for a course, it may be cancelled without notice. The registrar or academic department will attempt to notify all students of course cancellations before the first meeting of the semester.

Room Changes

Room and laboratory changes are noted in the online schedule maintained by the registrar via ***Highlander Pipeline***.

Curriculum Change Procedure

If a curriculum is revised after a student has been admitted, the student has the option of pursuing the revised curriculum or the curriculum in place at the time of admission. The decision to follow the revised curriculum must be made no later than the end of the academic year in which the revised curriculum becomes operative.

Academic departments which are implementing curriculum changes should notify all students who will be affected by the changes to outline/explain these changes. Notification should be multi-faceted (i.e., letters, announcements on homepages, meetings with groups of students, announcements in class) to ensure wide dissemination of information. Bridge courses may be developed to facilitate a student’s switching to a revised curriculum.

Policy on Midterm and Final Exams

NJIT policy requires that all midterm and final exams must be proctored, regardless of delivery mode, in order to increase academic integrity. Note that this does not apply to essay or authentic based assessments. Effective beginning Fall semester 2019, students registered for a fully online course section (e.g., online or Hyflex mode) must be given the option to take their exam in a completely online format, with appropriate proctoring.

Final Exam Conflict Policy

In the event that three final exams are scheduled on the same day or that two exams are scheduled for the same hour of the same day, the following rules shall be used to resolve such conflicts:

Rule 1. Final examinations of courses with multiple sections taking a common final examination shall be taken during their regularly scheduled period.

If the conflict is not completely resolved by Rule No.1, then Rule No.2 shall be used to resolve the remaining conflict.

Rule 2. The final examination for a course of higher numerical value shall be taken during the regularly scheduled period. (e.g. ME 470 Engineering Properties of Plastics will be taken before ME 455 Automatic Controls or HIST 351 Ancient Greece and the Persian Empire).

If the conflict is still not completely resolved by Rules No.1 and 2, Rule No.3 shall be used to resolve the remaining conflict.

Rule 3. The final examinations of courses with the same numerical value (e.g. CE 210 Construction Materials and Procedures and PSY 210 Introduction to Psychology) shall be taken in alphabetical order of the prefix of the course number (e.g. CE 210 Construction Materials and Procedures during its regularly scheduled period and EE during some other period which is mutually convenient).

Once priority has been determined for the examination to be taken during its regularly scheduled period, the deferred examination may be taken during the conflict period at the end of all other examinations, with an evening section of the course, or by special arrangement between the instructor and the student; if that arrangement does not create another conflict for the student.

Credit For Courses Not Taken At NJIT

Registration at Another College

Students in good standing at NJIT wishing to take courses at a college or university[1] other than those included in the cross-registration program must:

1. Obtain an Approval for Courses at other Colleges Form (https://www.njit.edu/registrar/sites/njit.edu.registrar/files/lcms/forms/pdf/Approval%20for%20Undergraduate.pdf) from the Registrar's office.
2. Obtain approval from the NJIT department giving the comparable course prior to enrolling in the course. Be prepared to show the department advisor a catalog description of the course(s) you intend to take.
3. Have the form countersigned by the registrar and your home department retain one copy. Registrar will retain original and send a copy to the NJIT department involved.
4. Take the copy to host college and follow their registration procedure.
5. Upon completion of the course(s), arrange to have an official transcript sent from the host college to the NJIT Registrar. Upon receipt, transfer credit will be posted to your NJIT transcript provided the grade earned is a "C" or higher.
6. Courses completed at another college other than "cross-registered courses" will not be factored in the calculation of the NJIT semester but they may apply to the NJIT Undergraduate Course Repetition Policy (p. 94).
7. Summer classes may be taken at Rutgers-Newark or Essex County College only if the course(s) is (are) not offered at NJIT during the summer.
8. Calculus I and II (equivalents of MATH 111 Calculus I, MATH 112 Calculus II, MATH 113 Finite Mathematics and Calculus I) may be taken in the summer at other colleges/universities where the duration of the summer course is eight (8) weeks or more.
9. Physics I and II (equivalents of PHYS 111 Physics I and PHYS 121 Physics II) may be taken in the summer at other colleges/universities where the duration of the summer courses is six (6) weeks or more.
10. Throughout a student's academic career at NJIT, a maximum of two (2) humanities or social science GER-equivalent courses may be taken at other colleges/universities during the summer. However, the capstone seminar in humanities and social science must be taken at NJIT.

[1] Exclusive of cross-registration at Rutgers-Newark College of Arts and Sciences, Essex County College, RBHS.

Cross-Registration Procedure

Matriculated NJIT students may cross-register for courses at Rutgers-Newark College of Arts and Sciences, Essex County College and at the Rutgers Biomedical and Health Sciences (RBHS). Eligible students who wish to do so should follow current procedures as described on the Registrar's website (http://www.njit.edu/registrar/).

Summer Students

The above procedure applies only to fall and spring undergraduate courses. For summer courses, a form entitled Permission to Take Courses at Other Colleges (https://www.njit.edu/registrar/sites/njit.edu.registrar/files/lcms/forms/pdf/Approval%20for%20Undergraduate.pdf) must be processed through the registrar's office and the student must pay the applicable tuition and fees to the host school.

Cross-Registration Rutgers Students

Rutgers students cross-registering for courses at NJIT must be matriculated in a degree-granting program on the Newark campus.

Transfer Credit

Undergraduate transfer credit may be awarded at the time of admission for courses that are equivalent to those offered by NJIT. These are based on transfer articulation agreements among the nineteen community colleges and NJ senior colleges and universities. The transfer articulations between NJIT and NJ community colleges can be found at http://www5.njit.edu/registrar/transfer/statewide-transfers.php**.** Information on how to transfer prior coursework to NJIT can be found at: https://www.njit.edu/admissions/how-credits-transfer (https://www.njit.edu/admissions/how-credits-transfer/)**.** NJIT does not have a specific credit limit for the number of credits that may be accepted for transfer. However, to be eligible for graduation, undergraduate students transferring into NJIT must complete at least 33 credits in upper division courses approved by the department of their major study. A minimum grade of C must be earned in the course in order to receive transfer credit. All transfer credit must be documented by an official transcript issued by the school where the course was completed. Students who have attended foreign institutions of higher education must also submit an evaluation of their work made by World Educational Services Inc. or another approved service. Students are required to submit course descriptions for all course work taken outside of the United Stated to the Registrar's Office. Further information regarding evaluations may be obtained from the Registrar's Office. Graduate students may transfer a maximum of nine credits, limited to coursework completed at a US or Canadian Institution.

Transfer Credit – Veteran and Active Duty Students

Undergraduate transfer credit may be awarded at the time of admission for courses that are equivalent to those offered by NJIT. These are based on transfer articulation agreements among the nineteen community colleges and NJ senior colleges and universities. The transfer articulations between NJIT and NJ community colleges can be found at http://www5.njit.edu/registrar/transfer/statewide-transfers.php**.** Information on how to transfer prior coursework to NJIT can be found at: https://www.njit.edu/admissions/how-credits-transfer (https://www.njit.edu/admissions/how-credits-transfer/)**.** NJIT does not have a specific credit limit for the number of credits that may be accepted for transfer. However, to be eligible for graduation, undergraduate students transferring into NJIT must complete at least 33 credits in upper division courses approved by the department of their major study. A minimum grade of C must be earned in the course in order to receive transfer credit. All transfer credit must be documented by an official transcript issued by the school where the course was completed. Students who have attended foreign institutions of higher education must also submit an evaluation of their work made by World Educational Services Inc. or another approved service. Students are required to submit course descriptions for all course work taken outside of the United Stated to the Registrar's Office. Further information regarding evaluations may be obtained from the Registrar's Office. For veterans and active duty military personnel transferring into NJIT as undergraduate students, an evaluation of the Joint Service Transcript (JST) is conducted by the respective academic departments to determine if, or how many, credits from the student’s military career are transferable to NJIT. Graduate students may transfer a maximum of nine credits, limited to coursework completed at a US or Canadian Institution.

Credit for AP Courses

Advanced placement credit can be given in certain cases; please refer to the appropriate section under Admissions.

Credit for Non-Traditional Learning

Students may be granted course credit for certain college-level knowledge acquired through non-traditional education such as independent study or job-related experiences. This credit may be granted for successfully passing selected DANTES or CLEP (College Level Examination Program) Subject Examinations, or, if credit is sought for advanced courses, by successfully passing a special departmental examination. Interested students should contact the Counseling Center for additional information about CLEP or DANTES examinations: (973) 596-3414. Students should contact the appropriate academic department for information about special departmental examinations. A fee is charged for these examinations.

Credits That Must Be Taken at NJIT

To be eligible for graduation, students transferring to NJIT must complete in residence at NJIT, at least 33 credits in upper division courses approved by the department of their major study.

Skills Testing

NJIT places prime importance on its students' ability to communicate. The ability to communicate effectively what has been learned in courses is essential, and so the university requires students to master the verbal skills necessary for writing and speaking clear, correct English. Appropriate developmental work may be assigned to students who do not demonstrate the mastery of these skills. To the extent appropriate to the course, instructors in all disciplines stress the importance of writing and speaking ability.

English as a Second Language (ESL)

Students whose first language is not English and/or whose English proficiency is limited will be required to take a special examination in English and enroll for the appropriate course in their first semester. Placement in the appropriate course (ENGL 090 General Skills in the English Language or the sequence HUM 099S-100S) is based on performance in the examination. Tutoring is a required part of these courses. Students will not be permitted to enroll in cultural history courses until they have achieved satisfactory grades in HUM 099S-100S (and ENGL 090 General Skills in the English Language , if required).

The ESL program offers a number of courses in the Humanities Department. These sections carry full academic credit and are designed to help students strengthen their English language proficiency while also mastering course content. Enrollment in the ESL section of a course is optional. ESL sections include HUM 211 The Pre-Modern World, HUM 212 The Modern World, HIST 213 The Twentieth-Century World, COM 313 Technical Writing, LIT 320 American Literature, and LIT 350 Fiction.

Freshman Placement

Upon deposit and completion of the math placement test, all freshmen will be placed in courses according to their major curriculum and based on standards established by specific departments (i.e. Humanities/English, Mathematics, Chemistry and Computer Science).

Transfer Testing

Transfer students who do not receive transfer credit for required first year courses in Humanities/English, mathematics, chemistry and/or computer science are required to take placement tests. The results will be used to make course placement decisions.

Professional Skills Examinations

NJIT actively participates in programs that assure the quality of education in all undergraduate majors. In some cases, this participation requires students to prepare and sit for professional examinations. In other cases, NJIT students are required to sit for examinations, especially during the sophomore and senior years. Since these examinations carry no credit, they are not specifically listed in the major curricula listed elsewhere in this catalog. Nonetheless, these proficiency examinations are part of degree requirements, and students selected to participate in such examinations are required to take them.

All students enrolled in an Accreditation Board for Engineering and Technology, Inc. (ABET) accredited engineering program at NJIT are required to take an assessment examination, the Basic Engineering Skills Test (BEST), in the junior or senior year. The examination is offered at the beginning of the fall and the spring semester. Taking the examination is a graduation requirement commencing with students entering Newark College of Engineering in Fall 2000.

Enrollment Status

Full-Time Students: Undergraduate students registered for 12 credits or more throughout an entire semester are considered full-time.

International students must maintain full-time status each semester.

Part-Time Students: Students registered for fewer than 12 credits during a semester.

Residency Policy for Undergraduate International Students

During the academic year, all undergraduate international students are required to live within commuting distance to campus, at the local address that they have reported to NJIT. Exceptions to the rule are:

1. A student is on a trip when the school is not in session (e.g. spring or summer breaks).
2. A student is away for academic reasons and with the permission of the student’s academic advisor.
3. A student has received NJIT’s official approval for out-of-state CPT and is registered in the CPT course.

International students who do not attend their classes and have regular face to face meetings with their academic advisors can be in violation of their F-1 status and therefore are at risk of having their SEVIS records terminated.

Attendance Policy

- All undergraduates are expected to attend all regularly scheduled classes. In the case of hybrid and fully online **classes, participation in discussion forums and other required online activities is expected**.
- Attendance, by itself, shall not constitute a basis for grading except for certain clearly designated courses. These courses include, but are not limited to, all Physics and Mathematics 100 and 200 level courses in which a student missing more than three classes may be required to withdraw.
- **Students who expect to miss classes or exams because of religious observance must submit to their instructors, by the end of the second week of classes, a written list of dates that will be missed. Students are expected to make up missed work. Faculty are expected to make reasonable attempts to accommodate students who are appropriately following this policy.**
- **Instructors are obligated to explain clearly, on all syllabi to be distributed at the beginning of each semester, what is expected of students in terms of activities such as class participation, reading assignments, and reports and how these activities factor into student grades.**
- Instructors are not obligated to make allowances for student absences unless those absences are due to illness or similarly unavoidable causes.
- When, in the opinion of the instructor, a student is jeopardizing the successful completion of the academic requirements of a subject due to excessive absences, the instructor will initiate an absence warning (Academic Warning Notice), which is to be sent to the student by the instructor.
- It is understood that this policy on attendance is intended to reinforce students’ personal responsibility to be present in class in order to:
  - Gain mastery of the subject matter, ideas, and techniques developed in the course.
  - Take examinations, tests and quizzes.
  - Participate in oral presentations, seminars, and field trips.
  - Participate in group activities such as laboratory experiments and study projects.
  - Remain fully informed as to class plans, announcements, and assignments.

(Effective Fall 2011)

Grades

The following grades will be used:

Grade	Description
A	Superior
B+	Excellent
B	Very Good
C+	Good
C	Acceptable
D	Minimum

F	Inadequate
AUD	Audit
I	Incomplete--given in rare instances to students who would normally have completed the course work but who could not do so because of special circumstances. It is expected that coursework will be completed during the next regular semester. If this grade is not removed before final grades are due at the end of the next regular semester, a grade of F will be issued.
W	Withdrawal
S	Satisfactory
U	Unsatisfactory

Satisfactory and Unsatisfactory

The grades S or U report progress in co-op, teaching methods, ESL and physical education courses. The grade of S is given for satisfactory progress and U is given for unsatisfactory progress. Students who fail to meet with their advisors or do not satisfy relevant attendance requirements will receive a U grade. Credits for courses in which U is received cannot count toward a degree.

Grade Reports

Students can view term grades along with their entire academic record via ***Highlander Pipeline***. The web term grade report is valid for employee tuition reimbursement if this benefit is available through the student's employer.

Grade Changes

Grade change requests will be accepted no later than the final grade due date the end of the subsequent semester.

Grade Disputes

Students are expected to resolve disputes about grades with their instructors. If they cannot reach a satisfactory settlement with their instructor, students are permitted to request the intervention of the chairperson of the department and the dean of the school or college.

Credit by Examination

Examinations to earn credit are available in certain courses. Students who believe they have the background covered in a given course should consult with their advisor and the department offering the course to see whether an examination is offered. To receive credit by examination, a student must perform at a level equivalent to a grade of "C" in the course. Students who have failed or attempted a course at NJIT may not take an examination for credit in that course. A fee will be charged for the examination.

Transcript of Grades

Students who wish to obtain a transcript issued on their behalf must submit a request via ***Highlander Pipeline***. Please allow 10 days to process the request. Transcripts will not be issued to or on behalf of a student with an outstanding financial obligation to the university. Official transcripts bearing the university's raised seal will be issued only to other educational institutions, government agencies, or employers.

Dean's List

Students matriculated in a regular program can qualify for academic honors at the end of the fall and spring semesters if they have completed 12 or more degree credits in the semester, achieved a GPA of 3.00 or better in the semester, and have no incomplete grades or any grade lower than a "C" in the semester. The Dean's List is posted on the student transcript.

Policy on Academic Standing for Undergraduate Students

Academic Standing

NJIT is committed to enabling its matriculated students to reach graduation in a timely fashion. The policies and procedures described here are meant to ensure that our students are aware of their academic status and receive the support they need to overcome any academic difficulties. If, after appropriate intervention from NJIT, a student fails to make progress towards graduation, NJIT is committed to helping the student make alternative academic plans in a timely manner.

Academic standing is determined for matriculated students only and is recorded on their academic transcripts. The policies and procedures governing academic standing are the same for all students (full-time, part-time, and transfer students).

A student’s academic standing at NJIT is determined twice a year, at the end of the fall and spring semesters after grades for the aforementioned semesters have been submitted. Academic standing is based on both the cumulative grade point average (CUM GPA) and the semester grade point average (TERM GPA) the student has earned. Any conditions associated with the academic standing determined at the end of a semester are effective for the next academic semester. Regardless of performance in courses that students may take during summer or winter sessions (which are not considered regular semesters), academic standing for such sessions is the one determined at the end of the immediately prior fall or spring semester in which students were enrolled in courses.

Students determined to be in any category other than Good Standing are notified via electronic mail of their academic standing

The categories of academic standing, along with the corresponding policies, are given below.

Good Standing

Students with TERM and CUM GPA of at least 2.0 are placed in Good Standing.

Academic Warning

Students are placed on Academic Warning in the following cases:

1. They have completed their first semester at NJIT with a TERM GPA of at least 1.75 but lower than 2.0, or
2. They have a TERM GPA lower than 2.0, a CUM GPA of at least 2.0, and have never previously had any academic standing other than Good Standing.

Students can be placed on Academic Warning only once during their studies at NJIT.

In the semester following the one in which they were placed on Academic Warning, students cannot attempt more than 15 credits and they must meet with their academic advisor as per the advisor’s specifications. If the student decides to take courses during the summer, the limit is 9 credits.

At the end of their first semester of enrollment after they have been placed on Academic Warning, students must earn a TERM (and CUM) GPA of at least 2.0 in order to be placed in Good Standing; otherwise, students are placed on Academic Probation.

Academic Probation

Students are placed on Academic Probation in the following cases:

1. They have completed their first semester at NJIT with a TERM GPA lower than 1.75, or
2. They have a TERM GPA lower than 2.0 and had been placed on Academic Warning in any prior semester at NJIT, or
3. They have a CUM GPA below 2.0 and have never previously had any academic standing other than Good Standing (this rule is not applicable to students who have just completed their first semester at NJIT with a TERM GPA of at least 1.75).

Students can be placed on Academic Probation only once during their studies at NJIT.

In the semester following the one in which they were placed on Academic Probation, students cannot attempt more than 14 credits, must meet with their academic advisor as per the advisor’s specifications, and must follow an improvement plan as per the advisor’s recommendations. The plan may include the use of resources such as academic support workshops provided by the Advising Success Center (ASC). If the student decides to take courses during the summer, the limit is 9 credits.

At the end of their first semester of enrollment after they have been placed on Academic Probation, students must earn a CUM (and TERM) GPA of at least 2.0 in order to be placed in Good Standing; otherwise, students are placed on Academic Pre-Suspension or Academic Suspension.

Academic Pre-Suspension

Students are placed on Academic Pre-Suspension if at the end of their first semester of enrollment after they have been placed on Academic Probation, have a TERM GPA of at least 2.0 but their CUM GPA is still below 2.0. Students on Academic Pre-Suspension are given the opportunity to attempt up to a total of 12 credits to achieve a CUM GPA of 2.0 and return to Good Standing. Attempted credits refer to those for which an actual letter grade was earned as well as those for which a W (Withdrawal) has been entered. Students on Academic Pre-Suspension are only allowed to attempt credits in courses that have been explicitly approved by their academic advisor. While on Academic Pre-Suspension, students must meet with their academic advisor as per the advisor’s specifications. Students on Academic Pre-Suspension are not allowed to register for courses offered in the winter session. If the student decides to take courses during the summer, the limit is 9 credits.

At the end of their first semester of enrollment after they have been placed on Academic Pre-Suspension, students must earn a CUM (and TERM) GPA of at least 2.0 in order to be placed in Good Standing. If they have attempted 12 credits and their TERM (and CUM) GPA is below 2.0, students are placed on Academic Suspension; if they have attempted less than 12 credits and achieved a TERM GPA of at least 2.0, students are placed again on Academic Pre-Suspension and given a final semester to attempt the remaining of the 12 advisor-approved credits and achieve a CUM GPA of at least 2.0.

Academic Suspension

Students are placed on Academic Suspension in the following cases:

1. They have either a TERM GPA or a CUM GPA lower than 2.0 and had been placed on Academic Probation in any of their prior semesters at NJIT, or
2. They have a TERM (and CUM) GPA lower than 2.0 at the end of a semester following one in which they were placed on Academic Pre-Suspension.

Students can be placed on Academic Suspension only once during their studies at NJIT.

Students placed on Academic Suspension are not permitted to enroll in courses at NJIT unless they are reinstated, as described below.

Academic Dismissal

Students who reach the point of Academic Suspension after reinstatement following their first Academic Suspension are permanently dismissed from the university. Academically dismissed students can neither be reinstated nor readmitted to the university under any circumstances.

Student Appeals

Students cannot appeal any decision on their academic standing except a decision to place them on Academic Suspension. Information on how to file an appeal following placement on Academic Suspension is provided in the notification sent (via electronic mail) to the students regarding their academic standing. The appeal documents must be submitted electronically and are reviewed by the Committee on Undergraduate Academic Standing. The Committee does not meet in person with students filing appeals and its decision is final. Students with successful appeals are placed on Academic Pre-Suspension. Students are notified of the Committee’s decision via electronic mail.

Reinstatement after Academic Suspension

Students who are suspended from the university may apply for reinstatement after a lapse of at least one fall or spring semester. Final decisions about applications for reinstatement are made by the appropriate academic department on the basis of its written policy, after students have met with an academic advisor.

Extenuating Circumstances

The university continues to make every effort to protect students’ academic and personal information. Moreover, maintaining the confidentiality of students’ medical information is a legal and ethical duty, as defined by federal and state laws and regulations, and by the courts. Whenever students have a situation that affects their academic standing, it should be brought to the Dean of Students. This includes medical or psychological documentation to support a student’s claim. Students should not bring such information to their instructors, nor should it be requested by a faculty member. The Dean of Students has a physician and staff psychologists to evaluate such information to verify its legitimacy. The Dean of Students will then notify the faculty member(s) if a student has a legitimate absence and will ask that the student receive consideration in making up any missed course work or exam. This process ensures confidentiality of students’ information and, just as important, consistency in dealing with such matters.

Undergraduate Course Repetition Policy

An NJIT student may take a single course no more than four times at NJIT and/or another institution, including withdrawals. If an undergraduate course is repeated at NJIT, then the lowest of the grades is excluded in computation of the cumulative GPA and all other grades are included. All grades are shown on the student's transcript. In the case where the student passes the course by earning transfer credit, only the lowest letter grade (B, C, D, or F) is excluded from the GPA calculation.

Change of Major

Students seeking change of major must submit a Change of Major form to the Registrar, with signature approvals from the student's current and new department representatives. For students with an approved change of major, grades in all courses that are not applicable to students’ new majors, as determined by the new advisor, are excluded from the cumulative grade calculation. The new recalculated GPA will be in effect at the end of the semester in which the student transfers. Advisors arbitrate which classes can apply to new major. **(Effective Summer 2011)**

Class Standing

A student's class/year standing is determined by the number of course credits earned: first year standing, 0--28 credits; sophomore standing, 29--56 credits; junior standing, 57--90 credits; and senior standing, 91+ credits.

Graduation

New Jersey Institute of Technology is authorized to grant degrees by the Commission on Higher Education. Each degree is certified by a diploma bearing the university seal and the signatures of officers of the university.

Candidates for graduation who satisfactorily complete a regular undergraduate program receive the bachelor's degree in the program pursued. Each prospective candidate for any degree must file an application for graduation on or before the deadline date set by the university.

In order to graduate, students must attain a cumulative grade point average of 2.0 in all the courses listed in the catalog as being required in the appropriate curriculum. They must also earn a cumulative GPA of 2.0 in the upper division course requirements of their major as determined by the academic department offering the major.

Additive credit courses will be excluded from the calculation of the cumulative GPA requirements for graduation.

NJIT holds its annual commencement exercises in May of each year. Graduates who obtain their degree at any of the 3 degree dates (August, January or May) are encouraged to participate.

Credits That Must Be Taken at NJIT

To be eligible for graduation, students transferring to NJIT must complete in residence at NJIT, at least 33 credits in upper division courses approved by the department of their major study.

Graduation with Academic Honors

The academic honors of cum laude (GPA of 3.400--3.649), magna cum laude (GPA of 3.650-3.849), and summa cum laude (GPA of 3.850--4.00) are awarded to qualified students at graduation. Note that to be eligible for academic honors, students must complete a minimum of 60 credits in residence at NJIT, with at least 33 credits in upper division courses, counting towards their degree at NJIT.

The NJIT Presidential Medal is awarded to all graduating undergraduates with a grade of A in all courses taken at NJIT or transferred into NJIT that are counted toward degree requirements. To be eligible for the Presidential Medal, students must complete a minimum of 60 credits at NJIT, with at least 33 credits in upper division courses.

Expiration of Credit

For all degrees, course credits normally expire ten years after completion of the semester in which they were earned. Expired course credits cannot be used to fulfill degree requirements and must be replaced by current course credits. Students may apply to the department which offered the course or which approved the transfer of course credit for an extension of these course credits.

Student Privacy Concerns

Consistent with the Family Educational Rights to Privacy Act (FERPA), NJIT allows for the release of directory information, which includes a student's preferred name. If a student does not want their directory information disclosed to external organizations or persons, they can select "Do NOT show my profile". Members of the NJIT community can however view ones directory information through the "Advanced Search" function. Students can log into the Directory via http://directory.njit.edu (http://directory.njit.edu/).

Students may also request to withhold disclosure of directory information altogether. New Jersey Institute of Technology assumes that failure on the part of any student to specifically request in writing preventing the disclosure of directory information indicates individual approval of disclosure.

NJIT Policy for Recording Classes **(**https://www5.njit.edu/registrar/njit-policy-recording-classes/**)**

https://www5.njit.edu/registrar/njit-policy-recording-classes/

Policies for Online Courses

In any given semester, there are two types of online courses, ***Virtual Campus*** and ***Newark Campus***:

- Enrollment in ***Virtual Campus*** courses is restricted to ***Virtual Campus*** students.
- Enrollment in ***Newark Campus*** online courses is restricted to ***Newark Campus*** students.

Virtual Campus Online Courses

Enrollment in ***Virtual Campus*** courses is restricted to ***Virtual Campus*** students. ***Virtual Campus*** students are those who are accepted, at the time of admission, to a fully online program (the program is what matters, not whether a student has been taking all online courses).

Virtual Campus students (in-state, out-of-state, international attending from abroad) are eligible for eTuition provided that all of their courses, in a given semester, are offered online through the ***Virtual Campus***.

Virtual Campus students who wish to register for courses that are not part of the ***Virtual Campus*** will need to either:

1. Officially apply for a change of campus (this can only be completed once), or
2. Obtain special permission from the home department.

Please note that ***Virtual Campus*** students who take courses that are not part of the ***Virtual Campus,*** will lose their eligibility for eTuition for that semester and for all courses they take.

- For more information about NJIT's online programs, please visit online.njit.edu (https://www.njit.edu/academics/degrees/#/?tab=degree&degree_offerings=online).
- Questions on changing campus should be addressed to the Registrar's Office

Newark Campus Online Courses

NJIT offers a number of online courses that can be taken by students who are normally enrolled in face-to-face courses offered on the main Newark campus. These online courses are identified as ***Newark Campus*** courses on the course schedule.

Newark Campus students are those who are accepted, at the time of admission, to a program that requires in-person attendance. ***Newark Campus*** students are not eligible to register for ***Virtual Campus*** courses.

Online courses that are identified as ***Newark Campus*** are not eligible for eTuition. eTuition is only available to ***Virtual Campus*** students.

International students who have been admitted to ***Newark Campus programs*** can take as many ***Newark Campus*** online courses as the federal policies allow for. The Office of Global Initiatives can be consulted about the allowed number.

Preferred Name Policy*

NJIT recognizes that students may wish to be addressed by a name other than their legal name to identify themselves. For this reason, the university now allows students to apply for a preferred name where reasonably possible in the course of university business and education.

In order to initiate this process, a student must submit a Preferred Name Change form with the Office of the Registrar; the application of a preferred name may only be requested once an academic year and must be completed at least one week before the start of the next academic semester. Depending on time of application, it may take several days for the preferred name to appear on university rosters.

Once a preferred name application has been approved, students may proceed to use the preferred name to identify themselves. Please note that some records may require the use of legal names only, such as Financial Aid and/or medical documentation. Students who are utilizing a preferred name should always be prepared to reference their legal name as well as provide their college identification when necessary.

NJIT reserves the right to decline or revoke an approved preferred name on the grounds the preferred name may be used for criminal or misrepresentation purposes, may be harmful to the reputation or interests of NJIT, and/or conveys inappropriate or offensive language or meaning. In the rare circumstance when a denial is made, the student may appeal the decision in writing to the Registrar. The Registrar will provide the appeal to the Dean of Students and Campus Life to reconsider the request and the denial. Abuse or misuse of this policy and process may result in disciplinary action under the Code of Student Conduct.

Students requesting a preferred name under the age of 18 must submit written permission from a parent/legal guardian in addition to a Preferred Name Change form.

Note: Students who have completed a legal name change must fill out a Request to Change Student Name (https://www.njit.edu/registrar/sites/njit.edu.registrar/files/lcms/forms/pdf/LegalNameChange2018.pdf) form with the Office of the Registrar.

Preferred Name Will Appear:*

- Athletic Team Rosters
- Online directory
- Class rosters
- Commencement programs
- Dean’s List
- Library Records
- Learning Management System
- Residence Life Rosters
- Student ID Card
- Email display name

** Implementation of these functions may vary*

Legal Name Will Appear:

- Financial Aid and Billing Records and Communication
- Official and Unofficial Transcripts
- Paychecks & Paystubs

- Registrar's Office Records (i.e., permanent student file records)
- Study Abroad (i.e., travel documents, signature documents)
- Some official forms or correspondence from the University such as financial aid awards, residence life contracts, departmental or program notices, new hire forms, etc.
- Transfer credit evaluation
- Tax Records
- Diplomas and certifications
- Medical records
- Admissions records
- Disciplinary records
- Law enforcement records

ID Cards

NJIT recognizes it may be important to students for the NJIT Photo Identification Card to reflect ones preferred name. Approved students may request a new ID card with your preferred name from Facility Systems, Photo Identification and Parking Services Department located in the Laurel Hall Annex, on 141 Summit Street (at the corner of Summit and Warren Streets). A one-time $25 ID printing fee will be waived for approved students.

Gender Identity

In addition to a preferred name, students may request their legal gender (i.e., male, female) be removed from their student record.

Process and Implementation

Beginning fall 2018, the university will launch the initial use of the Preferred Name policy as described above. Updates will be communicated to the campus community as the necessary changes are complete to support continued implementation.

Frequently Asked Questions

What is a preferred name?

A "preferred name" is the name other than ones legal name that the student has indicated the desire to be identified by. A "legal name" is the name recorded on the student's legal identification (i.e., passport, birth certificate, Social Security card) and used on official NJIT records.

Are there any Preferred Name restrictions?

NJIT reserves the right to decline or revoke an approved Preferred Name if the preferred name may be used for criminal or misrepresentation purposes may be harmful to the reputation or interests of NJIT, and/or conveys inappropriate or offensive language/meaning.

When/why will NJIT departments/personnel continue to use my legal name?

NJIT departments, offices, and/or personnel often must use appropriate identification of students' legal name to conduct university business and functions (i.e., sending reports to federal, State, and other government agencies that require legal identity verification). Students utilizing a preferred name should always be prepared to reference their legal name as well as provide university identification when necessary.

How long will it take for my preferred name registration to take effect?

Depending on the time a preferred name application was submitted to the Office of the Registrar, it may take several business days for the preferred name to begin appearing on certain university rosters. NJIT does not guarantee the preferred name will appear in all locations or in all circumstances.

What if I've already received identification with my legal name only?

Students who have already received identification with legal names only may apply for new identification reflecting the approved preferred name.

Will background checks include preferred names?

Students who register a preferred name must be aware that preferred names are required to be disclosed in certain circumstances, including during background checks and other legal processes. The university is under a continued responsibility to report such names even after a student has discontinued use of the preferred name.

Degree Programs

College	Department	Degree Level	Discipline	Special Degree Options
SL	Mathematics	Master's	Applied Mathematics - M.S.	
SL	Mathematics	Bachelor's	Applied Mathematics and Applied Physics - B.S.	Double Major (p. 452)
SL	Physics	Bachelor's	Applied Physics - B.S. (p. 474)	
SL	Physics	Master's	Applied Physics - M.S.	
SL	Physics	Doctoral	Applied Physics - Ph.D.	
SL	Humanities	Master's	Applied Science - M.S.	
SL	Mathematics	Master's	Applied Statistics - M.S.	
AD	Architecture	Master's	Architecture (professional or post-professional) - M.Arch. and Civil Engineering - M.S.	Double Major
AD	Architecture	Master's	Architecture (professional or post-professional) - M.Arch. and Infrastructure Planning - M.I.P.	Double Major
AD	Architecture	Master's	Architecture (professional or post-professional) - M.Arch. and Management - M.S.	Double Major
AD	Architecture	Bachelor's	Architecture - B.Arch. (p. 165)	
AD	Architecture	Bachelor's	Architecture - B.Arch. and Civil Engineering - M.S.	B.S./M.S. (p. 171)
AD	Architecture	Bachelor's	Architecture - B.Arch. and Infrastructure Planning - M.I.P.	B.S./M.S. (p. 178)
AD	Architecture	Bachelor's	Architecture - B.Arch. and Management - M.S.	B.S./M.S. (p. 175)
AD	Architecture	Bachelor's	Architecture - B.Arch. and Technology - M.B.A.	B.S./M.S.
AD	Architecture	Bachelor's	Architecture - B.S. (p. 155)	
AD	Architecture	Bachelor's	Architecture - B.S. and Civil Engineering - M.S.	B.S./M.S. (p. 159)
AD	Architecture	Bachelor's	Architecture - B.S. and Infrastructure Planning - M.I.P.	B.S./M.S. (p. 163)
AD	Architecture	Bachelor's	Architecture - B.S. and Management - M.S.	B.S./M.S. (p. 161)
AD	Architecture	Bachelor's	Architecture - B.S. and Technology - M.B.A.	B.S./M.S. (p. 157)
AD	Architecture	Master's	Architecture - M.Arch.	
AD	Architecture	Master's	Architecture - M.S.	
SL	Chemistry & Environmental Sci.	Bachelor's	BioChemistry - B.S. (p. 347)	
SL	Mathematics	Master's	BioStatistics - M.S.	
CC	Computer Science	Master's	Bioinformatics - M.S.	
SL	Biology	Bachelor's	Biology - B.A. (p. 313) • Cell Biology (p. 333) • Ecology and Evolution (p. 336) • Neurobiology (p. 338)	
SL	Biology	Bachelor's	Biology - B.A./D.M.D.,O.D.	Accelerated (p. 323)
SL	Biology	Bachelor's	Biology - B.A./M.D. (p. 320)	Accelerated
SL	Biology	Bachelor's	Biology - B.A./Physical Therapy Ph.D.	Accelerated (p. 327)
SL	Biology	Bachelor's	Biology - B.A./Physician Assistant	Accelerated (p. 330)
SL	Biology	Bachelor's	Biology - B.S. (p. 316)	
SL	Biology	Master's	Biology - M.S.	
SL	Biology	Doctoral	Biology - Ph.D.	
SL	History	Bachelor's	Biology and Law, Technology and Culture - B.A	Double Major (p. 398)
SL	Mathematics	Bachelor's	Biology and Mathematical Sciences - B.S.	Double Major (p. 459)
SL	Biology	Master's	Biology of Health - M.S.	
EN	Bio-Medical Engineering	Bachelor's	Biomedical Engineering - Accelerated B.S. (p. 539)	
EN	Bio-Medical Engineering	Bachelor's	Biomedical Engineering - B.S. (p. 525)	
EN	Bio-Medical Engineering	Master's	Biomedical Engineering - M.S.	

College	Department	Degree Level	Discipline	Special Degree Options
EN	Bio-Medical Engineering	Doctoral	Biomedical Engineering - Ph.D.	
CC	Informatics	Bachelor's	Business & Information Systems - B.S. (p. 237)	
CC	Informatics	Master's	Business & Information Systems - M.S.	
SM	Management	Bachelor's	Business - B.S. (p. 671) • Accounting (p. 672) • Finance (p. 673) • Innovation and Entrepeneurship (p. 673) • Management Information Systems (p. 673) • Marketing (p. 674)	
SM	Management	Doctoral	Business Data Science - Ph.D.	
EN	Chemical and Materials Engr	Bachelor's	Chemical Engineering - B.S. (p. 547)	
EN	Chemical and Materials Engr	Master's	Chemical Engineering - M.S.	
EN	Chemical and Materials Engr	Doctoral	Chemical Engineering - Ph.D.	
SL	History	Bachelor's	Chemistry & Law, Technology and Culture - B.S.	Double Major (p. 403)
SL	Chemistry & Environmental Sci.	Bachelor's	Chemistry - B.S. (p. 351)	
SL	Chemistry & Environmental Sci.	Master's	Chemistry - M.S.	
SL	Chemistry & Environmental Sci.	Doctoral	Chemistry - Ph.D.	
EN	Civil & Environmental Engr	Bachelor's	Civil Engineering - B.S. (p. 563)	
EN	Civil & Environmental Engr	Master's	Civil Engineering - M.S.	
EN	Civil & Environmental Engr	Doctoral	Civil Engineering - Ph.D.	
SL	Humanities	Bachelor's	Communication and Media - B.A. (p. 428)	
SL	Humanities	Bachelor's	Communication and Media - B.S. (p. 431)	
EN	Electrical & Computer Engr.	Bachelor's	Computer Engineering - B.S. (p. 577)	
EN	Electrical & Computer Engr.	Master's	Computer Engineering - M.S.	
EN	Electrical & Computer Engr.	Doctoral	Computer Engineering - Ph.D.	
CC	Computer Science	Bachelor's	Computer Science - B.A. (p. 214)	
CC	Computer Science	Bachelor's	Computer Science - B.S. (p. 216)	
CC	Computer Science	Master's	Computer Science - M.S.	
CC	Computer Science	Doctoral	Computer Science - Ph.D.	
CC	Computer Science	Bachelor's	Computer Science and Applied Physics - B.S.	Double Major (p. 218)
CC	Computer Science	Bachelor's	Computer Science and Mathematical Sciences, Applied Mathematics - B.S.	Double Major (p. 219)
CC	Computer Science	Bachelor's	Computer Science and Mathematical Sciences, Computational Mathematics - B.S.	Double Major (p. 222)
CC	Computer Science	Bachelor's	Computing and Business - B.S. (p. 221)	
CC	Computer Science	Master's	Computing and Business - M.S.	
EN	SAET-Built Env, Division	Bachelor's	Concrete Industry Management - B.S. (p. 647)	
EN	Civil & Environmental Engr	Master's	Critical Infrastructure Systems - M.S.	

College	Department	Degree Level	Discipline	Special Degree Options
CC	Computer Science	Master's	Cyber Security and Privacy - M.S.	
SL	Humanities	Bachelor's	Cyberpsychology - B.S. (p. 433)	
CC	Data Science	Bachelor's	Data Science - B.S. (p. 254)	
CC	Computer Science	Master's	Data Science - Computational Track M.S.	
SL	Mathematics	Master's	Data Science - Statistics Track M.S.	
AD	School of Art & Design	Bachelor's	Digital Design - B.A. (p. 189)	
AD	Architecture	Master's	Digital Design - M.S.	
EN	Electrical & Computer Engr.	Bachelor's	Electrical Engineering - B.S. (p. 583)	
EN	Electrical & Computer Engr.	Master's	Electrical Engineering - M.S.	
EN	Electrical & Computer Engr.	Doctoral	Electrical Engineering - Ph.D.	
EN	Mechanical & Industrial Engr	Master's	Engineering Management - M.S.	
EN		Master's	Engineering Science - M.S.	
EN	SAET-Elec. & Mech. Division	Bachelor's	Engineering Technology, Computer Technology - B.S. (p. 620)	
EN	SAET-Built Env, Division	Bachelor's	Engineering Technology, Construction Engineering Technology - B.S. (p. 640)	
EN	SAET-Built Env, Division	Bachelor's	Engineering Technology, Construction Management Technology - B.S. (p. 643)	
EN	SAET-Elec. & Mech. Division	Bachelor's	Engineering Technology, Electrical and Computer Engineering Technology - B.S. (p. 623)	
EN	SAET-Elec. & Mech. Division	Bachelor's	Engineering Technology, Manufacturing Engineering Technology - B.S. (p. 626)	
EN	SAET-Elec. & Mech. Division	Bachelor's	Engineering Technology, Mechanical Engineering Technology - B.S. (p. 628)	
EN	SAET-Elec. & Mech. Division	Bachelor's	Engineering Technology, Medical Informatics Technology - B.S. (p. 631)	
EN	SAET-Built Env, Division	Bachelor's	Engineering Technology, Surveying Engineering Technology - B.S. (p. 645)	
EN	SAET-Eng. Edu Division	Bachelor's	Engineering Technology, Technology Education - B.S. (p. 652)	
EN	Civil & Environmental Engr	Master's	Environmental Engineering - M.S.	
EN	Civil & Environmental Engr	Doctoral	Environmental Engineering - Ph.D.	
SL	Chemistry & Environmental Sci.	Bachelor's	Environmental Science - B.S. (p. 352)	
SL	Chemistry & Environmental Sci.	Master's	Environmental Science - M.S.	
SL	Chemistry & Environmental Sci.	Doctoral	Environmental Science - Ph.D.	
SM	Management	Bachelor's	Financial Technology - B.S. (p. 674)	
SL	Chemistry & Environmental Sci.	Bachelor's	Forensic Science - B.S. (p. 354)	
EN	*Office of the Dean (NCE)	Bachelor's	General Engineering - B.S. (p. 609)	
EN	Mechanical & Industrial Engr	Master's	Healthcare Systems Management - M.S.	
SL	History	Bachelor's	History - B.A. (p. 384)	
SL	History	Bachelor's	History - B.A./D.P.T.	Accelerated (p. 369)
SL	History	Bachelor's	History - B.A./J.D.	Accelerated (p. 371)

College	Department	Degree Level	Discipline	Special Degree Options
SL	History	Bachelor's	History - B.A./M.D., D.M.D., D.D.S., O.D.	Accelerated (p. 373)
SL	History	Master's	History - M.S.	
CC	Informatics	Bachelor's	Human-Computer Interaction - B.S. (p. 240)	
AD	School of Art & Design	Bachelor's	Industrial Design - B.S. (p. 193)	
EN	Mechanical & Industrial Engr	Bachelor's	Industrial Engineering - B.S. (p. 600)	
EN	Mechanical & Industrial Engr	Master's	Industrial Engineering - M.S.	
EN	Mechanical & Industrial Engr	Doctoral	Industrial Engineering - Ph.D.	
CC	Informatics	Bachelor's	Information Systems - B.A. (p. 233)	
CC	Informatics	Master's	Information Systems - M.S.	
CC	Informatics	Doctoral	Information Systems - Ph.D.	
CC	Informatics	Bachelor's	Information Technology - Accelerated B.S. and J.D.	Accelerated (p. 232)
CC	Informatics	Bachelor's	Information Technology - B.S. (p. 242)	
CC	Informatics	Master's	Information Technology and Administration Security - M.S.	
AD	School of Art & Design	Bachelor's	Interior Design - B.A. (p. 192)	
EN	Electrical & Computer Engr.	Master's	Internet Engineering - M.S.	
SL	History	Bachelor's	Law, Technology and Culture - B.A. (p. 386)	
SL	History	Bachelor's	Law, Technology and Culture -B.A./J.D	Accelerated (p. 376)
SM	Management	Master's	Management - M.S.	
SM	Management	Master's	Management of Technology - M.B.A.	
EN	Mechanical & Industrial Engr	Master's	Manufacturing Systems Engineering - M.S.	
AD	Architecture	Master's	Master of Fine Arts in Digital Design - M.F.A	
EN	Chemical and Materials Engr	Bachelor's	Materials Engineering Program - B.S. (p. 553)	
SL	Physics	Master's	Materials Science and Engineering - M.S.	
EN	Chemical and Materials Engr	Master's	Materials Science and Engineering - M.S.	
SL	Physics	Doctoral	Materials Science and Engineering - Ph.D.	
EN	Chemical and Materials Engr	Doctoral	Materials Science and Engineering - Ph.D.	
SL	Mathematics	Bachelor's	Mathematical Sciences - B.S. • Mathematical Biology (p. 463) • Mathematics of Finance and Actuarial Science (p. 465) • Applied Mathematics (p. 448) • Applied Statistics and Data Analysis (p. 450) • Computational Mathematics (p. 457)	
SL	Mathematics	Bachelor's	Mathematical Sciences - B.S./M.D.	Accelerated
SL	Mathematics	Bachelor's	Mathematical Sciences - B.S./M.D., D.M.D., D.D.S., O.D.	Accelerated (p. 446)
SL	Mathematics	Doctoral	Mathematical Sciences - Ph.D.	
EN	Mechanical & Industrial Engr	Bachelor's	Mechanical Engineering - B.S. (p. 602)	
EN	Mechanical & Industrial Engr	Master's	Mechanical Engineering - M.S.	
EN	Mechanical & Industrial Engr	Doctoral	Mechanical Engineering - Ph.D.	
EN	Mechanical & Industrial Engr	Master's	Occupational Safety and Health Engineering - M.S.	

College	Department	Degree Level	Discipline	Special Degree Options
SL	History	Bachelor's	Patent Law, Technology and Culture - B.A. (p. 381)	
SL	Chemistry & Environmental Sci.	Master's	Pharmaceutical Chemistry - M.S.	
EN	Chemical and Materials Engr	Master's	Pharmaceutical Engineering - M.S.	
EN	Mechanical & Industrial Engr	Master's	Pharmaceutical Systems Management - M.S.	
SL	Physics	Bachelor's	Physics & Law, Technology and Culture - Astronomy Option - B.S.	Double Major (p. 478)
SL	Physics	Bachelor's	Physics & Law, Technology and Culture - Optical Science & Engineering Option - B.S.	Double Major (p. 480)
EN	Electrical & Computer Engr.	Master's	Power and Energy Systems - M.S.	
CC	Informatics	Bachelor's	Science, Technology and Society/Business and Information Systems - B.S.	Double Major (p. 247)
SL	Humanities	Bachelor's	Science, Technology, & Society - B.S. (p. 434)	
CC	Computer Science	Master's	Software Engineering - M.S.	
EN	Electrical & Computer Engr.	Master's	Telecommunications - M.S.	
SL	Humanities	Bachelor's	Theatre Arts and Technology - B.A. (p. 429)	
EN	Civil & Environmental Engr	Master's	Transportation - M.S.	
EN	Civil & Environmental Engr	Doctoral	Transportation - Ph.D.	
AD	Architecture	Master's	Urban Design - M.S.	
AD	Architecture	Doctoral	Urban Systems - Ph.D.	
CC	Informatics	Bachelor's	Web & Information Systems - B.S. (p. 248)	

Special Degree Options

Two Baccalaureate Degrees

Qualified students whose special interests and career plans make such study appropriate may be granted permission to earn two undergraduate baccalaureate degrees.

Written approval to undertake this curriculum must be obtained from each of the departments involved and the dean(s) of the appropriate college(s). In addition to meeting all general education requirements, the candidate for two degrees must earn at least 30 credits more than is required for either degree and must fulfill all requirements of the two degree programs. Two degrees can be earned only with programs having at least 15 non-overlapping credits in course requirements. Normally this requires five years of study.

Double Major

Qualified students whose career plans make such study appropriate may be granted permission to major in two disciplines. Written approval of the proposed curriculum by the department chairperson(s) offering the majors, subject to the review and authorization of the appropriate dean(s), must be obtained by the student. The candidate for the double major must fulfill all requirements for both majors (the second major is noted on the transcript.) In some instances, there is an articulated double major with Rutgers-Newark.

Dual Major with Rutgers-Newark

NJIT and Rutgers-Newark offer their students the option of pursuing a dual major at the two institutions. NJIT students may elect to pursue a dual (or second) major at Rutgers-Newark. Acceptance into the Rutgers-Newark major program is consistent and uniform with practices in place at NJIT and is determined solely by Rutgers-Newark. Upon successful completion of the major, Rutgers-Newark conveys certification for graduation to the appropriate certifying office at NJIT. In addition, NJIT certifies for graduation the completion of the NJIT major and any and all college requirements. NJIT then annotates the student's transcript to read: "Completion of Major Program in (name of major), (date) at Rutgers-Newark."

This option may not apply to chemistry/applied chemistry, mathematics/applied mathematics, physics/applied physics, information systems/computer science, management/School of Management programs.

Minors

Minors require a **minimum** number of credits of which half must be in upper level courses and earned at NJIT. Minors may not be earned in the student's same major area of studies. Courses to fulfill the minor do not need to be exclusive to the minor. Exceptions may include a federated department.

Students wishing to earn minors are responsible for registering their intent with the registrar's office no later than the semester preceding graduation. They must complete the Declare a Minor form (https://generalssb-prod.ec.njit.edu/BannerExtensibility/customPage/page/stuRegMajorChange/) which is available from, and should be returned to, the Registrar's Office.

Academic Minors

Policy on Academic Minors

A minor consists of a minimum of 15 credits of coursework within a single area of study or across several disciplines. At least six credits of courses that make up the minor must be upper-level courses. Any undergraduate student in good academic standing who also has at least sophomore standing may declare a minor. Students majoring in a program may not earn a minor made up exclusively of courses from that program. In addition, at least nine credits used to satisfy the minor requirements should be counted only toward the minor; in other words, these nine credits should not overlap with requirements for the major or another minor. Also, at least nine credits used to satisfy the minor requirements must be completed at NJIT or Rutgers-Newark if the minor is offered by an academic department federated with Rutgers-Newark. A student can be awarded a minor only when a bachelor's degree is awarded. This policy applies to minors created or updated beginning academic year 2022-2023.

Ying Wu College of Computing

- Computer Science Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/computer-science/minor/) (not for Computer Engineering majors)
- Computer Science Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/computer-science/minor-computer-engineering/) (for Computer Engineering majors)
- Data Analytics (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/data-analytics-minor/)
- Design of the User Experience Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/human-computer-interaction-minor/)
- Business and Information Systems Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/bis-minor-not-computing-science-majors/) (not for Computing Sciences majors)
- Business and Information Systems Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/bis-minor-computing-science-majors/) (for Computing Sciences majors)
- Information Technology Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/minor/) (not for Computing Sciences majors)
- Information Technology Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/minor-computing-science-majors/) (for Computing Sciences majors)
- Mobile and Web Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/web-information-systems-minor/)

College of Science and Liberal Arts

- Applied Mathematics Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/mathematical-sciences/applied-mathematics-minor/)
- Applied Physics Minor (http://physics.njit.edu/Minor.php)
- Applied Statistics Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/mathematical-sciences/applied-statistics-minor/)
- Biological Sciences Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/biology/biological-sciences-minor/)
- Chemistry Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/chemistry-environmental-science/chemistry-minor/) (not for Chemical Engineering majors)
- Chemistry Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/chemical-materials-engineering/chemistry-minor-chemical-engineering-majors/) (for Chemical Engineering majors)
- Communication Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/communication-minor/)
- Computational Mathematics Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/mathematical-sciences/computational-mathematics-minor/)
- Electronic Creative Writing Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/electronic-creative-writing-minor/)

- Environmental Science and Policy Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/chemistry-environmental-science/environmental-science-policy-minor/)
- Environmental Studies and Sustainability Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/interdisciplinary-programs/environmental-studies-sustainability-minor/)
- Forensic Science Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/chemistry-environmental-science/forensic-science-minor/)
- Global Studies Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/global-studies-minor/)
- History Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/history/minor/)
- Journalism Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/journalism-minor/)
- Leadership and Aerospace Studies Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/aerospace-studies/leadership-aerospace-studies-minor/)
- Legal Studies Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/history/legal-studies-minor/)
- Literature Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/literature-minor/)
- Mathematical Biology Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/mathematical-sciences/mathematical-biology-minor/)
- Mathematics of Finance and Actuarial Science Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/mathematical-sciences/mathematics-finance-actuarial-science-minor/)
- Philosophy and Applied Ethics Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/philosophy-applied-ethics-minor/)
- Psychology Minor (not for STS majors) (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/psychology-minor/)
- Science, Technology and Society Minor (http://humanities.njit.edu/academics/undergraduate/)
- Technology, Gender and Diversity Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/technology-gender-diversity-minor/)
- Theatre Arts and Technology Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/theatre-arts-technology-minor/)

Newark College of Engineering

- Biomedical Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/biomedical/minor/)
- Chemistry Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/chemical-materials-engineering/chemistry-minor-chemical-engineering-majors/) (for Chemical Engineering majors)
- Computer Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/electrical-computer/computer-engineering-minor/) (not for Electrical Engineering or Computer Science majors)
- Computer Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/electrical-computer/computer-engineering-minor-computer-science-majors/) (for Computer Science majors)
- Computer Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/electrical-computer/computer-engineering-minor-electrical-engineering-majors/) (for Electrical Engineering majors)
- Electrical Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/electrical-computer/electrical-engineering-minor/) (not for Electrical Engineering or Computer Science majors)
- Electrical Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/electrical-computer/electrical-engineering-minor-computer-engineering-majors/) (for Computer Engineering majors)
- Environmental Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/civil-environmental/environmental-engineering-minor/)
- Geosystems Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/civil-environmental/geosystems-minor/)
- Geriatric Engineering Technology Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/saet-semd/geriatric-minor/)
- Grand Challenges of Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/saet-semd/grand_challenges_of_engineering_minor/)
- Industrial Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/mechanical-industrial/industrial-engineering-minor/)
- Manufacturing Engineering Technology Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/saet-semd/manufacturing-engineering-technology-minor/)

- Materials Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/chemical-materials-engineering/materials-engineering-minor/)
- Remote Sensing Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/saet-sbed/remote_sensing_minor/)

Martin Tuchman School of Management

- Business Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/management/management/business-minor/)
- Economics Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/management/management/economics-minor/)
- Innovation and Entrepreneurship Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/management/management/innovation-entrepreneurship-minor/)

General Education Requirements

Philosophy

The New Jersey Institute of Technology (NJIT) is dedicated to producing graduates who have the knowledge, skills, and motivation necessary to advance the state-of-the-art knowledge in their respective fields in addition to possessing a devotion to lifelong personal development as well as intellectual discovery beyond their discipline. Graduates must possess outstanding communication skills and understand the complexities of contemporary society and the ethical and societal issues involved in the professional pursuit of their discipline. Graduates must also possess a deep understanding of and appreciation for science and technology. The NJIT General Education Requirements (GER) are designed to be the dynamic yet minimal foundational curriculum encompassing the necessary preconditions for success in undergraduate disciplines as well as the breadth of knowledge demanded by contemporary society. Each college or department may set additional requirements that exceed the GER. In a larger sense, the GER are intended to provide an educational grounding for our students, a set of educational experiences harmoniously attuned to the mission of NJIT and its responsibilities to its constituents. In essence, the completion of the GER is a necessary step in the fulfillment of the implicit intellectual and social contract that NJIT has with its students and its local, national, and global communities. The maintenance and updating of the GER, including the list of courses fulfilling these requirements, are the responsibility of the Faculty Senate through its Committee on Undergraduate Education.

Computing Literacy

An understanding of the nature of computing, its impact on society and the driving forces behind its pervasive deployment is integral to effective functioning as a professional and as a citizen. Each student should learn to use software and computing systems and to access, store, process, and analyze information as an essential aspect of critical thinking and problem solving. Students should also develop an ability to design algorithms, to write programs, and to use software tools as appropriate to their discipline. Each student must complete a minimum of 3 credits in an introductory computing course covering the foundations of computational thinking.

Code	Title	Credits
Computer Literacy GER Course List (p. 106)		

Cultural Literacy

Cultural literacy provides students with proficiency in oral and written English, while encouraging students to analyze culture and society using the perspectives of history and the humanities. The ability to communicate ideas effectively is an essential characteristic of educated individuals. All educated individuals are also expected to understand and appreciate history and the world's cultures. Cultural literacy courses allow students to develop their capacity for critical thinking while cultivating an interest in one or more areas of the humanities, including: communications; ethics; history; literature; philosophy; politics; religion, and the performing and visual arts.

Each student must complete a minimum of 18 credits of history and humanities courses which form a natural progression of intellectual development. First year students must complete 6 credits of introductory communication courses (ENGL 101 and ENGL 102).

Then, students must complete 3 credits of History and Humanities courses at the 200 level.

Code	Title	Credits
History and Humanities GER 200 level Course List (p. 106)		

This is followed by 6 credits of History and Humanities courses at the 300 level.

Code	Title	Credits
History and Humanities GER 300+ level Course List (p. 108)		

Finally, students must complete 3 credits of an HSS senior seminar.

Code	Title	Credits
HSS Senior Seminar Course List (p. 112)		

Quantitative Reasoning/Mathematics Literacy

The ability to reason qualitatively and quantitatively, to understand probability and statistics, and to apply mathematical models to a variety of circumstances is fundamental to making informed decisions in the modern world. Depending on the discipline, the student should also be able to apply appropriate mathematical concepts and methods to the solution of problems in their professional domain. Each student must complete a minimum of 6 credits in introductory courses in quantitative reasoning with one course having content in probability and statistics.

Code	Title	Credits
Quantitative Reasoning GER Course List (p. 113)		

Scientific Literacy

Natural science provides the basis for our knowledge of the physical universe and for technological progress. All students are expected to develop a thorough understanding of at least one laboratory science. Each student must complete a minimum of 7 credits in natural science courses including a laboratory experience.

Code	Title	Credits
Scientific Literacy GER Course List (p. 113)		

Social Science Literacy

An understanding of the social sciences is essential in order to understand the economic, social, and political forces at work in our world, both in an organizational setting and in society at large. Each student must complete a minimum of 3 credits in an appropriate social science or management-related course.

Code	Title	Credits
Social Science Literacy GER Course List (p. 114)		

First Year Seminar

All first-time, full-time freshman students are required to attend a first year seminar. The goal of the first year seminar is to assist students in adjusting to university life and to introduce them to their academic programs.

Computing Literacy GER

Computer Science GER

Code	Title	Credits
Choose from of the following:		3
BME 210	Processing Fund for Biol Signa	
BNFO 135	Programming for Bioinformatics	
CS 100	Roadmap to Computing	
CS 101	Computer Programming and Problem Solving	
CS 103	Computer Science with Business Problems	
CS 104	Computer Programming and Graphics Problems	
CS 106	Roadmap to Computing for Engineers	
CS 113	Introduction to Computer Science	
CS 115	Introduction to Computer Science in C++	
Total Credits		**3**

History and Humanities GER 200 level

NJIT and Rutgers History and Humanities 200-level GER Courses

Code	Title	Credits
Select from the following:		
COM 200	Communicating in Organizations	
HIST 2**	History Elective	
HIST 213	The Twentieth-Century World	
HIST 214	Tech & Cult in Amer History	
HUM 2**	Humanities Elective	

HUM 211	The Pre-Modern World
HUM 212	The Modern World
LIT 230	Introduction to Literature
PSY 210	Introduction to Psychology
STS 2**	Science Tech and Society Elect
STS 201	Understanding Technological Society
STS 205	Intro to Research Methods
STS 221	Introduction to Sociology
STS 257	Technology, Society and Culture: An American View
STS 258	Technology, Society and Culture: A Global View
THTR 208	Movement for Theatre
THTR 209	Voice and Speech for Theatre I
THTR 210	Voice & Speech for Theater II
THTR 212	From Page to Stage
THTR 213	Directing I
THTR 215	Acting II
THTR 216	Improvisational Theatre Short Form
THTR 217	Improvisational Theatre Long Form
THTR 261	Performance I
THTR 262	Performance II
R510 201	Hist Of West Civ
R510 202	History Of West. Civ.
R510 207	Hist Of Latin Amer
R510 208	History Of Latin America
R510 209	History of the Caribbean
R510 226	ST:
R510 227	ST:
R510 240	Women in European History
R510 255	Ancient Greece & Persian Empir
R510 256	Roman Civilization
R510 257	Golden Age Of Europe
R510 263	History Of Africa
R510 264	History Of Africa
R510 280	South Asia up to 1750
R510 281	South Asian History II
R510 286	The Ancient Near Est
R510 287	Hist Islamic Civ
R510 288	Hist Of Islamic Civ.
R510 297	Far Eastern History
R510 298	Far Eastern History
R512 201	History U.S.
R512 202	Hist Of United States II
R512 203	History of Newark
R512 204	LGBT History
R512 215	US Hist Fict/Fact
R512 226	Topics American History
R512 227	Topics American History
R512 231	America's Pacific: Asian
R512 230	Hist of American Immigration
R512 233	Afro-Amer History
R512 234	Afro American Hist
R512 265	Amer Legal Hist

R512 266	American Legal History II	
R512 273	History of Women in US to 1877	
R512 274	History Women US 1877-present	
R512 297	American Foreign Affairs I	
R512 298	American Foreign Affairs II	
R830 101	Principles Of Psychology I	
R830 102	Prin Of Psychology	
R920 201	Intro Sociology I	
R920 202	Sociology II	

History and Humanities GER 300+ level

NJIT and Rutgers History and Humanities 300-level GER Courses

Code	Title	Credits
Select from the following courses:		
COM 303	Video Narrative	
COM 310	Interpersonal Communication	
COM 312	Oral Presentations	
COM 313	Technical Writing	
COM 314	Theory of Rhetoric	
COM 315	Environmental Communication	
COM 316	Creative Writing	
COM 317	Advanced Composition	
COM 318	Communication Theory	
COM 319	Technical, Professional and Scientific Writing for Publication	
COM 321	Technology & Tactics of Sound	
COM 323	Mobile Media Making	
COM 325	Special Topics in Communication	
COM 337	Photojournalism	
COM 338	The Newsroom	
COM 339	Practical Journalism	
COM 350	Digital Video Production	
COM 351	Documentary Studies	
COM 353	Composing Documents for Print	
COM 354	Composing Documents for the Web	
COM 355	Cybertext	
COM 369	Digital Poetry	
COM 390	Electronic Writing Workshop	
HIST 320	Law and Evidence	
HIST 329	Dante: Hell, Heaven, and Medieval Florence	
HIST 334	Environmental History of North America	
HIST 338	Environmental Justice and Climate Change in America	
HIST 341	The American Experience	
HIST 342	Civil Rights Revolution and Law	
HIST 343	African-American History I	
HIST 344	African-American History II	
HIST 345	Communication through the Ages	
HIST 351	Ancient Greece and the Persian Empire	
HIST 352	The Hellenistic States and the Roman Republic	
HIST 361	The Founding of the American Nation	
HIST 362	Sex, Gender, and the Law in American History	
HIST 363	The United States as a World Power	

HIST 364	American Law in the World
HIST 365	Science and Technology in the Global South
HIST 366	Gender, Race and Identity in American History
HIST 367	International Law and Diplomacy in History
HIST 369	Law and Society in History
HIST 370	Legal issues in the History of Media
HIST 372	Contemporary Europe
HIST 373	The Rise of Modern Science
HIST 374	Modern Russian Civilization
HIST 375	Legal Issues in Environmental History
HIST 377	Cities in History
HIST 378	Medicine and Health Law in Modern America
HIST 379	History of Medicine
HIST 380	History of Public Health
HIST 381	Sci & Tech In Modern Medicine
HIST 382	War and Society
HIST 383	The Making of Modern Thought
HIST 384	Invention and Regulation
HIST 385	Technology and Society in European and World History
HIST 386	Technology in American History
HIST 387	Computers, Innovators and Hist
HIST 388	Britain in the 20th Century
HIST 390	Historical Problems of the 20th Century through Film
HIST 391	Industrial Revolution in World
HIST 395	Research Methods in Law and Society
LIT 320	American Literature
LIT 321	British Literature
LIT 330	World Literature I: North America, Latin America and the Caribbean, Australia and Oceania
LIT 331	World Literature II: Africa and the Middle East, Asia, and Europe
LIT 340	Contemporary Literature
LIT 350	Fiction
LIT 352	20th Century European Fiction
LIT 355	Poetry
LIT 361	20th Century American Drama
LIT 364	Modern Continental and British Drama
LIT 365	Non-Fiction
LIT 370	Literature and Diversity
LIT 372	African-American Literature
LIT 374	Women and Literature
LIT 376	Latin America through Art and Literature
LIT 378	Literature and Nature
LIT 380	Historical Literature
LIT 382	The Comic Tradition in English and American Literature
LIT 386	Science Fiction
LIT 388	The Russian Novel and Short Story
PHIL 310	Logic
PHIL 331	Problems in Philosophy
PHIL 333	Moral Philosophy
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering
PHIL 337	World Religions
PHIL 350	Representative Philosophies
PHIL 351	Biomedical Ethics

PHIL 355	The Philosophy Of Science
PHIL 380	Philosophy of Language
PSY 358	Moral Psychology
PSY 359	Foundations of Cyberpsychology
STS 300	Legal Reasoning, Writing, and Technology
STS 303	Independent Study
STS 304	Qualitative Research Methods in the Social and Behavioral Sciences
STS 306	American Mosaic: Understanding Cultural Diversity
STS 307	Quantitative Research Methods in the Social and Behavioral Sciences
STS 308	Globalization
STS 309	Advocacy and the Law
STS 310	Technology and Human Values
STS 312	Technology and Policy in Contemporary America
STS 315	Sports, Technology and Society
STS 316	Mass Communications, Technology and Culture
STS 325	ST:
STS 342	Gender, Technology and Society
STS 344	Communications Policy
STS 346	Pragmatism and Technology
STS 347	Music and Society
STS 349	Electronic Music in Practice
STS 350	Computers and Society
STS 351	Minds and Machines
STS 352	Race and Ethnicity
STS 360	Ethics and the Environment
STS 365	Animal Intelligence and Ethics
STS 363	Introduction to Sustainability Studies
STS 364	Sustainability Policy and Practice
STS 375	AI and the Human Mind
STS 376	Cyborg Society
STS 378	Literature and Environment
STS 380	Policy Issues in the Coastal Environment
STS 382	Geographical Perspectives on the Environment
THTR 310	Theatre History I
THTR 315	Theatre History II
THTR 344	American Musical Theater
THTR 360	Drama
THTR 363	Ethnic and Minority Drama
THTR 362	Non-Western Drama
THTR 364	Technology in Performance
THTR 365	Principles of Playwriting
THTR 384	Musical Theater Adaptations
R510 301	Film And History
R510 305	Ancient Sport
R510 306	Greek & Roman City
R510 311	Latin Amer & The Us
R510 312	Democracy & Reb Mod Latin Amer
R510 314	Film and Colonialism
R510 315	Perspectives in History
R510 316	Perpectives in History
R510 319	Classical World
R510 320	Roman History

R510 325	The Ancient World
R510 327	Civil Of Middle Ages
R510 328	Civiliztn Of Middle Ages
R510 331	British History
R510 332	British History
R510 337	The History Of Iran
R510 338	Ottoman Empire
R510 339	West Islam & Middle East
R510 343	Renaissance & Reform
R510 344	Renaissance & Reform
R510 351	Tpcs:Human Smglng & Trafcng
R510 352	History Of France
R510 353	Modern China
R510 354	Modern China
R510 355	Traditional China
R510 356	Hist People'S Republic
R510 357	19th Century Europe
R510 358	20th Century Europe
R510 361	Mod Near & Mid East
R510 362	Capitalism & Socialism
R510 365	Islam In Africa
R510 367	Hist. Of Russia & Soviet
R510 368	Hist Russia & Soviet
R510 374	History of Spain to 1700
R510 377	Portugal & Its Empire
R510 378	Colonialism to 1825
R510 379	Colonialism & Decolonizn
R510 385	Hist Of So Africa
R510 386	History Of South Africa
R510 390	Gender & Casteins.Asia
R510 391	Hist Germany
R510 392	History Germany
R510 396	Honors Non-American History
R510 397	Honors Non American History
R510 401	Topics European Hist
R510 403	Topics in Social History
R510 404	Mod Europe War & Revolut
R510 405	Topics: Caesar & Augustus
R510 406	Topics in Medieval Civ
R510 407	Topics In Anc Hist II
R510 431	Topics In Africa-19/20th
R510 432	Topics African Hist
R510 433	Topics In Islamic Hist
R510 435	ST:
R510 441	Latin America & Cari
R510 442	Lat Amer & Carib Hist
R510 449	Topics Asia & Far East
R510 450	Topics Asia & Far East
R510 451	Topics in Hist of Eastern Euro
R510 452	Topics In Eastern Europe
R510 458	Topics Women'S History
R510 460	ST:

R510 461	Tpcs:Immgtn to the Americas
R510 462	Special Topics
R510 463	Topics in Transnational Hist
R510 479	Readings Non-Amer Hist
R510 480	Readings Non-Amer Hist
R510 489	Seminar:Readings
R510 490	Seminar:Research
R512 308	Gay & Lesbian Lives
R512 309	History American Thought
R512 310	Hist Amer Thought
R512 311	Colonial America
R512 312	Trash Cinema and the Cultural Policies of the Sleaze
R512 313	City in US Cinema
R512 318	Labor History
R512 337	Hist Of Family In Us
R512 343	Early American Republic
R512 350	Civ War & Recon
R512 357	Econ & Bus History
R512 358	Econ & Bus History
R512 361	Urban History Of Us
R512 362	Urban History Of U.S.
R512 367	Age Of Corporation
R512 368	Modern America:1890-1940
R512 371	Contemporary America
R512 379	Us Hist In The Court
R512 383	U.S. In Cold War
R512 385	History Of Amer Politics
R512 386	Hist American Politics
R512 387	Hist Race Ehtnicity
R512 388	Hist Race Ethnicity
R512 389	America In The 1960'S
R512 391	Honors Program in Amer Hist
R512 392	Honors American History
R512 402	Selected Topics
R512 403	Topics Amer Politic Hist
R512 404	Topics in American Business and Economic History
R512 405	Topics in the History of Science
R512 408	Selected Topics History
R512 410	Tpcs:Cold War in Third World
R512 452	Topics Legal History
R512 462	Topics in Recent American Hist
R512 472	Topics Afro-Am History
R512 473	Topics Women'S Hist
R512 364	Military Us 1800-2000

HSS Senior Seminar

HSS Capstone

Code	Title	Credits
Select from the following courses:		
HSS 404	Humanities, History and Social Sciences Senior Seminar	
HSS 405	Humanities Senior Seminar - Philosophy	

HSS 406	Humanities Senior Seminar - English
HSS 407	Humanities Senior Seminar - Theater
HSS 408	Humanities Senior Seminar - Science, Technology, and Society
HSS 409	Humanities Senior Seminar - Social Science
HSS 410	Humanities and Social Sciences Senior Seminar

Quantitative Reasoning GER

Mathematics GER

Code	Title	Credits
Select from the following courses:		
ECE 321	Random Signals and Noise *	3
IE 331	Applied Statistical Methods *	3
MATH 101	Foundations of Mathematics for the Liberal Arts	3
MATH 105	Elementary Probability and Statistics *	3
MATH 107	University Mathematics A	3
MATH 108	University Mathematics B	4
MATH 110	University Mathematics B II - Trigonometry	4
MATH 111	Calculus I	4
MATH 112	Calculus II	4
MATH 113	Finite Mathematics and Calculus I	3
MATH 120	Basic Concepts in Statistics *	1
MATH 135	Calculus for Business	3
MATH 138	General Calculus I	3
MATH 225	Survey of Probability and Statistics *	1
MATH 238	General Calculus II	3
MATH 244	Introduction to Probability Theory *	3
MATH 279	Statistics and Probability for Engineers *	2
MATH 305	Statistics for Technology *	3
MATH 333	Probability and Statistics *	3
MNET 315	Industrial Statistics *	3

* Probability and Statistics

Scientific Literacy GER

Natural Science GER

Code	Title	Credits
Biology Courses		
BIOL 115	Evolution and Biology of Sex	3
BIOL 150	Living in a Variable Universe	4
R120 101	General Biology	4
R120 102	General Biology II	4
R120 109	Basic Plant Science	3
R120 110	Basic Plant Sci Lab	1
R120 205	Environmental Issues	3
R120 206	General Horticulture	3
R120 207	Horticulture Lab	1
R120 208	Human Sexuality	3
R120 237	Environmental Microbiology	4
R120 141	Anatomy & Physiology	4
R120 142	Anatomy & Physiology	4

Chemistry Courses		
CHEM 121	Fundamentals of Chemical Principles I	3
CHEM 122	Fundamentals of Chemical Principles II	3
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
CHEM 126	General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
Geology Courses		
R460 101	Intro To The Earth	3
R460 103	Planet Earth	3
R460 104	Planet Earth Lab	1
R460 206	Env Geology	3
R460 207	Env Geology Lab	1
Physics Courses		
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
PHYS 202	Introductory Astronomy and Cosmology	3
PHYS 202A	Astronomy and Cosmology Laboratory	1
PHYS 203	The Earth in Space	3
PHYS 203A	The Earth in Space Lab	1
PHYS 204	Biophysics of Life	3

Social Science Literacy GER

Social Science GER

Code	Title	Credits
Select from the following courses:		
ECON 201	Economics	
ECON 265	Microeconomics	
or R220 101	Intro To Econo-Micro	
ECON 266	Macroeconomics	
or R220 102	Intro To Econ-Macro	
ENTR 210	Introduction to Entrepreneurship	
EPS 202	Society, Technology, and the Environment	
FRSC 201	Intro to Forensic Science	
HRM 301	Organizational Behavior [1]	
IE 492	Engineering Management [1]	
MGMT 390	Principles of Business [1]	
PSY 210	Introduction to Psychology	
STS 201	Understanding Technological Society	
STS 205	Intro to Research Methods	
STS 221	Introduction to Sociology	
STS 230	Introduction to Anthropology	
STS 376	Cyborg Society	
R070 203	Intro Phys Anth & Arch	
R070 204	Intro Cultural Anthro	

R202 103	Intro Criminal Justice
R790 201	American Government
R790 202	America & The World

[1] Students in the aerospace option take AS 333 (http://catalog.njit.edu/archive/2022-2023/search/?P=AS%20333) Leadership and Management and those in the dual degree program between architecture and management take HRM 301 (http://catalog.njit.edu/archive/2022-2023/search/?P=HRM%20301) Organizational Behavior.

Course Codes

Course Code Explanation

Alphabetical Codes

ACCT	Accounting
AD	Art & Design
ARCH	Architecture
AS	Aerospace Studies
BIOL	Biology
BME	Biomedical Engineering
BNFO	Bioinformatics
CE	Civil Engineering
CET	Construction Engineering Technology
CHE	Chemical Engineering
CHEM	Chemistry
CIMT	Concrete Industry Management
CS	Computer Science
CMT	Construction Management Technology
COM	Communication
COOP	Cooperative Education
CPT	Computer Technology
DD	Digital Design
ECON	Economics
ECE	Electrical and Computer Engineering
ECET	Electrical and Computer Engineering Technology
ENE	Environmental Engineering
ENTR	Entrepreneurship
ENGL	English
ENGR	Engineering
EPS	Environmental Policy Studies
ESC	Engineering Sciences
EVSC	Environmental Science
FED	Fundamentals of Engineering Design
FIN	Finance
FRSC	Forensic Science
FYS	First Year Student Seminar
GEN	General Engineering
HIST	History
HRM	Human Resource Management
HSS	Humanities and Social Sciences
HUM	Humanities
ID	Industrial Design
IE	Industrial Engineering
INT	Interior Design

IS	Information Systems
IT	Information Technology
LIT	Literature
MATH	Mathematics
ME	Mechanical Engineering
MECH	Mechanics
MET	Mechanical Engineering Technology
MGMT	Management
MIS	Management Information Systems
MNET	Manufacturing Engineering Technology
MR	Maintaining Registration
MRKT	Marketing
MTEN	Materials Engineering
MTSE	Materials Science and Engineering
MIT	Medical Informatics Technology
OM	Operations Management
PE	Physical Education
PHIL	Philosophy
PHYS	Physics
SET	Surveying Engineering Technology
STS	Science, Technology and Society
THTR	Theatre
TMT	Telecommunications Management Technology
TUTR	Freshman Tutorial

Numerical Codes

Lower Division Courses

Courses numbered between 100 and 199 are normally taken by first-year students.

Courses numbered 200--299 are normally taken by sophomores.

Upper Division Courses

Courses numbered 300--399 are normally taken by juniors.

Courses numbered 400--499 are normally taken by seniors.

The numbers after each course title (3 credits, 3 contact hours (0;0;3)) indicate the number of credits, the number of contact hours and the nature of the contact hours (Lecture; Laboratory; Other).

Rutgers-Newark Courses

The current Rutgers-Newark Schedule of Classes (https://sis.rutgers.edu/soc/) can be viewed for cross-registration along with the Rutgers catalog (http://catalogs.rutgers.edu/) when planning for cross-registration.

Student Rights and Responsibilities

Photo ID Card

All students must carry an NJIT identification card while on campus. An ID card must be presented at the request of a university administrator, faculty member or public safety officer. Facilities, parking, building access, and services of the university require presentation of a valid university ID.

Students should obtain an ID card as soon as possible after registration is completed. Photographs for ID cards are taken throughout the semester in the Department of Public Safety, located in the parking facility. Dates and times to obtain an ID are posted at the Campus Center information desk. Proof of registration in the form of a tuition receipt or registrar's receipt is required to obtain an ID card. These receipts also will be accepted as NJIT identification until the ID card is issued. ID validation stickers are issued each semester and are available at the Department of Public Safety or the Campus Center information desk.

Lost or stolen IDs should be reported as soon as possible to the Department of Public Safety. A replacement for a lost card is obtained by paying a $25 charge at the bursar's office cashier's window in the Student Mall and presenting the receipt at the Department of Public Safety where the card will be reissued.

Property Loss and Damage

NJIT is not responsible for loss of property by fire or theft in its buildings or grounds. NJIT is not responsible for property damaged as the result of vandalism in its buildings or grounds.

Code of Student Code

NJIT requires students to conduct themselves with decorum and to adhere to standards of ethical and professional behavior. NJIT has adopted, and requires all students to comply with, the Code of Student Conduct. The policies and procedures governing this code are contained in a separate publication, available online, and are deemed incorporated into this catalog. A copy of the Code of Student Conduct may be obtained from the Office of the Dean of Students or online at www.njit.edu/dos/policies/conductcode/index.php (http://www.njit.edu/dos/policies/conductcode/)

Anti-Discrimination Policy

New Jersey Institute of Technology reaffirms its commitment to a policy of non-discrimination on the basis of race, sex, sexual orientation, age, religion, ethnic origin, handicap or veterans' status in its employment policies, educational programs and activities under university control.

Assuring a climate of equal opportunity is the direct responsibility of all levels of management. Administrative and supervisory personnel are required to comply with applicable government regulations and the affirmative action goals of the university. Among these are Executive Orders 11246 and 11375 (Affirmative action); the Civil Rights Act of 1964, as amended; Title IX of the Education Amendments of 1972 (Sex Discrimination); Section 504 of the Rehabilitation Act of 1973; Americans with Disabilities Act (Non-discrimination on the Basis of Handicap); The New Jersey Law Against Discrimination, Title 10, Chapter 5, 10:5-1 to 10:5-28, NJ Revised Statutes, as amended; and the New Jersey Governor's Code of Fair Practices, Executive Order No. 21 (1965), as amended and Executive Order No. 39 (1991), "Prohibition in State Government of Discrimination Based on Sexual Orientation."

Any reported act of discriminatory behavior will be investigated through the Office of the Dean of Student Services, the Office of Compliance and Community Relations, or Office of General Counsel and Employment Policy Relations.

Sexual Harassment Policy

It is the continuing objective of the university to offer a work and study environment to its employees and students that rewards career and educational goals based upon relevant factors such as ability and work performance. Sexual harassment of employees and students is unacceptable. It is a barrier to educational and professional development and contrary to law and university policy.

In accordance with the NJIT's Title IX Sexual Harassment Policy (https://www.njit.edu/titleix/policies/), persons found to have violated university policy will face investigation, managerial review and possible disciplinary action up to and including employment termination and or dismissal from the university (for students). For a copy of the university's policies prohibiting sexual harassment, please visit the Title IX website (https://www.njit.edu/titleix/) or the Office of the Dean of Students for the Code of Student Conduct. (https://www.njit.edu/dos/policies/conductcode/) for sexual harassment that falls outside the scope of Title IX.

Drug Abuse Prevention Program

New Jersey Institute of Technology prohibits the use of illegal drugs on its premises including the possession, use, or selling of marijuana in any form on campus and during University activities. University policy concerning possession and consumption of alcoholic beverages on campus subscribes to strict enforcement of the laws of the State of New Jersey, the County of Essex and the City of Newark. In addition, the policy stipulates that any consumption must occur within a responsible social framework wherein beverages are not the focus of the event.

Students with concerns about their own or someone else's use of drugs and/or alcohol should be aware that they can receive information, counseling and referral assistance from the Office of the Dean of Students (https://www.njit.edu/dos/), the NJIT CARE Team (https://www.njit.edu/care/), the Center for Counseling & Psychological Services (https://www.njit.edu/counseling/), or Campus Health Services (https://www.njit.edu/healthservices/). The professional staff of the Counseling Center can provide substance abuse counseling and assessment in some situations and will refer more serious problems to off-campus facilities and services.

In addition, the university, through the Division of Student Affairs (https://www.njit.edu/studentaffairs/), offers a series of educational programs focused on the areas of drug and alcohol information and substance abuse prevention.

Drug-Free Workplace Policy

Student employees are subject to university policies regarding employment. New Jersey Institute of Technology is committed to maintaining a drug-free workplace in compliance with applicable laws. The university is further committed both to rigorous enforcement of applicable laws and policies and to support for those trying to cope with drug-related problems. The unlawful possession, use, distribution, dispensation, sale, or manufacture of controlled substances is prohibited on university premises. Any NJIT employee determined to have violated this policy or engaged in drug-related problems that have an impact upon the workplace may be subject to disciplinary action up to and including termination. At the discretion of the university, any employee convicted of a drug offense involving the workplace shall be subject to employee discipline (up to and including termination) and/or required to satisfactorily complete a drug rehabilitation program as a condition of continued employment.

The illegal use of controlled substances can seriously injure the health of employees, adversely affect the performance of their responsibilities, and endanger the safety and well-being of fellow employees, students, and members of the general public. Therefore, the university urges employees engaged in the illegal use of controlled substances to seek professional advice and treatment. Anyone who is employed at NJIT who has a drug problem is encouraged to contact the director of the Employee Assistance Program (EAP), who will assist in obtaining available treatment. Employees engaged in contracts with the U.S. Department of Defense are additionally subject to Department of Defense requirements and may be required to submit to tests for the illegal use of controlled substances.

As a condition of employment, an employee of NJIT will notify his/her supervisor if he or she is convicted of a criminal drug offense involving the workplace within five days of the conviction. In the event any such conviction involves an employee working on a federal contract or grant, the university will notify the granting or contracting federal agency within 10 days of receiving notice of a conviction. A copy of this statement shall be given to all employees.

This statement and its requirements are promulgated in accordance with the requirements of the Drug-Free Workplace Act of 1988 enacted by the United States Congress. The university will continue its efforts to maintain a drug-free environment by adhering to the above policy and by providing through the EAP and the offices of Human Resources, and Compliance and Training, ongoing drug awareness programs.

Family Educational Rights and Privacy Act

The Family Educational Rights and Privacy Act (FERPA) affords eligible students certain rights with respect to their education records. (An “eligible student” under FERPA is a student who is 18 years of age or older or who attends a postsecondary institution.) These rights include:

1. The right to inspect and review the student's education records within 45 days after the day New Jersey Institute of Technology receives a request for access. A student should submit to the registrar a written request that identifies the record(s) the student wishes to inspect. The registrar will make arrangements for access and notify the student of the time and place where the records may be inspected. If the records are not maintained by the registrar, the registrar shall coordinate access to inspect those records.

2. The right to request the amendment of the student’s education records that the student believes is inaccurate, misleading, or otherwise in violation of the student’s privacy rights under FERPA.

A student who wishes to ask New Jersey Institute of Technology to amend a record should write the registrar, clearly identify the part of the record the student wants changed, and specify why it should be changed.

If New Jersey Institute of Technology decides not to amend the record as requested, New Jersey Institute of Technology will notify the student in writing of the decision and the student’s right to a hearing regarding the request for amendment. Additional information regarding the hearing procedures will be provided to the student when notified of the right to a hearing.

3 . The right to provide written consent before New Jersey Institute of Technology discloses personally identifiable information (PII) from the student's education records, except to the extent that FERPA authorizes disclosure without consent. See “Additional Disclosure Information” below.

4. The right to file a complaint with the U.S. Department of Education concerning alleged failures by the New Jersey Institute of Technology to comply with the requirements of FERPA. The name and address of the Office that administers FERPA is:

Family Policy Compliance Office

U.S. Department of Education

400 Maryland Avenue, SW

Washington, DC 20202

Disclosure of Directory Information

New Jersey Institute of Technology, at its discretion, may provide directory information, in accordance with the provisions of the law including a student's name, address, telephone listing, date and place of birth, major field of study, participation in officially recognized activities and sports, weight and height of members of athletic teams, dates of attendance, degrees and awards received, and the most recent previous educational agency or institution attended by the student.

Students may request to withhold disclosure of directory information. To ensure that a request is properly processed, it must be submitted on the official ‘Request to Prevent Disclosure of Directory Information Form’, which is available in the Office of the Registrar. Request for non-disclosure will be honored by New Jersey Institute of Technology for one academic year and must be filed again at the beginning of the next academic year. New Jersey Institute of Technology assumes that failure on the part of any student to specifically request on the official form preventing the disclosure of directory information indicates individual approval of disclosure.

Additional Disclosure Information

FERPA permits the disclosure of PII from students' education records, without consent of the student, if the disclosure meets certain conditions found in §99.31 of the FERPA regulations. Except for disclosures to school officials, disclosures related to some judicial orders or lawfully issued subpoenas, disclosures of directory information, and disclosures to the student, §99.32 of FERPA regulations requires the institution to record the disclosure. Eligible students have a right to inspect and review the record of disclosures. A postsecondary institution may disclose PII from the education records without obtaining prior written consent of the student –

• To other school officials within New Jersey Institute of Technology whom New Jersey Institute of Technology has determined to have legitimate educational interests. A school official is a person employed by New Jersey Institute of Technology in an administrative, supervisory, academic, research, or support staff position (including law enforcement unit personnel and health staff); a person serving on the board of trustees; or a student serving on an official committee, such as a disciplinary or grievance committee. A school official has a legitimate educational interest if the official needs to review an education record in order to fulfill his or her professional responsibilities for New Jersey Institute of Technology. This includes contractors, consultants, volunteers, or other parties to whom the school has outsourced institutional services or functions, provided that the conditions listed in §99.31(a)(1)(i)(B)(1) - (a)(1)(i)(B)(2) are met. (§99.31(a)(1))

• To officials of another school where the student seeks or intends to enroll, or where the student is already enrolled if the disclosure is for purposes related to the student's enrollment or transfer, subject to the requirements of §99.34. (§99.31(a)(2))

• To authorized representatives of the U. S. Comptroller General, the U. S. Attorney General, the U.S. Secretary of Education, or State and local educational authorities, such as a State postsecondary authority that is responsible for supervising New Jersey Institute of Technology State-supported education programs. Disclosures under this provision may be made, subject to the requirements of §99.35, in connection with an audit or evaluation of Federal- or State-supported education programs, or for the enforcement of or compliance with Federal legal requirements that relate to those programs. These entities may make further disclosures of PII to outside entities that are designated by them as their authorized representatives to conduct any audit, evaluation, or enforcement or compliance activity on their behalf. (§§99.31(a)(3) and 99.35)

• In connection with financial aid for which the student has applied or for which the student has received, if the information is necessary to determine eligibility for the aid, determine the amount of the aid, determine the conditions of the aid, or enforce the terms and conditions of the aid. (§99.31(a)(4))

• To organizations conducting studies for, or on behalf of, the school, in order to: (a) develop, validate, or administer predictive tests; (b) administer student aid programs; or (c) improve instruction. (§99.31(a)(6))

• To accrediting organizations to carry out their accrediting functions. ((§99.31(a)(7))

• To parents of an eligible student if the student is a dependent for IRS tax purposes. (§99.31(a)(8))

• To comply with a judicial order or lawfully issued subpoena. (§99.31(a)(9))

• To appropriate officials in connection with a health or safety emergency, subject to §99.36. (§99.31(a)(10))

• Information the school has designated as "directory information" under §99.37. (§99.31(a)(11))

• To a victim of an alleged perpetrator of a crime of violence or a non-forcible sex offense, subject to the requirements of §99.39. The disclosure may only include the final results of the disciplinary proceeding with respect to that alleged crime or offense, regardless of the finding. (§99.31(a)(13))

• To the general public, the final results of a disciplinary proceeding, subject to the requirements of §99.39, if the school determines the student is an alleged perpetrator of a crime of violence or non-forcible sex offense and the student has committed a violation of the school's rules or policies with respect to the allegation made against him or her. (§99.31(a)(14))

• To parents of a student regarding the student's violation of any Federal, State, or local law, or of any rule or policy of the school, governing the use or possession of alcohol or a controlled substance if the school determines the student committed a disciplinary violation and the student is under the age of 21. (§99.31(a)(15))

Copyright Ownership

NJIT believes its role as an educational institution is best served by disclosing to the public all academic research, projects, theses and dissertations developed by students during the course of their studies or employment at the university.

Projects, theses and dissertations created by students shall be governed by the following provisions as outlined in NJIT's copyright policy under "Ownership and Disposition of Copyrightable Materials":

A. Copyright ownership of projects, theses and dissertations generated by research that is performed in whole or in part by the student with financial support in the form of wages, salaries, stipend, or grant from funds administered by the University shall be determined in accordance with the terms of the support agreement, or in the absence of such terms, shall become the property of the University.

B. Copyright ownership of projects, theses and dissertations generated by research performed in whole or in part utilizing equipment or facilities provided to the University under conditions that impose copyright restriction shall be determined in accordance with such restrictions.

C. Copyright in projects, theses and dissertations not within the provisions of Categories A and B of this policy shall be the property of the author. However, the student must, as a condition of a degree award, grant royalty-free permission to the University to reproduce and publicly distribute copies of the project, thesis or dissertation.

Requests for permission to publish Category A and B should be addressed to the Office of Intellectual Property.

For further information, call the Office of Intellectual Property, (973) 596-5825.

Ownership of Intellectual Property

In accordance with university policy, NJIT retains all right, title and interest to any and all intellectual property (i.e., inventions, discoveries, creative works, trade secrets and know-how) developed by NJIT students during the course of their studies or employment at the university or while using university facilities.

To protect against premature disclosure of an invention and/or publication of anything that may be of a proprietary nature, students must immediately report their intent to do so to the Office of Technology Development (see https://www.njit.edu/research/home/). Students must neither publish nor discuss proprietary information with anyone other than the Office of Technology Development or members of the University's Intellectual Property Committee. When a project, thesis or dissertation covers material that is potentially proprietary, both the student and the advisor must report the existence of such material to the Office of Graduate Studies and the Office of Technology Development; so that the University may expedite its review of such material and determine whether or not it is proprietary and should be protected under the University's guidelines for protecting its Intellectual Property. If necessary, the Office of Graduate Studies and the Office of Technology Development will take steps to sequester patentable material in archival documents such as theses and dissertations. If the University applies for a patent, the student will sign an appropriate assignment agreement. All income derived from such intellectual property will be shared between NJIT and the student in accordance with the University's published policy (see http://www.njit.edu/policies/sites/policies/files/lcms/pdf/patentpolicy.pdf).

For further information, call the Office of Intellectual Property, (973) 596-5825.

Instructional Delivery

Modes of Instructional Delivery

6 Modes of Instructional Delivery at NJIT[1]

1) **Face-to-Face**: Delivery of instruction is structured around in-person classroom meeting times. Instruction is delivered in person and students are expected to attend class. (sometimes referred to as traditional classroom courses[2])

2) **Converged Learning**: Delivery of instruction is independent of place, merging the physical and virtual classrooms. There is an attendance expectation and students can choose to attend class face-to-face or using real-time synchronous video conferencing technology. Some instructors may require occasional proctored exams. (sometimes referred to as a synchronous distributed course).

Notes

- F-1 and J-1 Students: Students must attend the class face-to-face.
  - Please refer to the Office of Global Initiatives (https://www.njit.edu/global/) for more information.

3) **Synchronous online:** delivery of instruction takes place during the day and time noted, independent of location. All course activity can be completed online through the learning management system. There are no face-to-face sessions, but remote attendance is expected.

4) **Online**: Delivery of instruction in which all course activity can be completed online through the learning management system. There are no required face-to-face sessions but students are expected to follow a week-by-week schedule as outlined in the syllabus. Work is typically done in an asynchronous mode and students can complete the coursework without coming to campus. Note: some instructors may require occasional synchronous online meetings or proctored exams.[3] (sometimes referred to as eLearning).

Notes:

- Fully online programs: NJIT offers several master's degrees and Graduate Certificates that can be completed entirely online (https://www.njit.edu/online/programs/).
- eTuition: Online courses count towards eTution status.
- F-1 and J -1 Students: Students may only count three credits of Hyflex or Online courses toward a full course of study per academic term:

  #A full course of study for undergraduate students is 12 credits.

#A full course of study for graduate students is 9 credits.

#There are no restrictions during the summer unless it is an F-1 and J-1student’s last term.

#In their last term F-1 and J-1 students must take at least one Face-to-Face or Hybrid or Converged Learning course.

#Please refer to the Office of Global Initiatives (https://www.njit.edu/global/) for more information.

5) **Hybrid**: Delivery of instruction in which some traditional face-to-face contact hours are replaced with required synchronous or asynchronous online instruction (frequently through the learning management system). The amount of online activity is set by the instructor and varies by course. Students should refer to the course syllabi for the course meeting schedule, however no Hybrid course should be more than 50% online. (sometimes referred to as blended learning)

Notes:

- F-1 and J-1 Students: Hybrid courses count towards a full course of study. There are no restrictions to how many hybrid courses F-1 and J-1 students can register for.

#A full course of study for undergraduate students is 12 credits.

#A full course of study for graduate students is 9 credits.

#There are no restrictions during the summer unless it is an F-1 and J-1 student’s last term.

#In their last term F-1 and J-1 students must take at least one Face-to-Face or Hybrid or Converged Learning course.

#Please refer to the Office of Global Initiatives (https://www.njit.edu/global/)for more information.

6) **HyFlex**: Delivery of instruction is independent of time and place, allowing for students to choose to attend class in any of three modes:

- Face-to-Face – the traditional classroom model;
- Synchronous Online – delivery of instruction takes place during the day and time noted, independent of location. All course activity can be completed online through the learning management system. There are no face-to-face sessions, but remote attendance is expected;
- Asynchronous Online – different time, different place; utilizing multimedia learning objects and lecture capture technologies. Students are expected to follow a week-by-week schedule as outlined in the syllabus.

Students can choose to change which option they use to attend courses weekly. Some instructors may require occasional proctored exams.

Notes:

- eTuition: HyFlex courses count towards eTution status.
- F-1 and J-1 Students: Students may only count three credits of Hyflex or Online courses toward a full course of study per academic term:

#A full course of study for undergraduate students is 12 credits.

#A full course of study for graduate students is 9 credits.

#There are no restrictions during the summer unless it is an F-1 and J-1 student’s last term.

#In their last term F-1 and J-1 students must take at least one Face-to-Face or Hybrid or Converged Learning course.

#Please refer to the Office of Global Initiatives (https://www.njit.edu/global/) for more information.

1 Contact hours are independent of delivery method and defined in the course catalog.

2 Definitions are aligned with OLN’s definitions https://onlinelearningconsortium.org/updated-e-learning-definitions-2/.

3 See http://www.njit.edu/online/current-students/faq/ for more information about proctored exams.

Policy on Administration of Midterm and Final Exams

NJIT policy requires that all midterm and final exams must be proctored, regardless of delivery mode, in order to increase academic integrity. Note that this does not apply to essay or authentic based assessments. Effective beginning Fall 2019 semester, students registered for a fully online course section (e.g., online or Hyflex mode) must be given the option to take their exam in a completely online format, with appropriate proctoring.

Admissions and Financial Aid

If you're looking for an edge, start by enrolling in one of our undergraduate, graduate or continuing education programs and becoming an active participant in the NJIT experience.

Find out what sets NJIT apart (http://www.njit.edu/about/rankings-and-recognition/) from other schools and what's new on campus and in the classroom. As a public university, our tuition and fees—combined with a generous financial assistance (http://www.njit.edu/financialaid/) program—put the edge within your reach.

Admissions

Applying for Admission

Students considering applying for admission to any of the undergraduate programs at NJIT should read the detailed requirements and procedures set out on the following pages.

Many NJIT students enroll as freshmen after graduating from high school, but applications are also welcome from transfer students who have completed some college work. The university works closely with community colleges and other institutions to facilitate transfer of students.

Admissions counselors are available to help students define their college plans. They will provide further information about any of the undergraduate programs, and explain the admission requirements for each program. If students are uncertain about which program to take, a counselor can help them make a decision.

The university strongly encourages applicants to visit the campus. The Office of University Admissions will be happy to arrange an interview and a student-guided tour.

An interview may be required as the Office of University Admissions attempts to evaluate each student's ability to complete a program at NJIT.

For further information contact:

Office of University Admissions
New Jersey Institute of Technology
University Heights
Newark, NJ 07102-1982
(973) 596-3300 or (800) 925-NJIT
E-mail: admissions@njit.edu

For an online application for admission, see NJIT on the Internet at https://www.njit.edu/admissions/apply-online (https://www.njit.edu/admissions/apply-online/)

General Admission Requirements

All Math/Science/Engineering/Engineering Technology Majors

High School Units

Applicants for admission must have completed a minimum of 16 secondary school units. Prospective students who have not taken all these units may be required to complete preparatory courses in the summer and/or pursue a modified program in the freshman year.

Required Units

English	4
College preparatory mathematics, including algebra, geometry and trigonometry	4
Lab sciences, chemistry and physics preferred	2
Other Units	6

Standardized Examination Requirements

All applicants must take either the Scholastic Assessment Test (SAT) or the American College Test (ACT).

Architecture Majors

Same general requirements with the following exception:

Lab sciences, physics and biology preferred	2

History, Business, and Communication Majors

Same general requirements with the following exceptions:

College preparatory mathematics	3
Science including one lab science	2

Science, Technology and Society Majors

Same general requirements with the following exception:

College preparatory mathematics	3

Freshman Admission

High school graduates who have not previously attended college may apply for admission as freshmen. In lieu of a certificate of graduation from an approved secondary school, a high school equivalency certificate, as issued by the New Jersey State Board of Education or similar state agency, may be submitted.

Home-schooled students should submit a summary transcript of the courses they have completed and the grades or level of achievement attained for each subject.

To apply for admission, you must submit The Common Application (https://www.commonapp.org/) and pay a non-refundable application fee. Please review the admissions application for further details. Your application will be considered on the basis of your high school record, your performance on standardized examinations, and other pertinent information.

Early Admission

Exceptional students who meet the course requirements and standardized examination requirements for a freshman program may begin as freshmen without completing the senior year of high school or receiving a high school diploma. Inquiries should be directed to the Office of University Admissions.

Advanced Placements

Accepted students may be awarded credit for freshman course work in a number of areas by taking the proper courses in secondary school and/or attaining satisfactory scores on appropriate Advanced Placement (AP) or International Baccalaureate (IB) Examinations. Policies for awarding AP and IB credit may be found at https://www.njit.edu/apib-and-college-transfer-credit (https://www.njit.edu/apib-and-college-transfer-credit/)

Course Placement

Students enter at many levels of achievement. The credentials of all accepted students are reviewed before specific courses are assigned; for details refer to section on Freshman and Transfer Testing in **Academic Policies and Procedures**.

The course work available ranges from the review (refresher)-level to honors-level courses, which provide more challenge for the well-prepared student.

Students for whom review is suggested or required may do such work during summer school or in a modified program during the freshman year.

Transfer Admission

To be considered for admission as a transfer student applicants must submit an Application for Undergraduate Admission and a non-refundable application fee.

Further details on transcript and standardized examination requirements may be found online.

NOTE: Transfer candidates who have completed the equivalent of one or more years of full-time study at an accredited US college or university in the same discipline as the one they plan to enter at NJIT are not required to submit standardized examination results or secondary school records except in cases in which it is deemed necessary by the Office of University Admissions.

Only matriculated students will be considered for transfer credit. Credit will be given only for completed courses that are equivalent to those in the NJIT curriculum. A minimum grade of C is required in order to receive transfer credit. For transfer course equivalencies for New Jersey colleges, visit http://www.njtransfer.org.

Transfer Technology Majors

Transfer candidates for admission to the program leading to the Bachelor of Science in Engineering Technology may submit a transcript indicating that they hold an associate's degree in technology (AAS) or in related areas. The university will consider applicants who have an educational background equivalent to an appropriate associate's degree but who do not have the degree. Transfer students from engineering programs may be required to complete a minimum number of technology courses in addition to the junior and senior year Bachelor of Science in Engineering Technology program.

The computer technology option is designed as a continuation of an associate's degree program in computer-related areas offered by community colleges or technical institutes.

Students who apply to the construction option must demonstrate successful completion of a two-year program (or an approved equivalent) in one of the following fields of technology: civil engineering, construction, drafting and design, mechanical engineering, or architecture.

Students who apply to the construction management option typically have an associate's degree in engineering technology or other related technical areas.

Students who apply to the electrical option must demonstrate successful completion of a two-year program (or an approved equivalent) in electrical or electronics engineering technologies.

Students who apply to the manufacturing option must have completed a two-year program (or an approved equivalent) in a field of engineering technology.

Students who apply to the mechanical option must have completed a two-year program (or an approved equivalent) in mechanical technology.

Students who apply to the surveying option may have successfully completed a two-year program (or an approved equivalent) in a field of engineering technology, or may begin their studies as first-time freshmen.

Joint Admissions Agreements with New Jersey Community Colleges

To assure the smooth transition from associate's degree programs offered at New Jersey community colleges to NJIT's bachelor's degree programs, NJIT has a number of Joint Admissions Agreements in place. These agreements specify the courses that community college students should take in order to maximize the number of transferable credits to NJIT. Generally, students electing this option can complete a specific BA or BS degree in four semesters of full-time study.

An important feature of all joint admissions agreements is that high school graduates are simultaneously admitted to both the cooperating community college and NJIT. The NJIT Office of University Admissions monitors the academic progress of students as they pursue the associate's degree. For the most recent list of joint admission/articulation agreements, visit: https://www.njit.edu/admissions/transfer-agreement-schools (https://www.njit.edu/admissions/transfer-agreement-schools/).

International Student Admission

Students whose native language is not English are required to submit their results from the Test of English as a Foreign Language (TOEFL) examination or the International English Language System (IELTS) and may also be required to take courses in English as a Second Language. The minimum TOEFL score is 550 on the paper-based exam, 213 on the computer-based exam, or 79 on the internet-based exam. The minimum IELTS score is 6.0.

Students who wish to receive transfer credit for course work completed in a country other than the United States are required to have their credentials evaluated by an accredited independent service. NJIT recommends the use of: World Education Services, Inc, Old Chelsea Station, New York, New York 10011. The transcript evaluation will be used to determine the transferability of courses. The cost for the evaluation of foreign records is borne by the student. In some cases, students may also need to be prepared to show course syllabi. Other acceptable accreditation services may be found at http://www.naces.org.

Students whose native language is not English, who transfer to NJIT from other US colleges or from foreign universities are required to take the English Placement Test. Further details are included with the Application for Undergraduate Admission and in the Academic Policy Section.

All students who will maintain F-1 or J-1 student status while attending NJIT must submit an International Student Financial Statement as part of their application. This form is available on the admissions website: https://www.njit.edu/admissions/how-apply-international-students (https://www.njit.edu/admissions/how-apply-international-students/)apply-international-students (https://www.njit.edu/admissions/how-apply-international-students/).

Special Programs

Accelerated Seven-year Programs Combining an NJIT Bachelor's Degree with a Medical, Dental, or Optometry Degree

Seven-year programs are available leading to the MD degree from either Rutgers New Jersey Medical School (RNJMS), St. George's University School of Medicine (SGUSOM) or American University of Antiqua West Indies. Students spend three years at NJIT in an established accelerated curriculum, followed by either four years at RNJMS or two years at SGUSOM followed by two years at St. Michael's Medical Center, Newark. Seven-year programs are available leading to a Dental degree from RNJMS following a similar plan. A seven-year program is available leading to the Doctor of Optometry (O.D.) degree from SUNY College of Optometry.

Approved accelerated curricula have been established in Biology, Biomedical Engineering, Chemistry, Communication, Engineering Science, History, Mathematics, Physics and Science, Technology and Society. A Bachelor's degree is awarded by NJIT following successful completion of the first year at the professional school.

Accelerated Six-Year BS/JD or BA/JD

NJIT and the Seton Hall University School of Law and Pace University Law School offer a program leading to the Bachelor of Science (BS) or Bachelor of Arts (BA) and the Doctor of Law (JD) following completion of a prescribed six-year course of study, including three years in an accelerated curriculum at NJIT as described above.

Accelerated BS/DPT in Physical Therapy at NJIT and RNJMS

NJIT and RNJMS have established an accelerated 6-year program leading to a BS degree from NJIT and a Doctor of Physical Therapy (DPT) degree from RNJMS. The program includes three years of undergraduate education at NJIT followed by three years of professional education in physical therapy at RNJMS. The senior undergraduate year is also the first year of the doctoral curriculum, so students save time and tuition cost. Students may choose any undergraduate major in the College of Science and Liberal Arts, including biology, chemistry, communications, mathematics, physics, or science, technology and society. Engineering science is also another major that can be selected for this option.

Accelerated BS/MS in Physician Assistant at NJIT and RNJMS

NJIT and RNJMS have established a 6-year program leading to a BS degree from NJIT and a Master of Science degree – Physician Assistant from RNJMS. The program includes three years of undergraduate education at NJIT followed by three years of professional education in physical therapy at RNJMS. The senior undergraduate year is also the first year of the doctoral curriculum, so students save time and tuition cost. Students may choose an undergraduate major in the College of Science and Liberal Arts, including biology, chemistry, or science, technology and society. Engineering science is also another major that can be selected for this option.

Non-Matriculated Students

Academically qualified students who do not desire to enter a degree program may enroll for credit in certain undergraduate courses. Such students must present transcripts of previous academic work or other appropriate evidence each semester they register in order to indicate adequate preparation for the course work involved. A non-matriculated student fee is required for each semester in which a student registers. Students are limited to 15 credit hours of non-matriculated enrollment.

Official transcripts for non-matriculated students must list subjects completed, grades earned, and credits taken. No grades or academic credits will be awarded for audited courses. Auditors, however, may receive a statement of their attendance in the course.

Credit by Examination and Transfer Credit

For further information see **Academic Policies and Procedures**.

College Level Examination Program (CLEP)

Applicants may be granted course credit for non-traditional college education such as independent studies or job-related experiences by successfully passing appropriate CLEP Subject Examinations. Interested candidates should contact the Counseling Center for additional information: (973) 596-3414.

Examinations to earn credit are available in certain courses. Students who believe they have the background covered in a given course should consult with their advisor in the department offering the course to see whether an examination is offered. To receive credit by examination, a student must earn a test score at or above the level designated by that department. Students who have failed or attempted a course at NJIT may not take an examination for credit in that course. A fee is charged for the examination.

Readmission

Students who have discontinued their studies for one or more semesters must apply for readmission to the Office of University Admissions by the application deadline. A non-refundable application fee must accompany applications. Applicants are subject to all probationary and unmet conditions in force at the time they discontinued their studies. Program requirements at the time of readmission will apply in addition to satisfaction of any prior unmet conditions.

Application deadlines for academically suspended applicants are:

For the Fall semester	July 1
For the Spring semester	Nov 1

Application deadlines for all other applicants are:

For the Fall semester	August 1
For the Spring semester	December 1

The Office of University Admissions will inform applicants of their readmission status.

Financial Aid

Financial aid is funding for your college education that comes from sources outside your family, such as the federal or state government or an institution. Gift aid, which comes in the form of scholarships and grants, does not have to be repaid. Self-help aid, such as loans and work-study, is either repaid or earned, respectively.

At NJIT, the concept of "financial aid" typically refers to **undergraduate** awards that are offered based on financial need, merit, or both. Any combination of awards is referred to as your "financial aid package," which is calculated based on the information you provide on your Free Application for Federal Student Aid (FAFSA).Specifically, the package is determined by your Cost of Attendance (COA), Expected Family Contribution (EFC), and financial need. As a recipient of undergraduate financial aid, you can receive a combination of grants, scholarships, education loans, and student employment (work-study) in your financial aid package.

Financial aid is also available to **graduate** students in the form of education loans such as a Federal Direct, Perkins, Graduate PLUS, or private loans. To apply, you must file a Free Application for Federal Student Aid (FAFSA) at www.fafsa.ed.gov. In addition to education loans, NJIT offers other sources of graduate financial support. For more information on graduate tuition and stipend support go to: http://catalog.njit.edu/graduate/admissions-financial-support/financial-support/.

You can visit other pages of our website (http://www.njit.edu/financialaid/) to learn how eligibility is determined and the variables such as withdrawal, enrollment status, and other special circumstances that affect your financial aid package. Our website is located at: http://www.njit.edu/financialaid/

For more information, you can contact the Office of Student Financial Aid Services at 973-596-3479 or at finaid@njit.edu.

Tuition and Fees

2022-2023 Undergraduate Tuition & Fees

Tuition and Fees Assessed (per Semester)

In-State Tuition & Fees

Credits	Tuition	Fees	Total
1	579.00	195.00	774.00
1.5	868.50	292.50	1,161.00
2	1,158.00	390.00	1,548.00
3	1,737.00	585.00	2,322.00
4	2,316.00	780.00	3,096.00
5	2,895.00	975.00	3,870.00
6	3,474.00	1,170.00	4,644.00
7	4,053.00	1,365.00	5,418.00
8	4,632.00	1,560.00	6,192.00
9	5,211.00	1,755.00	6,966.00
10	5,790.00	1,950.00	7,740.00
11	6,369.00	2,145.00	8,514.00
12-19 (Full-Time)	7,599.00	1,657.00	9,256.00

Out-of-State Tuition & Fees

Credits	Tuition	Fees	Total
1	1,354.00	195.00	1,549.00
1.5	2,031.00	292.50	2,323.50
2	2,708.00	390.00	3,098.00
3	4,062.00	585.00	4,647.00
4	5,416.00	780.00	6,196.00
5	6,770.00	975.00	7,745.00
6	8,124.00	1,170.00	9,294.00
7	9,478.00	1,365.00	10,843.00
8	10,832.00	1,560.00	12,392.00
9	12,186.00	1,755.00	13,941.00
10	13,540.00	1,950.00	15,490.00

11	14,894.00	2,145.00	17,039
12-19 (Full-Time)	15,829.00	1,657.00	17,486.00

Other Programs

Undergraduate 100% Online Programs: $523.00 per credit

Additional Information

- Full-time students (12 credits or more) will be assessed a Student Health Insurance fee in the Fall at a cost of $2,152,00. Students may waive this cost by filling out a health insurance waiver by the posted deadlines. F1/J1 Visa holders are required to have the NJIT Student Health Insurance plan and are not permitted to waive the coverage. For more information on student health insurance, please visit the Bursar's Office website.
- Student who are registered full-time (12-19 credits) and register for additional credits above 19 will be assessed the appropriate per credit rate for every additional credit.
- The Schedule of Tuition and Fees has been carefully reviewed and has been subject of a public hearing as required by law prior to the approval by NJIT's Board of Trustees. All fees are mandatory for full-time and part-time students and are considered non-negotiable.
- During the Summer & Winter sessions there is a flat University Fee for Graduate ($194.00) and Undergraduate ($195.00) programs in lieu of the fees noted above. The flat rate for tuition (12-19 credits) does not apply during the summer/winter sessions

Additional Fees

Fee Amount	Fee Description
75.00	U/G Application/Readmit/N-Matric
120.00	Commencement Fee
160.00	Matriculation Fee
500.00	Late Payment Penalty
50.00	Credit by Examination
100.00	Late Registration Fee
25.00	Maintaining Registration Fee Undergraduate
50.00	Maintaining Registration Fee Graduate
75.00	Master's Thesis
100.00	Dissertation Fee
125.00	International Student Fee
100.00	Payment Plan Fee
346.53	Parking Full-time (per semester) - includes tax
194.06	Parking Part-time (per semester) - includes tax
490.00	On-Campus Resident Parking (per semester)
6.625%	Commuter Parking Tax
200.00	Optional Practical Training Application Fee
7.00	E-Transcript Fee
2,152.00	Fall Health Insurance
230.00	First Year Student Fee
100.00	Payment Plan Late Fee
30.00	Transfer Student Orientation Fee
25.00	ID Replacement Fee

Campus Life and Student Services

The Campus Center is the hub of cultural, educational, and social activities for the NJIT community. The Campus Center staff provides students, faculty and staff with a relaxing environment where they can enjoy a meal, attend a meeting, study, watch a film, play a variety of games, participate in the many cultural, social, and educational activities offered, or just socialize with friends.

Student Services

The **Division of Students Affairs** consists of a variety of offices and departments that offer a wealth of programming, services, and resources to NJIT students. The common thread that runs through Student Affairs is the commitment to enable all students in our community to fully participate in an engaging, healthy, active learning environment during their time at NJIT.

Career Services

Career Development Services (http://www.njit.edu/cds/) is a value–added contributor to the career planning and preparation of NJIT students and graduates. We are dedicated to continually improving our client services and to assuming leadership in the profession of career development.

Our Mission is fulfilled through assisting:

- Students in gaining a clear understanding of their career options and workplace requirements, in obtaining experiential learning opportunities in the private and public sectors, in developing job search and interviewing skills, and obtaining employment upon graduation;
- Alumni in refining their job search and interviewing skills, career objectives, gaining a clear understanding of their career options and workplace requirements, and obtaining meaningful employment in a specialty consistent with their education, experience, and personal goals;
- Faculty/staff in understanding the needs of employers and of the academic preparation and associated skills necessary for graduates, and thus influencing curricula content and academic advisement;
- Employers in staffing their organizations with qualified students, graduates, and alumni capable of filling their workforce needs, and in developing closer and more effective relationships with university staff;
- The community in linking students, alumni, faculty, and staff directly to service and civic engagement activities with organizations committed to improving the quality of life for New Jersey residents.
- New Jersey's economic and workforce development efforts through ready access to a highly skilled workforce, thereby reducing company expenses for new employee recruitment, staffing, and training; facilitating the transfer of technological knowledge to the workplace; and through stimulating the creation of new jobs.

The Digital Campus

Computing has become ubiquitous in 21st century life, changing the way we work and learn, and even the way we interact with each other. The importance and power of information technology are evident in every discipline at NJIT, particularly in the STEM disciplines, where cascading breakthroughs and advances in information technology, have created a new interdependence among engineering, the physical sciences, computer science and math, and the biomedical sciences. NJIT researchers are leveraging the power of computing and information technologies to meet tomorrow’s challenges, to create the tools to help the digital world function, and to evaluate the impact of new technologies on society.

NJIT has built a 21st century digital campus to support teaching, learning research, and the administration of the university. At the heart of the digital campus is the NJIT Network, with over 19,000 connections throughout the campus’ 38 buildings, supplemented with the NJIT Wireless Network that blankets the campus, connecting over 22,000 devices each semester. Both networks provide access to servers, storage arrays, a large software library (http://ist.njit.edu/software/), and other IT services within the NJIT Cloud, enabling students to immerse themselves in design, discovery, simulation and modeling, and research questions previously inaccessible. Examples include:

- Simulating the interaction of biomolecules and identifying promising leads for drug development;
- Modeling the consequences of various transportation and energy systems;
- Studying global social networks;
- Designing and building the next generation of software and applications;
- Practicing computational science alongside traditional approaches;
- Designing buildings and other artifacts that are environmentally responsible and resource efficient.

Highlander Pipeline (http://my.njit.edu/), the NJIT Portal, is the entry point for many NJIT Cloud services. Students conduct most routine business processes online (e.g. register for classes, accept financial aid, pay bills, etc.) via Highlander Pipeline. The NJIT Library (http://library.njit.edu) provides online access to 27 full-text databases, over 33,500 electronic journals and more than 27,700 electronic books. A centralized "search all" portal delivers a single search experience of all electronic library resources.

Classrooms and other learning spaces at NJIT are all network enabled and equipped with modern projection devices, display panels, and other collaborative technologies to facilitate engagement and collaboration among faculty and groups of students. Many classes leverage video conferencing, lecture archival, learning management, and online discussion systems, allowing faculty and students to participate independent of time and place – converging the physical and virtual classrooms.

Students can BYOD (“bring your own device”) or use any of the hundreds of workstations in public-access computer labs or specialized academic department facilities across the campus. A healthy mix of Windows, Mac, and Linux workstations support the diverse needs of a technological research university.

The Tartan High Performance Computing Initiative provides NJIT researchers the broad range of centralized computational and data storage resources necessary to conduct computationally-intensive research. With over 3,200 CPU cores and 26,000 GPU cores, Tartan provides researchers with local resources capable of supporting leading edge research. A separate Hadoop cluster provides the resources for managing and analyzing very large data sets, commonly referred to as “big data.”

For additional information on IT services available at NJIT, visit the Home page of the Information Services & Technology (IST) Division (http://ist.njit.edu/).

Residence Life

Almost 2000 students live on campus in five coed residence halls and the Greek Village. More than 50 percent of first-year students live on campus. First-year students live in Cypress, Honors, and Redwood Halls. Upper-class students live in every building. Rooms are fully furnished (bed, desk, chair, closet, dresser), air-conditioned, wireless, and wired for the Internet and offer Residence Life Cinema (streaming service). Cable services are not provided. Each hall has common areas and facilities including lounges, study areas, kitchens, and laundry rooms. Snack and soda machines, recreational equipment (pool, ping-pong, large screen televisions, etc.), and mail service are also provided.

Cypress Hall is a coed facility that houses approximately 400 first-year, upper-class, and graduate students in single and double rooms. Suites are comprised of two bedrooms and a shared bathroom and foyer.

Greek Village is a coed facility that houses approximately 200 upper-class and graduate students in eight houses. Both fraternity and sorority members and nonmembers live in double rooms. Suites are comprised of two bedrooms and a shared bathroom. Each house has a common kitchen, dining, and living area (parlor space).

Honors Hall is a coed facility housing 360 first-year, upper-class and graduate students in single and double rooms. Suites have a shared bathroom. The building features a dining facility, convenience store, and fitness center. Residents assigned to the Honors Hall must be accepted to the Albert Doman Honors College.

Laurel Hall is a coed facility that houses 580 upper-class and graduate students in two-room suites. Suites consist of students living in single and double rooms, sharing a bathroom and foyer.

Oak Hall is a coed apartment facility that houses approximately 180 full-time upper-class and graduate students in both suite-style rooms and apartments. Each suite-style room is double occupancy with a kitchenette and a shared bathroom. Each apartment has a kitchen, living room, and bathroom. The eighth floor is designated for graduate and or non-traditional aged students.

Redwood Hall is a coed facility that houses 185 first-year and upper-class students living in single and double rooms. Residents share traditional floor bathrooms amongst the residents of the floor.

NJIT students use electronic cards for access to the residence halls. Desk attendants are on duty 24 hours a day and provide security for the residence halls by monitoring hall entrances and swiping resident IDs. All guests must have a valid government-issued photo ID and must be signed into the residence hall by a resident host. All guests must be accompanied by their hosts at all times. Residents wishing to host a guest under the age of 16 must receive permission from Residence Life; parental/guardian consent is required.

Residence Life has staff on-duty in each hall during non-business hours. Also, NJIT’s Department of Public Safety Office police and public safety officers patrol campus 24 hours a day. Patrols are conducted on foot, in cars, and on bicycles. Additionally, campus emergency phones are located on campus. Rooftop surveillance cameras are mounted throughout campus and monitored around the clock.

Once you have been admitted to NJIT and submitted your $250 university deposit, you can complete the Housing Application and Contract: https://www5.njit.edu/reslife/apply.php.

Applications for first-year students received by May 1 are guaranteed on-campus housing. After May 1, housing is assigned based on the distance you live from campus, need, and date of application.

For additional information please view our website: http://www.njit.edu/reslife (http://www.njit.edu/reslife/) or contact us via email reslife@njit.edu or call 973.596.3039.

Food Services

The Dining facilities are located in the Campus Center and the first floor of the Honors Residence. NJIT's private food services vendor, Gourmet Dining, operates all of the dining options on campus. Meal plan options include both Continuous Dining and Flex Dollar options. The Continuous Dining meal plans, A-E, features continuous dining with unlimited returns during all of the posted hours. Flex dollars can be used at Continuous Dining (for those without meal plans or only have flex), Korner Kilt C Store, Tech Café, Taco Bell, The Grill, Highlander Pub, Village Market, and Warren Street Café.

All residential students with less than 60 earned credits are required to select a meal plan from A-E. After one reaches 60 credits, they may drop their plan for the next semester or select from any available plan.

For hours and a complete listing of what is available via flex, please check https://njitecash-sp.transactcampus.com/eaccounts/AnonymousHome.aspx.

Library Services

Library Services

The Robert W. Van Houten Library (https://library.njit.edu/), NJIT's university library, is located in the Central Avenue Building (CAB) and serves as the primary facility for researching, studying, and browsing physical materials and online resources. In 1997, the Van Houten Library created the Information Commons, a computer lab with over 120 computer workstations. Today, it also houses the Information Training Lab, the Leir Data Observatory, and the IST Service Desk (https://ist.njit.edu/ist-service-desk/).

The Barbara and Leonard Littman Architecture & Design Library (https://archlib.njit.edu/), a branch of the university's library, is located in Weston Hall. It maintains a core collection of materials on architecture, art, and design: books, journals, maps, architectural drawings, various media, and models. The Littman Library also houses the Digital Scholarship Lab, Mostoller Reading Room, and Materials Library, a collection of materials samples.

Collection

The library collection comprises over 592,000+ volumes of print books and electronic books, journals, conference proceedings, reports, media, dissertations, and theses. The library spends over 95% of its materials budget on acquiring electronic resources accessible anytime and anywhere. Online resources include ACM Digital Library, Academic Search Premier, Artstor, ASTM International Standards, Avery Index, Business Source Premier, Factiva, IEEE Xplore, JSTOR, New York Times Online, ProQuest Academic Complete Ebook Central, ScienceDirect, SciFinder, Scopus, SPIE Digital Library, SpringerLink (includes Lecture Notes in Computer Science), Statista Expert, Wiley Online Library, and many more (https://researchguides.njit.edu/az.php). A centralized "search all (https://primo.njit.edu/)" portal delivers a single search experience of most electronic library resources.

Learning Spaces

The library strives to help students do their best work by offering a variety of individual and collaborative study spaces throughout the NJIT Library, including designated silent study areas and group study rooms with large display monitors for teamwork. The Leir Data Observatory provides a dedicated high-tech space for students and faculty to mutually study data science. See more about library services (http://library.njit.edu/services/).

Getting Started

Access to print and electronic resources starts at the Van Houten or the Littman Libraries home pages. Subject access to the journal literature in engineering, science, computer science, management, mathematics, architecture, design, and other subject areas is provided by various electronic databases.

Research and Instruction

Professional librarians provide instruction and consultation in all subject areas to enhance the student, faculty, and staff's ability to connect efficiently with needed information. Research help is available in person, by phone/text or via email, and through live chat (https://researchguides.njit.edu/start-research/researchhelp/) during selected hours. Not sure where to begin, the "Starting Your Research (https://researchguides.njit.edu/start-research/)" and other guides will help master the research process.

Resources Beyond NJIT

Students, faculty, and staff may supplement NJIT library resources by borrowing free of charge materials from the New Jersey Academic Library Network (NJALN) via Primo Discovery (https://primo.njit.edu/), Rutgers University – John Cotton Dana Library (https://www.libraries.rutgers.edu/newark/) and the George F. Smith Health Sciences Library (https://www.libraries.rutgers.edu/health-sciences/), the Newark Public Library (https://npl.org/), and the other state colleges and universities in New Jersey.

Interlibrary Loan and Document Delivery Services (https://researchguides.njit.edu/illiad/) can also provide free of charge materials to the students and researchers from anywhere globally, fulfilling article requests within 24-hours.

Special Collections and Archives

Included among NJIT's resources are the university's historical archive of artifacts developed and manufactured by Edward Weston. He was a scientist, a prolific inventor, and a founding member of the university's board of trustees. A collection of Dr. Weston's books, papers, and drawings is housed in the Rare Book room and available to scholars and others interested in the history of science and technology.

Contact Us

Van Houten Library	Littman Architecture & Design Library
Central Avenue Building	Weston Hall
(973) 596-3210	(973) 596-3083

http://library.njit.edu (http://library.njit.edu/) http://archlib.njit.edu (http://archlib.njit.edu/)

Student Life

The Office of Student Life (https://www.njit.edu/studentlife/) enhances the student experience at NJIT by providing opportunities for student-centered learning, personal and professional growth, and resources that foster an engaged and inclusive campus community. Through advisement, advocacy, annual programs and services, we empower our students to develop the skills necessary to be leaders in the workforce.

Specifically, Student Life meets the needs of our diverse undergraduate and graduate population by overseeing seven functional areas:

- **Student Organization Advisement:** We provide advisement and support to more than 150+ recognized student organizations (https://njit.campuslabs.com/engage/organizations/?categories=12123) through one-on-one advising, annual training, leadership development, and policy management.

- **Office of Fraternity & Sorority Life:** Provides opportunities for personal and professional development, civic engagement, and academic enhancement, all while developing close lifelong bonds with your peers. Celebrating 100 years of Greek life in 2021, NJIT supports over 30 fraternities and sororities that represent social, professional and service-based Greek-letter organizations.

- **Diversity and Inclusion:** The mission of Diversity and Inclusion is to initiate and support activities that promote cultural competency among students of the NJIT Community. We are committed to raising self-awareness, mutual understanding, knowledge, and respect for others. Our approach is relational in that we believe in growth-fostering relationships, therefore we commit to providing a welcoming place for all. We pledge to offer a safe space and outlet for dialogue; we commit to provide mentorship and support; as well as engage students to become advocates for issues of injustice in our multicultural world.

- **Annual Events:** We enhance campus engagement and school pride through campus wide annual events and traditions such Welcome Week, Student Appreciation Week, De-Stress Weeks, Winter Celebration, Constitution Day, and the Highlander Awards.

- **Commuter Resources:** We aim to address the needs of commuter students and provide resources and programmatic opportunities for engagement in campus life. One way we do this is by working with the Off-Campus and Commuter Student Association (OCCA), the commuter student union at NJIT.

- **Leadership Development**: Student Leadership Development is integral to a student's college experience. Under the oversight of the Office of Student Life, we offer a wide variety of leadership development opportunities, such as annual Student Leader Training, the NJIT L.E.A.D.S. Conference each winter, leadership workshops throughout the year, including within First Year Seminars, and a weekly Leadership Tip Tuesday series/social engagement on Instagram.

- **Food Pantry and Game Room:** We manage and promote free services provided in the Campus Center that are available to the student body including the Game Room and Food Pantry (https://www.njit.edu/foodpantry/). The NJIT Food Pantry is open to all NJIT community members who may have trouble affording or accessing a healthy diet.

In addition, Student Life oversees the campus wide management of **Highlander Hub**, NJIT's online platform for student engagement, student organizational management, and campus-wide events. Highlander Hub provides critical data regarding student involvement, attendance at campus-wide events, satisfaction and learning outcomes, and budget management tools.

Continuing Professional Education

NJIT's Continuing Professional Education provides enriching career-long learning opportunities through extension programs, Online Learning, graduate certificates, and professional development training for individuals and company employees.

Professional development programs include short courses, certificates and license reviews, with some leading to the award of continuing education units (CEUs). The CEU is used nationally to document the type, quality and duration of study. In general, a CEU is defined as being equal to classroom hours. All professional development courses can be adapted to meet a particular organization's needs and conducted as a custom-designed training program at a company site. For more than 50 years, NJIT has been designing and conducting high-quality professional development programs that meet organizations' business needs. Since 1990, NJIT has trained over 63,000 professionals as part of over 550 training initiatives for 300 different companies conducting business in New Jersey.

For further information contact cpe@njit.edu.

Special Programs

Academic Support

Dean of Freshman Studies

The Office of First Year Students supports new students --- freshmen and transfers --- in the completion of their first year of studies at NJIT. The dean works closely with faculty and students to resolve academic concerns or issues that may arise, and coordinates the freshman seminar. For further information, contact the Dean of First Year Students, (973) 596-2981.

Educational Opportunity Program (EOP)

EOP provides access and comprehensive support services for populations traditionally underrepresented in the disciplines offered at NJIT. Services provided include academic and financial support, career and personal counseling to first-time, full-time freshmen, upper-class students and eligible transfer students who received EOP funding at their previous institutions. The program features support services such as scholarships, grants and loans; an intensive pre-freshman summer academic enrichment program that helps prepare students for success in their first year of college; and access to job and internship opportunities. Further information may be obtained from the EOP office in Campbell Hall, third floor, by calling (973) 596-3690, or by visiting the EOP home page at http://www.njit.edu/eop/index.php (http://www.njit.edu/eop/).

University Research Experience (URE)

The Undergraduate Research Experience (URE) Program of EOP encourages students to include graduate and professional studies in their career planning and assists them in preparing for careers in academia by involving them in faculty guided and mentored research activities early in their undergraduate years. Assistance is also provided in the graduate admission process and identification of graduate financial aid. URE, established in September 1990, works in close collaboration with the Graduate Studies Office and the Center for Pre-College Programs at NJIT. This close collaboration affords a number of graduate students the opportunity to finance their education through stipends received as teaching or research assistants on campus and in public schools. This partnership also assists in the encouragement of students to pursue teaching careers, particularly at the university level.

Air Force ROTC-Aerospace Studies

A commission as a Second Lieutenant in the United States Air Force may be available to the student who completes the aerospace studies program on campus. Students in any bachelor's or master's degree program may pursue this option in conjunction with their normal academic studies. Additionally, students who are undecided about pursuing a career as an Air Force officer may take these courses to fill electives under special student status.

Students who seek a commission may participate in programs ranging from two to four years in length. The most comprehensive program consists of four academic years of AFROTC classes. The courses taken include AS 111 Heritage and Values of the United States Air Force I and AS 112 Heritage and Values of the United States Air Force II, introductory courses that explore the mission and organizational structure of the US Air Force; AS 221 Team & Leadership Fundamentals and AS 222 Team and Leadership Fundamentals II, the study of the evolution of air power from its earliest beginnings through the present, emphasizing historical events and their impact on the development and deployment of air power; AS 333 Leading People & Effective Com and AS 334 Leading Peo & Effective Com II, the study of the concepts and skills required by the successful manager and leader, focusing on organizational and personal ethics, communicative skills, and managerial strategy viewed in the context of the military; and AS 443 National Security Affairs/Prep Act and AS 444 Preparation for Active Duty, a survey of a broad range of topics concerning American civil and military relations and the environment in which US defense policy is formulated, including the role of the professional officer in a democratic society, the requisites for maintaining adequate national security forces, a special study of military justice and its effect on citizenship and preparation for active duty.

The four-year program requires students to participate in leadership laboratory held on Wednesday from 3:00-5:00 p.m.; departmental approval is required. This program also has a field training requirement of four weeks.

Programs of fewer than four years in length require a six-week field training session. During field training, which normally occurs the summer between the sophomore and junior years, students are placed in a variety of leadership positions and are given the opportunity to demonstrate their leadership, managerial, organizational, and physical skills. Upon returning to school for a fall semester, the students resume their aerospace studies with AS 333 Leading People & Effective Com, followed by AS 334 Leading Peo & Effective Com II, AS 443 National Security Affairs/Prep Act, and AS 444 Preparation for Active Duty as described above. Further information may be obtained by contacting the Department of Aerospace Studies, (973) 596-3626.

Cooperative Education and Internships

Cooperative Education (Co-op) and Internship programs offer students the opportunity, prior to graduation, to gain work experience that is related to their major. The Co-op Program provides students with an experiential and applications approach to education. Co-op is available to matriculated students in all majors. The program enhances the education of the student with the introduction of part- and full-time work experiences during which additive or degree credits can be earned.

Co-op enables students to examine a professional field through employment in a major-related job. All co-op students earn a salary that can help defray college and other expenses. Co-op work experiences are scheduled after the completion of the sophomore year; for architecture students, after the completion of the junior year; for students in Martin Tuchman School of Management, after the completion of the freshman year. Minimum requirements for admission into the Co-op Program include good academic standing and a GPA of at least 2.2. Architecture students are required to have a 2.5 minimum GPA for admission into the Co-op Program. Martin Tuchman School of Management Students are required to have a 2.8 minimum GPA for admission into the Co-op Program. Engineering students follow a Co-Op Option within their degree program and the admission requirements as well as other policies are specified at https://engineering.njit.edu/how-co-op-program-works (https://engineering.njit.edu/how-co-op-program-works/). Full-time undergraduate students completing a full-time co-op work assignment may register for only two courses in addition to their co-op course.

International students only: International students who wish to participate in the co-op experience must apply for employment authorization through the Office of Global Initiatives (OGI) and Career Development Services (CDS). International undergraduate students must register for 12 credits at all times (except last semester); credits from co-op can be used to count towards the minimum requirement. Students cannot take a co-op course by itself (except during summer term if summer is not the student’s final semester).

Descriptions for undergraduate co-op work experience courses (Co-op Work Experience I and Co-op Work Experience II) are found in the course listings of the departments offering them. See the list below.

Code	Title	Credits
ARCH 310	Co-Op Work Experience I	3
ARCH 410	Co-Op Work Experience II	3
BIOL 310	Work Experience I	3
BME 311	Co-op Work Experience	3
BME 411	Co-op Work Experience	0
CE 311	Co-op Work Experience I	0
CE 413	Co-op Work Experience II	3
CET 497	Co-op Work Experience	3
CHEM 310	Co-op Work Experience I	3
CHEM 311	Co-op Work Experience II	3
CIMT 497	Co-op Work Experience I	3
YWCC 310	Co-op Work Experience I	3
YWCC 410	Co-op Work Experience II	3
CS 485	Selected Topics In CS	3
CPT 395	Co-op Work Experience I	3
ECE 310	Co-op Work Experience I	0
ECE 410	Co-op Work Experience II	3
ECET 395	Co-op Work Experience I	3
ECET 495	Co-op Work Experience II	3
COM 490	Co-op Work Experience I	3
COM 491	Co-op Work Experience II	3
ENGR 310	Co-op Work Experience I	12
ENGR 410	Co-op Work Experience II	12
ESC 310	Work Experience I	3
IE 310	Co-op Work Experience I	0
IE 411	Co-op Work Experience II	3
IS 310	Co-op Work Experience I	3
IS 410	Co-op Work Experience II	3
IT 311	Co-op Work Experience I	3
IT 411	Co-op Work Experience	3
MATH 310	Co-op Work Experience I	3
MATH 410	Co-op Work Experience II	3
MGMT 310	Co-op Work Experience I	3
MGMT 410	Co-op Work Experience II	3
ME 310	Co-op Work Experience I	3
ME 410	Co-op Work Experience II	3
MET 395	Co-op Work Experience I	3
MET 495	Co-op Work Experience II	3
MNET 395	Coop Experience I	3
MNET 495	Cooperative Experien II	3

PHYS 311	Co-op Work Experience I	3
PHYS 411	Co-op Work Experience II	3
STS 311	Co-op Work Experience I	3
STS 411	Co-op Work Experience II	3

Graduate cooperative education courses may be found in the appropriate listing in the **Graduate Catalog**.

Ronald E. McNair Post Baccalaureate Achievement Program

The Ronald E. McNair Post Baccalaureate Achievement Program at NJIT is a US Department of Education funded program that prepares eligible undergraduate students majoring in Science, Technology, Engineering or Mathematics (STEM) for doctoral studies. Students with a GPA of 3.2 and above, junior or in some cases senior level standing who meet low income and first generation guidelines, or are from groups underrepresented in graduate education, are program eligible. McNair Fellows are engaged in research and other scholarly activities with faculty mentors from the academic community. Results of their research projects are presented at professional meetings and conferences and prepared for publication in peer reviewed and other professional journals. Additionally, McNair Fellows participate in a wide array of workshops and activities to prepare them for doctoral study. A primary goal of the McNair Program is to encourage minorities and individuals underrepresented in science, engineering and mathematics higher education fields to obtain doctorates and diversify the professoriate, thereby becoming role models for others of their background. For more information about the McNair Achievement Program visit the Web site at mcnair.njit.edu (http://mcnair.njit.edu/) or call (973) 596-6470 or 5590. Students may also stop by Kupfrian Hall, Room 201A.

Student Exchange/Study Abroad

NJIT offers a number of international exchange opportunities for undergraduate and graduate students in Europe and the Far East. Through established exchange agreements, participants are provided with opportunities to enhance their technological skills, expand their cultural horizons, and gain educational experience from an international perspective. Students gain firsthand knowledge of political, social, and economic systems of a rapidly changing world.

Students may elect to study for one semester or for a full academic year. NJIT students pay tuition and fees at NJIT and room and board at the host institution. Financial aid may be applied to these expenses.

With the prior written approval of the student's academic advisor, academic credit may be awarded for courses taken while participating in an international exchange program. Some programs may require proficiency in the language of the host country, especially if the language of instruction for course work is not English.

For further information, contact the Office of International Students and Faculty, (973) 596-2451.

Pre-Professional Programs

Pre-Law

While students desiring a professional legal career may apply to law school with any NJIT undergraduate course of study, the minor in legal studies is particularly appropriate for this purpose. This interdisciplinary minor introduces students to a wide range of approaches to the study of law. It combines a core course emphasizing skills needed to pursue further study in law with elective courses designed to enhance students' familiarity with the functioning of law, to sharpen their understanding of the historical and cultural dimensions of law, and to improve their grasp of legal issues in technological fields. For more information, contact the faculty coordinator of the legal studies minor.

Premedical, Pre-Dental or Preoptometric

Students interested in eventually obtaining degrees in medicine, dentistry or optometry may pursue any major at NJIT. Typically, schools of medicine,dentistry and optometry require that students have completed certain courses. For example, most medical schools require 1 year of English, 1 year of general physics with laboratory, 1 year of general biology with laboratory, 1 year of general chemistry with laboratory and 1 year of organic chemistry with laboratory. Some schools may require additional courses. Thus, certain majors at NJIT are especially suitable as they already incorporate most of these courses; these include biology, chemistry, biomedical engineering and chemical engineering. It is also possible to follow a focused four-year pre-medical, pre-dental or pre-optometric option with engineering science. Interested students may obtain further information from the Engineering Science program director.

Accelerated Programs in Law, Medicine, Dentistry or Optometry

Students may apply for accelerated joint degree programs (http://honors.njit.edu/academics/acceleratedprograms/) that offer the BS or BA degree plus the JD (law); the MD (medicine); either the DMD or DDS (dentistry); the OD (optometry); or the DPT (Doctor of Physical Therapy). These programs shorten the total time to the terminal degree by one year.

Students applying for these programs must first apply to, and be accepted by, the Albert Dorman Honors College (http://honors.njit.edu).

BS/MS, BS/PhD, and Dual Degree Programs

These accelerated dual degree programs permit undergraduates to earn credits toward a master's degree or a doctoral degree. Students in BS/MS take 6 credits of graduate course work in their senior year. These may be counted toward both a bachelor's degree and a following master's degree if enrollment as a graduate student in the master's degree program occurs within two years of completion of the bachelor's degree. After enrollment as a graduate student, those who wish to apply the 6 credits to the graduate degree program should contact the Office of Graduate Studies. Graduate study may be completed full or part-time.

Full-time undergraduate students become eligible to apply for the BS/MS program after they complete at least five courses in their major and have maintained a GPA of 3.0 or better. Students in the Albert Dorman Honors College are pre-approved for the BS/MS program at the time of admission to NJIT but will receive letters about activating their status in BS/MS if their GPA is still above 3.0 and have earned between 57 and 110 undergraduate credits. The activation letter will instruct Honors College students about contacting the Office of Graduate Studies. All other students with a 3.0 or better GPA will have to submit an application for admission to the BS/MS program to the Office of Graduate Studies no later than one year prior to graduation. Applicants must satisfy all university requirements for admission to graduate programs.

Exceptional students may seek to go into an NJIT doctoral program directly through the BS/PhD program and must have a record consistent with university criteria for doctoral study (3.5 GPA or better). Up to 12 graduate credits may be taken in the senior year and applied later toward an NJIT doctoral program. GRE scores are required for doctoral admission

Several other combinations of Bachelor's and Master's degrees exist or are under development. The number of dual-use credits for these combinations may exceed 6 credits in accordance with specific program requirements. An example is the B. Arch/MS in Management program which allows 12 dual-use credits. Information and applications for BS/MS, BS/PhD, and other accelerated dual degree programs can be obtained from the Office of Graduate Studies, Suite 140 Fenster Hall.

Community and Public Service

NJIT is committed to fostering opportunities for students to share their skills, talents, and enthusiasm through community service and civic engagement. Through both volunteer and paid service opportunities, students assist the public and non-profit sectors in meeting objectives to help improve the quality of life in our communities. Participants in these programs are a valuable resource of both technical and non-technical help for local and regional agencies. The office is open Mondays through Fridays, 8:30 a.m. - 4:30 p.m. during the school year. (Summer hours are 8:30 a.m.-5:00 p.m. Mondays through Thursdays). For more information about the programs described below, contact the Division of Career Development Services, Community and Public Service, (973) 596-3100 or view our website at https://www.njit.edu/cds/welcome/.

NJIT Community of Caring

NJIT "Community of Caring" Volunteers program is a concerted outreach to promote the good work of NJIT students. Annually, we challenge our campus members to provide at least 10,000 hours of service to the citizens, non-profit agencies, and schools in communities throughout New Jersey. Participants contribute service hours through the community connections volunteer referral service or through any of our other CDS civic engagement programs.

Community Service Work-Study Program

This program offers eligible students the option of working in community-based non-profit agencies, public schools, or governmental agencies to earn a work-study award. CSWS provides students the opportunity to earn part of the funds needed to cover educational cost and offers organizations an economical way to meet short-term staffing goals.

Wachovia/NJ DCA Housing Scholars and Community Development Program

The Housing Scholars Program continues to engage students in affordable housing and community development projects in New Jersey. This innovative program offered a paid, ten week, full-time summer internship for students attending NJIT and other New Jersey universities or colleges. NJIT students majoring in Architecture, Civil Engineering, and Management are selected to serve as Housing Scholars.

George Garrison and Sandy Kirk Community Service Scholarship

The George Garrison and Sandy Kirk Community Service Scholarship program promotes civic engagement by recognizing the commitment and outstanding community service contributions of NJIT students each year. One $1,000 scholarship and a $750 scholarship are presented for meritorious community service. The scholarship celebrates the dedication of George Garrison and Sandy Kirk, former CDS staff members, whose work at NJIT furthered the development of quality civic engagement for students.

NJIT Literacy Corps—America Learns

The NJIT Literacy Corps program is to engage students as tutors in local schools and after-schools sites. Our tutors help children in the greater Newark area to understand math concepts and to read well and independently by the end of the 3rd grade. NJIT students eligible for federal work-study and student volunteers provide one-on-one and group tutoring for children.

Service Learning Program

The Service Learning Program at NJIT facilitates experiential learning by helping students link academic theory with practical experience in a community service environment. Students participate in service learning internships related to their academic major and career goals. Successful involvement in community-based service experiences not only enhances career preparation but also provides students the opportunity to hone leadership skills in a service environment.

Athletes in Service to Communities

This program offers NJIT student-athletes the opportunity to provide community service and outreach through team-oriented projects. Team members serve as trainers and coaches for swimming and tennis camps, NJIT Celebrity Readers in our local schools, and coordinators to collect donated sports equipment for underprivileged youth.

Civic Engagement Computer Center @ NJIT

The Civic Engagement Computer Center @ NJIT is a student-supported resource of technical support through virtual volunteer projects for community agencies. The Center provides an avenue for NJIT students to hone their academic and technical skills through hands-on civic engagement experience. Our technology related majors volunteer or work to produce technical solutions for web design, data management, and basic computer training needs for community organizations and schools in the local and regional area.

Civic Engagement

NJIT is committed to fostering opportunities for students to share their skills, talents, and enthusiasm through community service and civic engagement. Through both volunteer and paid service opportunities, students assist the public and non-profit sectors in meeting objectives to help improve the quality of life in our communities. Participants in these programs are a valuable resource of both technical and non-technical help for local and regional agencies. The office is open Mondays through Fridays, 8:30 a.m. - 4:30 p.m. during the school year. (Summer hours are 8:30 a.m.-5:00 p.m. Mondays through Thursdays). For more information about the programs described below, contact the Division of Career Development Services, Civic Engagement, (973) 596-3100 or view our website at https://www.njit.edu/cds/welcome/.

Civic Scholars Program

The Civic Scholars program is an innovative civic engagement and leadership development learning experience for Honors College students. Participating students spend at least 25 hours per semester volunteering, as part of a service-learning experience, in a leadership shadowing and mentoring capacity with the Executive Director or senior staff member at a local non-profit or governmental agency.

NJIT- A.C.E. Mentor Program Partnership

The ACE Mentor Program serves high school youth who are exploring careers in Architecture, Construction, or Engineering. The program is designed to engage, inform, and challenge youth and college students in their pursuit of future careers in these professions. NJIT Collegiate interns assist professional mentors in their work with ACE high school protégés as part of a service-learning experience.

NJIT – Newark Public Schools – F.I.R.S.T. Robotics Programs

CDS, in collaboration with Pre-College Programs at NJIT, recruits and supervises the work of Honors College and work-study students serving as Technical Mentors/Literacy Tutors in a Robotics program. Mentors/Tutors guide 32 middle and high school teams in building robots to compete in tournaments at NJIT and in New Jersey. They also help teams gain hands-on experience in engineering and computer programming principles.

NJIT – Newark Public Schools College Tutors Partnership Program

NJIT students work to help 11th and 12th graders prepare for the New Jersey High School Proficiency Assessment Exam (HSPA). Tutors are employed to work 10 to 12 hours per week in the after-school and Saturday sessions in Newark high schools. They assist classroom teachers with providing instruction in Language Arts and Math competencies for over 350 NPS students.

Albert Dorman Honors College

Students with demonstrated high standards of personal and academic achievement can apply to the Albert Dorman Honors College. Admission depends on an excellent academic record, distinction in school activities, and meaningful service to the community. Additional financial support is available to Albert Dorman Honors Scholars.

The Honors College experience offers challenging courses as well as opportunities for research, leadership activities, and community engagement. Internships, co-op, and study abroad are all important educational milestones that are recognized as part of the individualized development of Albert Dorman Honors scholars.

Students enrolled in the Albert Dorman Honors College can choose to complete any degree program offered by the university; the Honors College additionally offers accelerated pre-health and pre-law programs that are available through selected accelerated majors.

For more information about the Albert Dorman Honors College, including how to apply, please visit honors.njit.edu (http://honors.njit.edu/)

Hillier College of Architecture and Design

The Hillier College offers undergraduate programs in Digital Design, Industrial Design, both NASAD accredited, Interior Design, CIDA and NASAD accredited, and two undergraduate programs in architecture -- a four-year pre-professional Bachelor of Science in Architecture (B.S.Arch.) and a NAAB accredited five-year professional Bachelor of Architecture (B.Arch.) degree leading to licensure. The College also offers four graduate degree programs: a NAAB accredited professional Master of Architecture leading to licensure (M.Arch.), a post-professional Master of Science in architecture (MS. Arch.), a Master in Urban Design (M.U.D) and a Ph.D. in Urban Systems.

Hillier College faculty engage in funded research in a variety of areas ranging from nanomaterials to sustainable and resilient design, the later led by the College's Center for Building Knowledge. With their emphasis on technological applications to design, both schools build on the strengths of a Carnegie Classification R1 research university while preparing students to succeed as practitioners, scholars and researchers. Students also benefit from our close proximity to New York City with its unparalleled cultural resources and employment possibilities. And our location in Newark provides students with a close-up view of a city that is rapidly transforming to reclaim the luster its citizens enjoyed in Newark's heyday as a manufacturing powerhouse.

Programs

- Architecture - B.Arch. (p. 165)
- Architecture - B.S. (p. 155)
- Digital Design - B.A. (p. 189)
- Industrial Design - B.S. (p. 193)
- Interior Design - B.A. (p. 192)

BS/MS Program Options **(**p. 102**)**

- Architecture - B.Arch. and Management - M.S. (p. 175)
- Architecture - B.Arch. and Technology - M.B.A. (p. 168)
- Architecture - B.Arch. and Urban Design - M.U.D. (p. 178)
- Architecture - B.Arch. and Civil Engineering - M.S. (p. 171)
- Architecture - B.S. and Management - M.S. (p. 161)
- Architecture - B.S. and Technology - M.B.A. (p. 157)
- Architecture - B.S. and Urban Design - M.U.D. (p. 163)
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Programs

- Architecture - M.Arch. (http://catalog.njit.edu/archive/2022-2023/graduate/architecture-design/architecture/march/)
- Architecture - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/architecture-design/architecture/ms/)
- Urban Design - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/architecture-design/architecture/infrastructure-planning-masters/)
- Digital Design - M.F.A (http://catalog.njit.edu/archive/2022-2023/graduate/architecture-design/architecture/fine-arts-in-digital-design-masters/).
- Digital Design - M.S (http://catalog.njit.edu/archive/2022-2023/graduate/architecture-design/architecture/master-of-science-in-digital-design/).

Double Majors **(**http://catalog.njit.edu/archive/2022-2023/graduate/academic-policies-procedures/special-programs/**)**

- Architecture (professional, or post-professional) - M.Arch. and Infrastructure Planning - M.I.P. (http://catalog.njit.edu/archive/2022-2023/graduate/architecture-design/architecture/march-mip-ms/)
- Architecture (professional, or post-professional) - M.Arch. and Management - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/architecture-design/architecture/march-management-ms/)
- Architecture (professional, or post-professional) - M.Arch. and Civil Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/architecture-design/architecture/march-civil-engineering-ms/)

- Urban Systems - Ph.D. (http://catalog.njit.edu/graduate/architecture-design/architecture/urban-systems-phd/)

College of Architecture and Design Courses

AD 111. Communication in Art and Design - Traditional Media. 3 credits, 6 contact hours (1;0;5).
Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. This course will explore a range of subjects from object still life to the human figure to landscape and will deal with specific issues of line, value, composition, structure, proportion and perspective. The aim of this course is to achieve a critical approach to hand-eye coordination and ideational sketching, through both direct observation and conceptual diagramming.

AD 112. Communication in Art and Design - Digital Media. 3 credits, 6 contact hours (1;0;5).
Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. This course will help students develop a critical attitude and analytical language to explore 3D and 2D issues involved in the study of design ideas but work will be focused primarily on digital techniques and modes of expression. It will cover drawing basics and digital modeling and extracted drawing techniques and critical analysis of these techniques and other methods of graphic (and architectural) representation.

AD 150. Color and Composition. 3 credits, 4 contact hours (2;2;0).
Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. Introduction to principles of 2D composition with emphasis on color use and color theory. Students are introduced to traditional media (watercolor and collage) and digital raster graphics (painting, image processing, and compositioning). Applications that include interior design, product/industrial design, advertising, web design, and fine arts are discussed. Concepts include grids and hierarchy, color models and mixing, color interaction, human response to color, printing, etc. Creative projects.

AD 161. History of Art And Design I. 3 credits, 3 contact hours (3;0;0).
This foundation history course surveys the principle aesthetic/functional themes and theories of the twentieth century. Students will explore how various individuals have used art and design to develop products that enriched society culturally and/or that resolved particular societal needs. The course will begin with how optics revolutionized painting, sculpture, architecture, film, etc, and explore how the modern movement broke with or reinterpreted the past through a series of flashbacks.

AD 162. History of Art And Design II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: AD 161. This course explores the major art and design movements and influences of the 20th century post 1930 that set the stage for today's 21st century art and design works that increasingly deal with issues of globalization and technology and ecology. Students will investigate the cultural meaning and historical significance of the art/design product throughout the 20th and 21st century.

AD 201. Human Factors/Ergonomics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Computing Literacy GER course, AD 150, AD 112. Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. Through lectures and "hands-on" experiments, this course will challenge the student to explore objects and environments as sensory and psychological experiences that effect human comfort, efficiency, function and emotion. Emphasis will be put on empathizing with the user with particular attention to those individuals with special physical, cognitive or occupational needs.

AD 325. Entrepreneurship for Designers. 3 credits, 3 contact hours (3;0;0).

AD 340. Photography and Imaging. 3 credits, 4 contact hours (2;2;0).
Prerequisites: AD 150 or ARCH 396 or permission of instructor. Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. Photography is introduced as an artistic medium in a digital context. General photographic principles and techniques will be discussed including digital flash photography, image processing, in/on-camera filters and post-processing filters, camera controls, and compositional elements. Photographic student projects will be required. Students must provide their own DSLR camera for use throughout the semester.

AD 463. Collaborative Design Studio. 5 credits, 11 contact hours (0;0;11).
Prerequisites: (DD 364 or ID 364 or INT 364 or ARCH 364) and PHYS 102. Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. Interdisciplinary and multi-disciplinary design studio where students work both individually and collaboratively on team project(s) that require the integration of different design disciplines.

AD 490. Special Topics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: DD 264 or ID 264 or INT 264 or ARCH 363. Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. As determined by individual section and topic. Group investigation of problems or topics of special interest in art and design including, but not limited to, fine arts, industrial design, interior design, and digital design.

AD 491. Independent Study. 1 credit, 1 contact hour (0;0;1).
Restriction: Permission of instuctor and departmental/school approval. Individual investigation of problems or topics of special interest in art and design including, but not limited to, fine art, industrial design, interior design, and digital design. Subjects may include the overlap between these areas and related areas including art/architectural history and architecture. Provides opportunities to work on a project with individual guidance from an instructor in the School of Art + Design.

AD 492. Independent Study. 2 credits, 2 contact hours (0;0;2).
Restriction: Permission of instuctor and departmental/school approval. Individual investigation of problems or topics of special interest in art and design including, but not limited to, fine art, industrial design, interior design, and digital design. Subjects may include the overlap between these areas and related areas including art/architectural history and architecture. Provides opportunities to work on a project with individual guidance from an instructor in the School of Art + Design.

AD 493. Independent Study. 3 credits, 3 contact hours (0;0;3).
Restriction: Permission of instuctor and departmental/school approval. Individual investigation of problems or topics of special interest in art and design including, but not limited to, fine art, industrial design, interior design, and digital design. Subjects may include the overlap between these areas and related areas including art/architectural history and architecture. Provides opportunities to work on a project with individual guidance from an instructor in the School of Art + Design.

ARCH 1. Architecture Elective. 3 credits, 3 contact hours (3;0;0).**

ARCH 110. Tools and Techniques I: Introduction to Architecture Thinking. 3 credits, 3 contact hours (3;0;0).
This course is the first of a required two-semester sequence; it introduces students to diverse tools and techniques of architecture thinking in diverse spheres of architecture culture through weekly lectures and recitations. Here, thinking is a critical disciplinary practice that parallels architecture as a practice of making, and this course is dedicated to fostering a broad understanding of what it means to “do” architecture. This fall semester course in tools and techniques of architecture thinking is followed by a spring semester of tools and techniques of architecture making.

ARCH 156. Tools and Techniques II: Introduction to Architecture Making. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 161 or ARCH 195. Introduction to digital tools in the delinieation, fabrication, and representation of contemporary design.

ARCH 195. Architecture Studio I. 4 credits, 9 contact hours (0;0;9).
This course is an introduction to the fundamental principles and elements of design. Emphasis on design methods, manipulation of form and space, and representation skills using traditional and digital instruments.

ARCH 196. Architecture Studio II. 4 credits, 9 contact hours (0;0;9).
Prerequisites: ARCH 195 or ARCH 161. A continuation of ARCH 195.

ARCH 2. Architecture Elective. 3 credits, 3 contact hours (3;0;0).**

ARCH 210. History of Architecture I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 110 and ENGL 101. This course examines the history of architecture and urbanism from the Paleolithic period to the Industrialization and provides a conceptual framework for looking at and analyzing structures and spaces. The geographic scope is global with emphasis on buildings, projects, landscapes, urban environments, and designers examined in relation to the social, economic, and political climates that produced them.

ARCH 211. History of Architecture II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 210 or ARCH 251 and ARCH 252. This course examines the history of architecture and urbanism from the eighteenth century to the early twenty-first century and builds upon the conceptual framework introduced in History I. The geographic scope continues to be global with emphasis on buildings, projects, landscapes, urban environments, and designers examined in relation to the social, economic, and political climates that produced them.

ARCH 223. Construction I. 3 credits, 3 contact hours (3;0;0).
This course is an introduction to construction processes, focusing on wood, steel, masonry, concrete materials and their related assemblies.

ARCH 224. Construction II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ARCH 223. This course surveys enclosure joints and assemblies, including roofing, insulation, doors, windows, glass and hybrid systems. It also focuses on interior and exterior finishes and their construction methodology and documentation, including Building Information Modeling (BIM).

ARCH 282. Structural Principles. 3 credits, 3 contact hours (3;0;0).
Restrictions: For Interior Design majors only, or with department approval. Course cannot be taken for Architecture Degree credit. Introduces structural statics through timber and steel design. Influences of materials and structural system choice analyzed relative to their impact on building design. Responsibilities of the architect during the structural design phase are introduced.

ARCH 283. Special Topics. 3 credits, 3 contact hours (3;0;0).
Investigation of problem of special interest in architecture.

ARCH 295. Architecture Studio III. 4 credits, 9 contact hours (0;0;9).
Prerequisites: (ARCH 196 and ARCH 110 and ARCH 156) or (ARCH 161 and ARCH 164 and ARCH 156). Examination of the technological, social and environmental issues as they relate to architectural design.

ARCH 296. Architecture Studio IV. 4 credits, 9 contact hours (0;0;9).
Prerequisites: ARCH 295 or ARCH 263. A continuation ARCH 295.

ARCH 301. Digital Modeling and Fabrication. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 156. The seminar in Digital Modeling and Fabrication is a 3-credit course for upper level students exploring advanced 3-dimensional computer modeling techniques and data export for assembly and fabrication to various computer numerically controlled (CNC) hardware available at the School of Architecture. Specifically, students engage in NURBS and solid modeling using Rhinoceros 3D and export data through various Rhino plug-ins including RhinoCAM, which writes G- and M- Codes for 2 and 3D milling operations. CNC hardware available as of Spring 2010 includes two (2) Universal Laser Cutters, each with 18" x 32" beds; two (2) Z-Corporation Z-310 3 dimensional printers; and a Precix 9100 Industrial CNC Router with a 48" x 96" bed. Students model and fabricate full scale assemblies individually and in teams and contribute to a final exhibition of student work. Familiarity with various software tools available at the College of Architecture and Design is encouraged but not required. Admission to the course to students in their second year of study by discretion of instructor.

ARCH 303. Structures I. 3 credits, 3 contact hours (3;0;0).
This course begins with the history of building structures, continues by introducing structural behavior, forces and responses in structural systems, and concludes with an introduction to static structural analysis.

ARCH 304. Structures II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 303 or ARCH 229. This course examines lateral forces, foundations, stability, deflection, long spans and special case structural systems. Methodology involves advanced static structural analysis.

ARCH 309. Environmental Control Systems I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 102. This course covers the basic principles and applications of passive environmental systems utilizing on-site resources to achieve thermal and visual comfort as well as energy and water conservation. The topics include climate analysis, thermal comfort, thermal envelope, solar shading, passive solar heating, passive cooling, visual comfort, daylighting, and renewables. This course is the first of a two-course sequence in building environmental control systems (309, 314) focusing on passive (architectural) solutions, yet active (mechanical/electrical) solutions are covered in the second sequence.

ARCH 310. Co-Op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Restriction: completion of the third year studio class, approval of the school and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. A designated faculty member monitors and evaluates the student's work and project. Requirements include mandatory participation in seminars and completion of a report and/or project. Apply in third year.

ARCH 312. Environmental Education I. 3 credits, 5 contact hours (2;3;0).
Involves architecture students in working with grade school or high school students in the solution of a joint environmental design project. Participants first work toward developing their own understanding and sensitivity of the manmade environment. Emphasis on learner-directed and discovery-guided inquiry, and educational methods to increase awareness of the physical settings created for human activities. Projects developed in nearby schools which focus on the interaction of individuals and small groups with the environment.

ARCH 314. Environmental Control Systems II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 309 or ARCH 227. This course provides students a deeper understanding of the relationship between architectural design and active building systems. The topics include heating and cooling systems, electric lighting design, electrical energy systems, acoustical systems, building water supply, plumbing systems, and fire protection. This course is the second of a two-course sequence in building environmental control systems (309, 314) focusing on active (mechanical/electrical) solutions.

ARCH 316. Structural Computer Applications BIM. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 304. The course explores the rising BIM technology with an emphasis on its structural applications as they relate to architectural design. The course also covers some structural computer applications using different types of computer programs. It is designed to help architecture students acquire and develop a more integrated approach to architecture. The course content consists mainly of some hands-on training projects in addition to some BIM related lectures. The lectures include some case studies such as the $611-million Nationals Park, in Washington, DC, illustrating how BIM can be successfully implemented. Various projects with different types of buildings will be used in the computerized applications.

ARCH 317. Advanced Architectural Graphics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 296. Gives students advanced techniques for architectural expression in traditional media. A basic knowledge of drawing methods, media, materials and projection techniques is assumed.

ARCH 324. Landscape and Urbanism. 3 credits, 3 contact hours (3;0;0).
This course is about Urbanism, Landscape Architecture and the intersection of the two. Students will learn about landscape design in relation to the human condition and develop an understanding of how the design of the constructed urban environment is directly tied into, and affecting of the global climate and our environmental health. Students will learn about access, topography, surrounding buildings, natural systems, adjacent functions and zoning.

ARCH 331. Formal Principles of Landscape Design Traditions Across the Globe. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 211. An overview of the opportunities and constraints of landscape designs. Emphasis on developing a practical understanding of the potentials of earth, water and plants in architecture. Students given an overview of social and ecological determinants of relations between land and buildings.

ARCH 332. Architecture: Image and Word I. 3 credits, 3 contact hours (3;0;0).
This course will present films on Architecture in which architects are speaking about and showing their own work. What we think is true about architecture is often wrong. Single images tend to abstract and greatly simplify why and how great architecture is created. Rarely are buildings seen in their content. Rarely are climatic, cultural and technical issues of design illustrated. AS a result, we often speculate about architecture based upon superficial or incomplete information.

ARCH 333. Architecture:Image and Word II. 3 credits, 5 contact hours (2;3;0).
This course will present films on Architecture in which architects are speaking about and showing their own work. Theoreticians provide "facts" to create a unified theory of design, which may lie outside the realm of historical reality, or the intention of the architect. The culture of architectural education and the nature of the design studio results in second hand knowledge, and design myth. Surveys of modern architecture leave a fragmentary memory of great works of architecture.

ARCH 335. Digital Tectonics. 3 credits, 3 contact hours (3;0;0).
This course uses 3D modeling tools to investigate the relationship of digital models to physical construction. The term digital tectonics refers to an idea regarding the qualities of works of contemporary architecture that seem to be influenced by the use of digital tools. In this course, students are asked to investigate this hypothesis by testing structure, skin, assemblage, form and space making methodologies that are aided by digital tools and rationalized through digital operations.

ARCH 337. Building Information Modeling. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 156. This course explores both technical and philosophical approaches to the use of the computer in architectural analysis, design development, information management, and document delivery. Autodesk Building Systems and Autodesk Revit Building will be used for 3D modeling and 2D documentation employing a systems-approach framework for spatial allocation, energy analysis, and structural considerations. The workings of the foundational information databases of the respective software will be thoroughly explored. Projects requirements will include building program resolution, solar analysis, asset scheduling, document layout, and design visualization. Proficiency with Autodesk Autocad (2D) and understanding of general CAD principles are required prerequisites.

ARCH 361. Adaptive Paradigms in Architecture. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 224. The course will focus on theories behind kinetic, responsive, and adaptive architecture. It will examine architecture in relation to the latest research in biology, material science, embedded systems, soft robotics, synthetic biology, bioengineering, and will address possible shifts in imagining and re-envisioning materialization of architecture. The course will underline architecture’s inseparable link to technology and speculate on new possibilities for architecture as an integrated, responsive, adaptive, and productive participant within larger ecologies.

ARCH 363. Architecture Studio III. 5 credits, 12 contact hours (0;0;12).
Prerequisites: ARCH 264, ARCH 251, ARCH 252, ARCH 223 or ARCH 541G, ARCH 227 or ARCH 543G and ARCH 229 or ARCH 545G. This course is a continuation of ARCH 264. Lecture hour explores the nature of technology, environment, and social order as they relate to studio work. Course materials purchase required.

ARCH 364. Architecture Studio IV. 5 credits, 13 contact hours (0;0;13).
Prerequisite: ARCH 363. A continuation of ARCH 363. Lecture hour explores in depth the nature of technology, environment, and social order as they relate to studio work. Students will be required to purchase course materials.

ARCH 381. History of Architecture III. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ARCH 252. A continuation of ARCH 252, this course surveys global developments in architecture, urban planning, and landscape design in the first half of the 20th century. It examines the continued architectural impact of industrialization and modernization and the geo-political consequences of World War I and World War II on the built environment. The focus is on the development and diffusion of modernism and its relationship to such key concepts as universalism, regionalism, historicism, and utopia.

ARCH 382. History of Architecture IV. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ARCH 381. Restrictions: For Digital Design and Interior Design majors only; other majors require department approval to register. This course is not part of the B.Arch and the Fall section cannot be taken for degree credit. The last in the sequence of history surveys, this course examines global developments in modern and contemporary architecture and urbanism after World War II and into the 21st century. Social uprisings, economic recessions, post-colonialism, modernization in the developing world, mass production and mass consumption, environmentalism, sustainability, and the computer revolution of the information age provide the historical and cultural framework for the course. The course pays particular attention to early extensions and critiques of modernism, the emergence of postmodernism, and current efforts to reevaluate modernism's legacy.

ARCH 395. Architecture Studio V. 4 credits, 9 contact hours (0;0;9).
Prerequisites: ARCH 224, and (ARCH 296 or ARCH 264), and ARCH 211 or (ARCH 381 and ARCH 382). This course is a continuation of ARCH 296.

ARCH 396. Architecture Studio VI. 4 credits, 9 contact hours (0;0;9).
Prerequisites: ARCH 395 or ARCH 363. A continuation of ARCH 395.

ARCH 408. Investigations in the Contemporary Landscape. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 211. Introduces the design, construction and management of contemporary landscape projects through case studies, field trips, and personal contact with prominent practicing landscape architects. A historical perspective of landscape architecture is used as a context for discussion.

ARCH 410. Co-Op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ARCH 310 or approval of the school and permission of the Office of Cooperative Education and Internships. Provides major-related work experience. A designated faculty member monitors and evaluates the student's work and project. Requirements include mandatory participation in seminars and completion of a report and/or project.

ARCH 423. Advanced Construction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 224. In this course students will learn about the relationship of contemporary architecture and current developments in the building industry and how this translates into tectonic systems. The course introduces students to manufacturing processes, assembly processes of building systems offsite and onsite, unconventional building materials and forms of representations and documentation at the intersection of design and building processes.

ARCH 429. Advanced Structures. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ARCH 304. This course covers advanced topics in structural analysis, design of reinforced concrete structures, design of steel connections, in addition to some topics in masonry structures. The course also includes design examples in relation to various types of foundation systems. It focuses on indeterminate structures in structural analysis and integrated structural systems in designing structures. Case studies of some well-known buildings are covered. Some BIM applications with computerized calculations are included.

ARCH 432. P3 Post Presentation Processing. 3 credits, 5 contact hours (2;3;0).
The project is deemed Architecture, with a capital A, but there remains nagging questions: What would the project be like if viewed stereoscopically? If it were rendered as a 360 degree panoramic view, what would the space be like? If it was accurately superimposed into the site (lighting, color, texture, camera angle), does the design improve when in the context? Would rendering styles using "natural media" be more descriptive? What would the architecture be like at night?.

ARCH 461. Resilient Structural Design and Construction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 304. This course discusses the topic of structural building design and construction for various hazards such as earthquakes, high winds/hurricanes, and floods. Each type of hazard is discussed separately. The structural design process is outlined based on the requirements of the latest codes and standards. Guidelines and recommendations for better design and construction in hazard areas are given. Design examples are used to illustrate the various design methods along with some practical building design projects. The standard procedures used in the safety assessment and evaluation of damaged buildings in the aftermath of hurricanes and earthquakes are introduced.

ARCH 463. Options Studio I. 5 credits, 11 contact hours (0;0;11).
Prerequisites: (ARCH 396 or ARCH 364), (ARCH 304 or ARCH 329), (ARCH 314 or ARCH 327) and ARCH 324. Studio methodology allows the students to select from various building programs, the nature of design dealing with technology, environment and the social order. Lecture hour coordinates with studio subject matter. Course materials purchase required.

ARCH 464. Option Studio II. 5 credits, 11 contact hours (0;0;11).
Prerequisites: ARCH 396 or ARCH 364 and ARCH 304 or ARCH 329 and ARCH 314 or ARCH 327 and ARCH 324. Studio methodology allows students to select from various building programs, the nature of design dealing with technology, environment and the social order.

ARCH 472. Professional Practice I. 3 credits, 3 contact hours (3;0;0).
Restrictions: senior standing. Covers the essentials for programming a building and understanding the full scope of project development that precedes and follows the programming phase. Identify major stakeholders in the building design and production process and examine their roles. Lectures and assignments include: user requirements and client values, methods of pro forma analysis for project development and approval, and how the development process changes over time.

ARCH 475. Professional Practice II. 3 credits, 3 contact hours (3;0;0).
Restrictions: senior standing. A forum for examination of the structure and practices of the profession of architecture. The formal and informal relationships between architects, and between architects and clients, government officials, and consultants are studied. Basic principles of office management for the small and large architectural firm are introduced.

ARCH 483. ST:. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 224, ARCH 304, ARCH 314. Technology Elective.

ARCH 491. Independent Study. 1 credit, 1 contact hour (0;0;1).

ARCH 493. Independent Study. 3 credits, 3 contact hours (0;0;3).

ARCH 495. Advanced Architecture Studio I. 5 credits, 11 contact hours (0;0;11).
Prerequisites: ARCH 396 or ARCH 364, ARCH 304 or ARCH 329, ARCH 314 or ARCH 327, ARCH 324. Architectural Studios, which introduce design methods and processes that synthesis a range of design determinants while integrating technical requirements. Projects consider a variety of interrelated scales and conditions including: site, environment, user and regulatory requirements, accessibility and life safety, structural and environmental systems, building envelope design and performance, architectural and cultural history; all of which influence architectural design, both creatively and technically.

ARCH 506. Advanced Design Options II. 5 credits, 13 contact hours.
Prerequisite: ARCH 504G. Required vertical studio electives; must be taken sequentially. Covers arange of advanced design issues in depth: integration of organizational, social, technical, spatial, and aesthetic issues within consistently articulated applied design solutions.

ARCH 510. Co-op Work Experience III. 0 credits, 3 contact hours.
Restriction: Approval of the school and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Students are required to complete and present miterm and final projects and/or reports. A designated faculty member monitors and evaluates the student's work and project.

ARCH 530. Methods of Architectural Research. 3 credits, 3 contact hours.
Prerequisite: ARCH 211. This course examines the essential methodologies of architectural research directed towards advanced undergraduates in the professional program. Methods of research will include those related to qualitative and quantitative analysis, historical investigations, critical interpretation, archival and field work, and diverse approaches to design-as-research.

ARCH 531. History of Modern Architecture. 3 credits, 3 contact hours.
Prerequisites: ARCH 211. This course examines the major tendencies of architectural practice and theory in the 20th century. Formal and cultural evolution of modernism is considered in relation to social, political, economic, and technological developments that informed its key buildings, projects, and texts.

ARCH 533. History of American Architecture. 3 credits, 3 contact hours.
Prerequisite: ARCH 211. This course investigates the emergence and development of architecture and urbanism in what is now the United States, from before European contact to the early 20th century. Focus is on building typologies and urban morphologies that contributed to a definition of a distinctive "American" approach to form, style, and settlement. The complex and enduring influence of colonization, enslavement, industrialization, and immigration is emphasized throughout.

ARCH 534. Aspects of Urban + Suburban Form. 3 credits, 3 contact hours.
Prerequisite: ARCH 211. This course examines major forms and patterns of urban and suburban development under modernity, focusing on the industrial and metropolis and its global influence. Changing concepts of the central city and the metropolitan periphery are examined in relation to cultural, socio-economic, and political developments.

ARCH 535. History of Architectural Ideas. 3 credits, 3 contact hours.
Prerequisite: ARCH 211. Discusses seminal architectural ideas in the western world from Vitruvius to the present day. Read books written by leading architectural theorists and analyze them in detail.

ARCH 536. Landscape and American Culture. 3 credits, 3 contact hours.
Prerequisites: ARCH 324. As in architecture, the parallel discipline of landscape architecture involves artistic intention set in conjunction with utilitarian concerns. As such, designs on the land include the integration of the arts and sciences of human culture with nature. Discusses landscape as a manifestation of American culture.

ARCH 537. Cable and Tension Structures. 3 credits, 3 contact hours.
Prerequisite: ARCH 304. The course covers the structural technology, history and design considerations of cable-suspended, cable-stayed, tensioned fabric and air-supported structures, and the use of light-tensile structures in architecture. The course also offers an overview of the engineering standards that provide guidelines and recommendations for their design. A long list of well-known cable and tensioned fabric structures will be used to illustrate the structural design concepts. The examples focus mainly on buildings and roof structures. The tensioned fabric roof examples include some of the impressive projects of Geiger Berger Associates and Horst Berger Partners who pioneered the evolution of tensioned fabric structures in the US and elsewhere.

ARCH 538. Sustainable Architecture. 3 credits, 3 contact hours.
Prerequisites: ARCH 314 or INT 222. Follows two precepts: accepting responsibility for the consequences of design decisions upon human well-being, and the long-term viability of natural systems. Topics include sustainable site design and development, environmentally sensitive building materials, lifecycle assessment and cost benefit analysis of building systems, and adaptive reuse.

ARCH 541. Material Systems in Design. 3 credits, 4 contact hours.
Prerequisites: ARCH 396. This seminar will allow students to exam material systems that give design agency to matter as a creative and technical force in the making of architecture. In doing so, it will provide students an opportunity to understand and explore the role material matters play in contemporary architectural theory and praxis. Focused on the exploration and understanding of material systems, this course will provide students with the intellectual underpinnings for the re-conceptionalization of matter within their own design processes.

ARCH 543. Lighting. 3 credits, 3 contact hours.
Prerequisites: ARCH 314 or INT 222. Explores, through modeling and calculation, the means by which architectural form and detail influence the luminous environment. Perceptual responses such as visual comfort and delight are examined. Topics include daylighting footprints, model design and testing, and computer-assisted light level analysis. Areas of investigation include the relationship between daylight and electric light in architecture; the variations of light with time; analysis of seasonal and weather differences; role of task in lighting strategies; and means of control for light quantity and quality.

ARCH 545. Case Studies in Architectural Technology. 3 credits, 3 contact hours.
Prerequisite: ARCH 224. Technological systems involved in the construction and use of buildings. Students conduct in-depth investigation of technology-related problems in architecture and construction. Case study method is used. Construction documents and reports are analyzed. Field visits are required.

ARCH 546. Designing and Optimizing the Building Enclosure. 3 credits, 3 contact hours.
Prerequisite: ARCH 224. Considers the building envelope, the boundary dividing the inside of a structure from the outside environment. Study and design optimal enclosures considering energy exchange, the relationship between energy and light, and life cycle costs.

ARCH 557. Problems in Modern Housing. 3 credits, 3 contact hours.
Prerequisite: ARCH 211. Attempts to provide decent, affordable and well-designed housing for broad segments of society are examined. Dwelling is examined through analysis of proto-typical design solutions in urban environments.

ARCH 559. Social Issues in Housing. 3 credits, 3 contact hours.
Prerequisites: ARCH 211. Lecture/seminar explores the historical, economic, social, technological, and political basis for current American housing policy and practice. Examines government, community-based and private sector attempts, both failed and successful, at providing decent, affordable, and well-designed housing for broad segments of society. Student teams analyze and discuss, in a series of classroom debates, the housing and planning implications of controversial social problems from homelessness and racial segregation to caring for the elderly and people with HIV/AIDS with an emphasis on the role of the architect.

ARCH 561. Synthesis Seminar. 3 credits, 3 contact hours.
Prerequisite: ARCH 495. Design research, analysis, application and presentation of the contextual, programmatic, regulatory and technical aspects of professional architectural practice as applied to an architectural design project in the Advanced Architectural Studio II.

ARCH 566. Advanced Architectural Design Studio. 5 credits, 12 contact hours.
Prerequisite: ARCH 564. This is an advanced architectural design studio, post Comprehensive Studio, studying contemporary design theories, design methods and construction technologies. Emphasis is placed upon independent design research as it relates to the broad range of architectural practice. Exploratory and experimental architectural projects are the focus of the course.

ARCH 571. Sustainable City. 3 credits, 3 contact hours.
Prerequisites: ARCH 110. This course will focus on sustainability issues (economic, social and environmental) at an urban scale. The course will provide an overview of existing frameworks and goals and speculate on solutions. This course will focus on recent descriptions and critiques of urban space and proposals for change.

ARCH 572. Mapping Urbanism. 3 credits, 3 contact hours.
Prerequisites: ARCH 211. This seminar provides the critical tools necessary to examine the city as both a representation and a reality in flux. Through an interdisciplinary framework, students study urban history, theory, visual thinking and information design. Parallel to learning about global cities, their urban challenges, and transformative design strategies, students learn to employ a diverse set of representational techniques to create inventive mappings.

ARCH 574. Case Studies in Community and Urban Design. 3 credits, 3 contact hours.
Prerequisites: ARCH 396. In-depth investigation of specific real-world problems of urban or community design carried out using case method approach. Current practices in the U.S. and other countries studied using interviews with designers, developers, community groups and government agencies. Site visits, reports and other documents provide important sources of information. Final report with supporting documentation required.

ARCH 576. Architecture of Utopia. 3 credits, 3 contact hours.
Prerequisites: ARCH 211. Seminar for the review of utopian projects that have attempted to embody and strengthen social ideas through transformations in the structuring of space. Architectural implications of different literary and philosophical utopias analyzed with an emphasis on those experimental proposals which were realized, in whole or in part, in built form.

ARCH 583. ST:. 3 credits, 3 contact hours.
Group investigation of problem of special interest in architecture.

ARCH 591. Independent Study. 1 credit, 1 contact hour.

ARCH 592. Independent Study. 2 credits, 2 contact hours.

ARCH 593. Independent Study. 3 credits, 3 contact hours.

ARCH 595. Advanced Architecture Studio II. 5 credits, 11 contact hours.
Prerequisites: ARCH 495 or ARCH 563. Corequisites: ARCH 561. Architectural Studios developing require design proposals that synthesis a diverse range of design determinants while integrating technical requirements and performance. Projects consider a variety of interrelated scales and conditions including: site, environment, user and regulatory requirements, accessibility and life safety, structural and environmental systems, building systems design and performance, architectural and cultural history; all of which influence architectural design, both creatively and technically.

DD 263. Digital Design Studio I. 4 credits, 9 contact hours (0;0;9).
Prerequisites: AD 111, AD 112. Corequisite: AD 150. Restrictions: For Digital Design majors only, or with department approval. Foundations of three dimensional design and image making. Project based applications focusing on the design and digital representation of narrative sequences and architectural or environmental settings for games, theater, advertisements, books, or similar contexts. Course includes modeling with different geometries (e.g. NURBS, polygonal) and advanced techniques in rendering with lighting and materials as well as issues of production design.

DD 264. Digital Design Studio II. 4 credits, 9 contact hours (0;0;9).
Prerequisites: AD 111, AD 112, AD 150, and DD 263. Restrictions: For Digital Design majors only, or with department approval. Foundations of motion based design and narrative exploring concepts of linear, motion-based two-dimensional media including motion graphics, live action filming, particle systems, digital video editing and digital video compression. Project based applications focusing on the design, production and post production of motion sequences for cinema, games, theater, advertisements, or similar contexts.

DD 275. History of Games. 3 credits, 5 contact hours (2;3;0).
Prerequisites: AD 111, AD 112 and AD 162 or ARCH 163, ARCH 263 and ARCH 251. Restrictions: For Digital Design majors only, or with department approval. A guided exploration through the world of games. Students will experiment, play, and analyze various aspects of games - from early traditional games to current generation electronically-mediated games; from individual games to collaborative online games. Game types will be analyzed with particular attention paid to the virtual environments in which these games take place. The expressive and persuasive aspects of games will also be explored.

DD 284. Video and Animation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 112 and AD 150 or equivalent with instructor's and program permission. Restrictions: For Digital Design majors only, or with department approval. Laboratory course exploring concepts of linear, motion-based two-dimensional media and includes motion graphics, live action filming, particle systems, digital video editing and digital video compression. Projects include the design and production of multiple projects addressing both technical and creative decision making.

DD 301. Acting Fundamentals for Animators. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 111, AD 112, AD 150 and DD 263. Introduction to the historical contexts of acting. Survey of acting techniques and principles and their relationship to successful visual storytelling. Topics covered include movement, empathy and dialogue. Application of acting to two-and three-dimensional animation. Students will study examples from animation as well as film and theater. Required projects include both in-class acting exercises as well as storyboard creation and directed computer graphics character animation.

DD 303. Foundations of Sound and Music. 3 credits, 3 contact hours (3;0;0).
Restrictions: For Digital Design majors only, or with department approval. A multimedia course to give an understanding of music theory and musicology. Survey of the history of music and musical movements, and the use of music in motion pictures, digital media, and interactive entertainment. An introduction to instrumentation, music notation, music theory world musicology, and ear training as well as the relationship between music and culture. Visual and audio components are included.

DD 320. Robotics for Architects and Designers. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 112, AD 150; or ARCH 295; or instructor approved equivalents. This course is for students who would like to explore and produce interactive and kinetic products or building prototypes using microcontrollers (Arduino), sensors, and actuators. The course will focus on producing creative and aesthetically articulated applications of robotic technologies. Topics include applications of adaptable, responsive, and distributed systems to various fields of design. The course will take a hands-on approach to learn about sensors (such as light, sound, motion, and gesture-tracking sensors, for example, Microsoft Kinect sensor), actuators (such as servo motors), graphic/game design/simulation software (Processing, Unreal Engine, and Unity3D), and prototyping using available digital fabrication tools such as laser cutters, 3-D printers, and CNC machines at the CoAD and others. Topics from IoT (Internet of Things) will be also explored for those who are interested in creating smart products. Recommended for 5th-, 4th-, and 3rd-year students with basic knowledge on programming, 3-D modeling, and digital fabrication skills. Open to students from any college. Non-CoAD students with appropriate backgrounds are welcome to join the course.

DD 321. Interactive and Reactive Environments. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 112, AD 150 and DD 284, or ARCH 295, or instructor permission. This course will investigate contemporary attitudes toward digital public spaces, from mainstream media facades, interactive art installations, and mobile applications to guerrilla-like techniques such as tactical media, activist gaming, and electronic civil disobedience. Based on their research of relevant precedents, students will design a 2D and/or 3D interactive environment.

DD 334. Simulated Environments. 3 credits, 3 contact hours (3;0;0).
Prerequisites: DD 263, DD 264 or ARCH 295. Pre or Corequisites: DD 275. Restrictions: Digital Design majors only, all others with permission of the department. This course will explore the application of desktop, non-immersive virtual reality to the representation of architecture. Course exercises and projects are designed to uncover both advantages and limitations of this emerging technology, on both practical and theoretical levels. The major focus of the course will be personal evaluation of these tools in the design of both object-specific and the spatial in architectural problem solving. The collaborative nature of the toolkit will inform design decisions vis-a-vis observation of participant behavior and open discussion with interactive critics.

DD 363. Digital Design Studio III. 5 credits, 11 contact hours (0;0;11).
Prerequisites: DD 263, DD 264, AD 161, AD 162, AD 150. Prerequisites or corequisites: DD 275, ARCH 251. Three-dimensional design in a digital milieu. Project-based applications focusing on the design and digital representation of architectural or environmental settings for games, theater, advertisements, books, or similar contexts. Course includes modeling with different geometries (e.g. NURBS, polygonal) and advanced techniques in rendering with lighting and materials as well as issues of production design.

DD 364. Digital Design Studio IV. 5 credits, 11 contact hours (0;0;11).
Prerequisites: ARCH 382, DD 275, DD 363, IT 201. Design studio focusing on two-and three-dimensional visual communication of data, including interactive and scripted/animated communication as well as still-image utilization. Applications may include website creation, information kiosks, exhibit design, educational videos, scientific visualization, and other graphics-intensive projects.

DD 403. Digital Sound and Music. 3 credits, 3 contact hours (3;0;0).
Restrictions: For Digital Design majors only, or with department approval. A studio class that provides a baseline understanding of sound design within an animated video and video game environment. Course includes an introduction to sampling, field recording, sound effects, production techniques, and general sound design for the purpose of integrating and managing the integration of audio in motion pictures, television, and video games. Analytical and creative projects are required.

DD 415. Web/Exhibit Development. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 150, DD 284, IT 201. Instructor may waive or accept alternate prerequisite(s) based on individual student preparation. Overview of multimedia exhibit design dealing with issues of graphic identity human-computer interactions, and information visualization as tools for comprehension, enhanced communication, and effective decision-making. Exhibit types include educational symposia, museum/gallery shows, and online environments. Analyses and creative project(s) are required.

DD 442. Visual and Special Effects in Movies. 3 credits, 3 contact hours (3;0;0).
Restrictions: For Digital Design majors only, or with department approval. The creating of narrative-dependent moving images pushes the boundaries of entertainment technology. This class investigates the progress of visual and special effects as viewing moved from the Kinetoscope to 4K digital projection. The use of mirrors, cameras, and other analog devices along with information technology enabled effects including computer generated imagery are studies. Analytical and creative projects are required.

DD 443. 2-Dimensional Character Design. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 111, DD 275 and DD 284 This course focuses on the design of charaters for 2-Dimensional media such as graphic novels, 2D video games, model sheets for 3D creation, concept art and so on. Students will create both humanoid and creature-based charaters by using a variety of skillsets, including basic anatomy, illustrating age, acting (through characters), prop and costume design, etc. Students will also learn pre-production tools such as reference gathering, concept sketches and mood boards.

DD 444. 3-Dimensional Character Devel. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 111, DD 275, DD 284 and DD 301 In-depth exploration of 3D character design, modeling and animation for video games and cinematographic production. Conceptual and technical/production topics are considered. Precedent studies are required from sources including illustration, gaming and video/animation disciplines as well as theatrical and cinematographic choreography including fashion designers and make-up artists. 3D modeling, UV unwrapping, texturing and rigging as well as pipeline production processes are also included.

DD 449. Imaginary Worlds: Architecture in Motion Pictures. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 112, AD 161, AD 162 or ARCH 211, ARCH 395. Restrictions: DD cohort designation for DD majors only. Like childhood photographs in family albums, movies are part of our collective memories and become a unique way of "remembering" an era or place even one that has never existed or could exist. The study of imaginary worlds in motion pictures provides students with opportunities to gain an awareness of architecture and study it from different perspectives. Movies studied will be limited to those that postulate new, or unique, environments rather than those films that faithfully document reality. Discussions will focus on architectural issues raised by the movies studied as well as those found in critical essays.

DD 464. Digital Design Studio III. 5 credits, 11 contact hours (0;0;11).
Prerequisite: DD 364. Continuation of Digital Design Studio II with projects of greater complexity requiring the selection and use of multiple media (including time-based media) in the preparation and completion of creative work. Independent research and production by each student is required for all projects. Production of both passive and interactive projects will be part of the studio program.

ID 203. Past, Present and Future of Design. 3 credits, 3 contact hours (3;0;0).
Restriction: Sophomore level or higher. Intensive survey course marking pivotal design paradigm shifts from ancient cultures through the industrial revolution, the present day and projecting into the future, this course focuses on the human activity called design. Case studies of selected cultures and designers will expose the student to the forces, history, methods, styles and meanings that shape the human ecology.

ID 216. Modeling and Prototyping. 3 credits, 3 contact hours (3;0;0).
Corequisite: ID 263. Restrictions: Sophomore level or higher. For Industrial Design majors only, or with department approval. Introduction to the drafting skills, techniques and methods needed to communicate a design for fabrication as well as the materials, tools and techniques to make full size working prototypes. The drafting component of the course will cover orthographic, isometric, line weight, dimensioning and specifications. Building from the drafting component of the course, the prototypes component will - through work in the model shop - introduce the student to the most common fabrication techniques, tools and methods used to build appearance and working prototypes in various materials.

ID 217. Modeling and Manufacturing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ID 216. Corequisite: ID 264. Restriction: For Industrial Design majors only, or with department approval. This course will build on the computer modeling techniques of the ID 216 course and combine it with the programs, tools and facilities used in Computer-Aided Manufacturing (CAM). The student will take computer-generated designs and feed them directly into the manufacturing system. The course will also explore Computer Aided Manufacturing as a means of facilitating mass customization: the process of creating small batches of products that are custom designed to suit each particular user.

ID 263. Industrial Design Studio I. 4 credits, 9 contact hours (0;0;9).
Prerequisites: AD 111 and AD 112. Corequisite: AD 150. Restriction: For Industrial Design majors only, or with department approval. Students are introduced to designing objects, environments and systems through a series of exercises in conceptual, abstract, and strategic thinking as it applies to the small and large-scale artifact. The relationship between function structure materiality, production aesthetics and human needs are introduced and tested.

ID 264. Industrial Design Studio II. 4 credits, 9 contact hours (0;0;9).
Prerequisites: AD 150 and ID 263. Restrictions: For Industrial Design majors only, or with department approval. This course is a continuation of ID 263 with the focus shifting toward selected problems derived from the areas of work, health, education, recreation and communication. Introduction to the case study method of analyzing existing products.

ID 301. Industrial Design Specialization. 3 credits, 3 contact hours (3;0;0).
Corequisite: ID 363 (or higher) or INT 363 (or higher). Restriction: Permission of Art + Design Advisor. This project-based course will expose the student to one of many specialties within the Industrial Design profession that may include industry-specific design explorations and case studies in areas that include the design of furniture, consumer products, toys, footwear and apparel, jewelry, lighting, exhibits, way-finding graphics, transportation, etc.

ID 310. Ethnographic and Marketing Research. 3 credits, 3 contact hours (3;0;0).
Restriction: Junior level or higher. Research methodologies will be explored and conducted as a means to lend an objective understanding of user needs, desires and motivations. This will occur through well documented interviews, surveys, observations and interventions. The information gathered will be used to shape new products, add value to existing products or give insite to yet unexplored products or marketing opportunities.

ID 312. Mechanics and Electronics. 3 credits, 3 contact hours (3;0;0).
Corequisite: ID 263. Restrictions: Sophomore level or higher. For Industrial Design majors only, or with department approval. This is an advanced research course that addresses products which employ electronics predominantly as the major factor of design, then products that employ mechanical systems as the major determining factor, finally, the interpolanation of the mechanical with the electronic with a focus on the human interface with these products.

ID 340. Materials and Processes. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 201 or ARCH 295. Restrictions: Junior level or higher. The student will be introduced to the basic materials and processes used in manufacturing of both short run and mass-produced objects. The course will comprise of lectures, field trips and design exercises employing both traditional and state-of-the-art manufacturing processes.

ID 341. Sustainable Materials and Processes. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 201 or ARCH 295. Restrictions: Junior level or higher. The course will comprise of lectures and field trips that take a critical look at the traditional materials and processes used in manufacturing and evaluate alternatives based on research and experimentation. Each student will perform a Life Cycle Analysis (LCA) on an existing product by following the products life from the mining of raw materials to disposal taking particular attention to energy usage, use of natural resources, toxicity and decomposition.

ID 363. Industrial Design Studio III. 5 credits, 11 contact hours (0;0;11).
Prerequisite: ID 216, ID 217 and ID 264. This project specific studio will address real-world needs, parameters, and research as it applies to market trends and industry focused development. Companies and entrepreneurs will be invited to submit industry or need specific project briefs to the studio which will become the project for the semester. The students will experience first-hand the challenges of designing, building and testing within a real-life, interdisciplinary framework. The company will participate as sponsor, mentor and partner to the students.

ID 364. Industrial Design Studio IV. 5 credits, 11 contact hours (0;0;11).
Corequisites: ID 216, ID 363, AD 201. A knowledge and evidence-based studio that addresses real-world needs, parameters, and research. Work and product design(s) may be derived from requirements that include governmental and non-governmental not-for-profit organizations as well as from research about needs that can affect the social, physical, and economic health of individuals.

ID 370. New Product Testing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: AD 201 or ARCH 295 or permission of instructor. A hybrid course combining hands-on physical testing of products with lectures, readings, and case study presentations (both group and individual- oral and written). Multiple evaluative criteria (e.g safety, value, sustainability) will be discussed, established, and tested on a variety product types. Students may be required to provide/purchase a limited number of items for destructive testing. In-class student participation required.

ID 410. Professional Practice and Ethics. 3 credits, 3 contact hours (3;0;0).
Restriction: Senior level. This course covers the concepts of legal rights, copyrights, responsibilities and obligations of the designer, re: liabilities, contract review, patents, royalties, etc. The course also covers areas of responsibility in owner-offices, within corporate offices, working with design consultants and procedures for establishing a professional design practice. The course will also focus on the ethics of practice, research and marketing within a social, political and cultural context.

ID 463. Industrial Design Studio V. 5 credits, 11 contact hours (0;0;11).
Prerequisite: ID 364. This studio will draw from the vast academic talent at NJIT by partnering Industrial Design students with students in the other colleges and departments on campus such as engineering, architecture, management and computing. The students will develop methodologies for achieving effective collaboration and integration of industrial design with other disciplines, especially in the early phases of product development, through an industry specific design project.

ID 464. Industrial Design Studio V. 5 credits, 11 contact hours (0;0;11).
Prerequisites: ID 364 and PHYS 102. A comprehensive studio with projects (including multi-disciplinary projects) of advanced design and complexity. Students will work to initiate research and development of projects within the studio to demonstrate a full range of professional competencies, including but not limited to, the ability to independently critique work in progress. Completed work and presentation materials are expected to be exhibitable quality.

INT 221. Building and Interior Systems I. 3 credits, 3 contact hours (3;0;0).
Restrictions: For Interior Design majors only, or with department approval. An introduction to, and overview of, large-scale systems used in and affecting the design of building interiors. The operation and impacts of heating, ventilating, and air conditioning equipment on building space and layout are emphasized. Additional topics include the design of plumbing and waste systems as they affect building planning and the design of related spaces (including kitchens and bathrooms) and the use and design requirements for vertical transportation in building interiors.

INT 222. Building and Interior Systems II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 102. Restriction: For Interior Design majors only, or with department approval. An introduction to, and overview of, small-scale systems used in and affecting the design of building interiors. The needs and scope of design potentials in electrical systems (including requirements for media installations) and lighting design as they are used in, affect the design of, interiors are emphasized. Also included is an introduction to building acoustics and how basic principles affect design layout and material and furniture selection for a variety of building and construction types.

INT 263. Interior Design Studio I. 4 credits, 9 contact hours (0;0;9).
Prerequisites: AD 111, AD 112. Corequisite: INT 221. Pre or Corequisite: AD 150. Restriction: For Industrial Design majors only, or with department approval. A hands-on studio based introduction to the basic principles and elements of design for interior design students. Emphasis on design methods using multiple media, manipulating form and space. Course includes lectures, readings, analytical exercises, and (primarily three-dimensional) design projects.

INT 264. Interior Design Studio II. 4 credits, 9 contact hours (0;0;9).
Prerequisites: AD 150, INT 263. Corequisite: INT 222. Restriction: For Interior Design majors only, or with department approval. A continuation of Interior Design Studio I. A hands-on studio course that expands introductory design problems into commercial interiors and public spaces. Interior design as a knowledge-based discipline is introduced. Emphasis is placed on the development of an iterative and reflective design process as well as the production and presentation of interior design proposals. Preliminary integration of multiple technical variables is included.

INT 321. Methods and Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 111, AD 112, AD 150 or ARCH 334, AD 161, AD 162 and ARCH 251. Restriction: For Interior Design majors only, or with department approval. The study of materials, products, and assemblies used in interior design. The course covers code requirements and life safety, specification, installation, performance of materials (including fabrics and textiles), and sustainability of material selection and utilization. Also covered are the impacts of materials utilization on health and interior environmental quality.

INT 322. Contract Documents. 3 credits, 3 contact hours (3;0;0).
Prerequisites: INT 321, INT 363. Pre or Corequisites: ARCH 282. Restrictions: For Interior Design majors only, or with department approval. The course addresses issues of standards and methods of ethical and professional practice. It covers the production of contracts between the professional design service provider and clients as well as various project deliverables used in initial design phases through project close out. Document types covered include letters of agreement, contract document drawing sets and addenda sketches, specifications, schedules and budgets.

INT 350. History of Furniture. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 161 and AD 162 or equivalent; or ARCH 295. Survey course studying the history and characteristics of furniture design from antiquity to the present day. Study of social and design forces influencing furniture. Students will analyze furniture in terms of style, aesthetic intent, construction and materials, ergonomics, universal/barrier-free accessibility, sustainability, and technology. Major stylistic movements will be discussed.

INT 351. Furniture Design. 3 credits, 5 contact hours (2;0;3).
Prerequisites: INT 264 or ID 264 or DD 364 or FA 264 or ARCH 211. Corequisite: Studio enrollment. This course is an introduction to the concepts, materials and construction technologies involved in the design and fabrication of furniture. It explores the relationship between ergonomics, comfort and function in the design of furniture for both site-specific environments and mass-produced applications. Course includes lectures, field trips and a variety of drawn, modeled, and built design projects.

INT 363. Interior Design Studio III. 5 credits, 11 contact hours (0;0;11).
Prerequisites: INT 222, INT 264. Pre or Corequisites: INT 221, INT 321, INT 350. Design studio focusing on residential design. The course includes a study of the relationship of human behavior to design emphasizing dwelling, security, comfort, and home. The correlation between furniture use and selection and residential space is explored. Variables studied include aesthetics and design organization, as well as the link between residential design and interior systems like lighting and plumbing.

INT 364. Interior Design Studio IV. 5 credits, 11 contact hours (0;0;11).
Prerequisites: INT 221, INT 222, INT 321, INT 363. Pre or Corequisites: ARCH 282. A continuation of the studio sequence with design and space planning projects of increasing complexity selected within the context of commercial and institutional building types - from office environments and healthcare facilities to religious venues and community facilities. Students are expected to further develop skills to simultaneously resolve conceptual, technical, aesthetic, and functional aspects of designs.

INT 464. Interior Design Studio V. 5 credits, 11 contact hours (0;0;11).
Prerequisites: ARCH 282, ARCH 337, INT 321, INT 322, INT 364. Corequisite: AD 201. A comprehensive studio with projects of advanced design and programming complexity concentrating on larger multi-level institutional and/or mixed-use building types. Students will work to initiate research and development through all design phases to synthesize the functional, sociological, aesthetic, regulatory, and project-specific technical requirements of their projects as they relate to interior design.

Architecture

Accredited by: The National Architectural Accrediting Board.

In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit U.S. professional degree programs in architecture, recognizes three types of degrees: the Bachelor of Architecture, the Master of Architecture, and the Doctor of Architecture.

The New Jersey School of Architecture offers a five-year Bachelor of Architecture (B.Arch.) as a first professional degree program that is accredited by The National Architectural Accrediting Board The school also offers a nonprofessional, four-year undergraduate program leading to the Bachelor of Science in Architecture (B.S.Arch.). The B.S.Arch. does not lead to licensure as an architect; instead it presents students with a wide array of complementary options leading to career opportunities within the larger design and building industries.

The New Jersey School of Architecture educates students to assume positions of responsibility and leadership in the architectural profession and in developing areas of opportunity in technology and community design related to the discipline of architecture. An emphasis on studio design in the curriculum is reinforced by required courses in history, building science, professional practice and social concerns. A diverse faculty brings its expertise to bear on issues of architecture, technology and culture and challenges students to prepare for their productive years as practitioners, scholars and researchers. The architecture program builds on the strengths of a top-tier Research University with its long history in computer graphics while emphasizing design directed toward the traditional human-centered values of architecture.

NJIT Faculty

A
Alcala, Jose M., University Lecturer

B
Bess, Mark E., University Lecturer
Brothers, David A., Senior University Lecturer

C
Cays, John M., Associate Dean for Academics, College of Architecture and Design;
Interim Director, School of Art and Design

D
Decker, Martina, Associate Professor
Evans, Deane, Associate Dean for Research; Director, Center for Resilient Design

E
Esperdy, Gabrielle, Professor, Interim Dean

G
Garcia Figueroa, Julio C., University Lecturer
Goldman, Glenn, Professor, School of Design

H
Harp, Cleveland J., University Lecturer
Hurtado De Mendoza, Maria, Associate Professor

K
Kelly Hutzell, Associate Professor, Director, School of Architecture
Kim, Hyojin, Associate Professor
Kolarevic, Branko R., Professor,
Kum-Biocca, Hyejin Hannah

N
Narahara, Taro, Associate Professor
Navin, Thomas R., Senior University Lecturer

O
Ogorzalek, Thomas, Senior University Lecturer

P
Parlac, Vera, Associate Professor

R
Riether, Gernot, Associate Professor

S
Schwartz, Mathew L., Assistant Professor
Sollohub, Darius T., Associate Professor

T
Taher, Rima, Senior University Lecturer
Theodore, Georgeen, Professor

W
Won He Ko, Assistant Professor

Z

Zarzycki, Andrzej, Associate Professor
Zdepski, Michael, S., Associate Professor

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- Architecture - B.S. and and Management of Technology - M.B.A. (p. 157)
- Architecture - B.S. and Infrastructure Planning - M.I.P. (p. 163)
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New Jersey School of Architecture Courses

ARCH 1. Architecture Elective. 3 credits, 3 contact hours (3;0;0).**

ARCH 110. Tools and Techniques I: Introduction to Architecture Thinking. 3 credits, 3 contact hours (3;0;0).
This course is the first of a required two-semester sequence; it introduces students to diverse tools and techniques of architecture thinking in diverse spheres of architecture culture through weekly lectures and recitations. Here, thinking is a critical disciplinary practice that parallels architecture as a practice of making, and this course is dedicated to fostering a broad understanding of what it means to “do” architecture. This fall semester course in tools and techniques of architecture thinking is followed by a spring semester of tools and techniques of architecture making.

ARCH 156. Tools and Techniques II: Introduction to Architecture Making. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 161 or ARCH 195. Introduction to digital tools in the delinieation, fabrication, and representation of contemporary design.

ARCH 195. Architecture Studio I. 4 credits, 9 contact hours (0;0;9).
This course is an introduction to the fundamental principles and elements of design. Emphasis on design methods, manipulation of form and space, and representation skills using traditional and digital instruments.

ARCH 196. Architecture Studio II. 4 credits, 9 contact hours (0;0;9).
Prerequisites: ARCH 195 or ARCH 161. A continuation of ARCH 195.

ARCH 2. Architecture Elective. 3 credits, 3 contact hours (3;0;0).**

ARCH 210. History of Architecture I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 110 and ENGL 101. This course examines the history of architecture and urbanism from the Paleolithic period to the Industrialization and provides a conceptual framework for looking at and analyzing structures and spaces. The geographic scope is global with emphasis on buildings, projects, landscapes, urban environments, and designers examined in relation to the social, economic, and political climates that produced them.

ARCH 211. History of Architecture II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 210 or ARCH 251 and ARCH 252. This course examines the history of architecture and urbanism from the eighteenth century to the early twenty-first century and builds upon the conceptual framework introduced in History I. The geographic scope continues to be global with emphasis on buildings, projects, landscapes, urban environments, and designers examined in relation to the social, economic, and political climates that produced them.

ARCH 223. Construction I. 3 credits, 3 contact hours (3;0;0).
This course is an introduction to construction processes, focusing on wood, steel, masonry, concrete materials and their related assemblies.

ARCH 224. Construction II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ARCH 223. This course surveys enclosure joints and assemblies, including roofing, insulation, doors, windows, glass and hybrid systems. It also focuses on interior and exterior finishes and their construction methodology and documentation, including Building Information Modeling (BIM).

ARCH 282. Structural Principles. 3 credits, 3 contact hours (3;0;0).
Restrictions: For Interior Design majors only, or with department approval. Course cannot be taken for Architecture Degree credit. Introduces structural statics through timber and steel design. Influences of materials and structural system choice analyzed relative to their impact on building design. Responsibilities of the architect during the structural design phase are introduced.

ARCH 283. Special Topics. 3 credits, 3 contact hours (3;0;0).
Investigation of problem of special interest in architecture.

ARCH 295. Architecture Studio III. 4 credits, 9 contact hours (0;0;9).
Prerequisites: (ARCH 196 and ARCH 110 and ARCH 156) or (ARCH 161 and ARCH 164 and ARCH 156). Examination of the technological, social and environmental issues as they relate to architectural design.

ARCH 296. Architecture Studio IV. 4 credits, 9 contact hours (0;0;9).
Prerequisites: ARCH 295 or ARCH 263. A continuation ARCH 295.

ARCH 301. Digital Modeling and Fabrication. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 156. The seminar in Digital Modeling and Fabrication is a 3-credit course for upper level students exploring advanced 3-dimensional computer modeling techniques and data export for assembly and fabrication to various computer numerically controlled (CNC) hardware available at the School of Architecture. Specifically, students engage in NURBS and solid modeling using Rhinoceros 3D and export data through various Rhino plug-ins including RhinoCAM, which writes G- and M- Codes for 2 and 3D milling operations. CNC hardware available as of Spring 2010 includes two (2) Universal Laser Cutters, each with 18" x 32" beds; two (2) Z-Corporation Z-310 3 dimensional printers; and a Precix 9100 Industrial CNC Router with a 48" x 96" bed. Students model and fabricate full scale assemblies individually and in teams and contribute to a final exhibition of student work. Familiarity with various software tools available at the College of Architecture and Design is encouraged but not required. Admission to the course to students in their second year of study by discretion of instructor.

ARCH 303. Structures I. 3 credits, 3 contact hours (3;0;0).
This course begins with the history of building structures, continues by introducing structural behavior, forces and responses in structural systems, and concludes with an introduction to static structural analysis.

ARCH 304. Structures II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 303 or ARCH 229. This course examines lateral forces, foundations, stability, deflection, long spans and special case structural systems. Methodology involves advanced static structural analysis.

ARCH 309. Environmental Control Systems I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 102. This course covers the basic principles and applications of passive environmental systems utilizing on-site resources to achieve thermal and visual comfort as well as energy and water conservation. The topics include climate analysis, thermal comfort, thermal envelope, solar shading, passive solar heating, passive cooling, visual comfort, daylighting, and renewables. This course is the first of a two-course sequence in building environmental control systems (309, 314) focusing on passive (architectural) solutions, yet active (mechanical/electrical) solutions are covered in the second sequence.

ARCH 310. Co-Op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Restriction: completion of the third year studio class, approval of the school and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. A designated faculty member monitors and evaluates the student's work and project. Requirements include mandatory participation in seminars and completion of a report and/or project. Apply in third year.

ARCH 312. Environmental Education I. 3 credits, 5 contact hours (2;3;0).
Involves architecture students in working with grade school or high school students in the solution of a joint environmental design project. Participants first work toward developing their own understanding and sensitivity of the manmade environment. Emphasis on learner-directed and discovery-guided inquiry, and educational methods to increase awareness of the physical settings created for human activities. Projects developed in nearby schools which focus on the interaction of individuals and small groups with the environment.

ARCH 314. Environmental Control Systems II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 309 or ARCH 227. This course provides students a deeper understanding of the relationship between architectural design and active building systems. The topics include heating and cooling systems, electric lighting design, electrical energy systems, acoustical systems, building water supply, plumbing systems, and fire protection. This course is the second of a two-course sequence in building environmental control systems (309, 314) focusing on active (mechanical/electrical) solutions.

ARCH 316. Structural Computer Applications BIM. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 304. The course explores the rising BIM technology with an emphasis on its structural applications as they relate to architectural design. The course also covers some structural computer applications using different types of computer programs. It is designed to help architecture students acquire and develop a more integrated approach to architecture. The course content consists mainly of some hands-on training projects in addition to some BIM related lectures. The lectures include some case studies such as the $611-million Nationals Park, in Washington, DC, illustrating how BIM can be successfully implemented. Various projects with different types of buildings will be used in the computerized applications.

ARCH 317. Advanced Architectural Graphics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 296. Gives students advanced techniques for architectural expression in traditional media. A basic knowledge of drawing methods, media, materials and projection techniques is assumed.

ARCH 324. Landscape and Urbanism. 3 credits, 3 contact hours (3;0;0).
This course is about Urbanism, Landscape Architecture and the intersection of the two. Students will learn about landscape design in relation to the human condition and develop an understanding of how the design of the constructed urban environment is directly tied into, and affecting of the global climate and our environmental health. Students will learn about access, topography, surrounding buildings, natural systems, adjacent functions and zoning.

ARCH 331. Formal Principles of Landscape Design Traditions Across the Globe. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 211. An overview of the opportunities and constraints of landscape designs. Emphasis on developing a practical understanding of the potentials of earth, water and plants in architecture. Students given an overview of social and ecological determinants of relations between land and buildings.

ARCH 332. Architecture: Image and Word I. 3 credits, 3 contact hours (3;0;0).
This course will present films on Architecture in which architects are speaking about and showing their own work. What we think is true about architecture is often wrong. Single images tend to abstract and greatly simplify why and how great architecture is created. Rarely are buildings seen in their content. Rarely are climatic, cultural and technical issues of design illustrated. AS a result, we often speculate about architecture based upon superficial or incomplete information.

ARCH 333. Architecture:Image and Word II. 3 credits, 5 contact hours (2;3;0).
This course will present films on Architecture in which architects are speaking about and showing their own work. Theoreticians provide "facts" to create a unified theory of design, which may lie outside the realm of historical reality, or the intention of the architect. The culture of architectural education and the nature of the design studio results in second hand knowledge, and design myth. Surveys of modern architecture leave a fragmentary memory of great works of architecture.

ARCH 335. Digital Tectonics. 3 credits, 3 contact hours (3;0;0).
This course uses 3D modeling tools to investigate the relationship of digital models to physical construction. The term digital tectonics refers to an idea regarding the qualities of works of contemporary architecture that seem to be influenced by the use of digital tools. In this course, students are asked to investigate this hypothesis by testing structure, skin, assemblage, form and space making methodologies that are aided by digital tools and rationalized through digital operations.

ARCH 337. Building Information Modeling. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 156. This course explores both technical and philosophical approaches to the use of the computer in architectural analysis, design development, information management, and document delivery. Autodesk Building Systems and Autodesk Revit Building will be used for 3D modeling and 2D documentation employing a systems-approach framework for spatial allocation, energy analysis, and structural considerations. The workings of the foundational information databases of the respective software will be thoroughly explored. Projects requirements will include building program resolution, solar analysis, asset scheduling, document layout, and design visualization. Proficiency with Autodesk Autocad (2D) and understanding of general CAD principles are required prerequisites.

ARCH 361. Adaptive Paradigms in Architecture. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 224. The course will focus on theories behind kinetic, responsive, and adaptive architecture. It will examine architecture in relation to the latest research in biology, material science, embedded systems, soft robotics, synthetic biology, bioengineering, and will address possible shifts in imagining and re-envisioning materialization of architecture. The course will underline architecture’s inseparable link to technology and speculate on new possibilities for architecture as an integrated, responsive, adaptive, and productive participant within larger ecologies.

ARCH 363. Architecture Studio III. 5 credits, 12 contact hours (0;0;12).
Prerequisites: ARCH 264, ARCH 251, ARCH 252, ARCH 223 or ARCH 541G, ARCH 227 or ARCH 543G and ARCH 229 or ARCH 545G. This course is a continuation of ARCH 264. Lecture hour explores the nature of technology, environment, and social order as they relate to studio work. Course materials purchase required.

ARCH 364. Architecture Studio IV. 5 credits, 13 contact hours (0;0;13).
Prerequisite: ARCH 363. A continuation of ARCH 363. Lecture hour explores in depth the nature of technology, environment, and social order as they relate to studio work. Students will be required to purchase course materials.

ARCH 381. History of Architecture III. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ARCH 252. A continuation of ARCH 252, this course surveys global developments in architecture, urban planning, and landscape design in the first half of the 20th century. It examines the continued architectural impact of industrialization and modernization and the geo-political consequences of World War I and World War II on the built environment. The focus is on the development and diffusion of modernism and its relationship to such key concepts as universalism, regionalism, historicism, and utopia.

ARCH 382. History of Architecture IV. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ARCH 381. Restrictions: For Digital Design and Interior Design majors only; other majors require department approval to register. This course is not part of the B.Arch and the Fall section cannot be taken for degree credit. The last in the sequence of history surveys, this course examines global developments in modern and contemporary architecture and urbanism after World War II and into the 21st century. Social uprisings, economic recessions, post-colonialism, modernization in the developing world, mass production and mass consumption, environmentalism, sustainability, and the computer revolution of the information age provide the historical and cultural framework for the course. The course pays particular attention to early extensions and critiques of modernism, the emergence of postmodernism, and current efforts to reevaluate modernism's legacy.

ARCH 395. Architecture Studio V. 4 credits, 9 contact hours (0;0;9).
Prerequisites: ARCH 224, and (ARCH 296 or ARCH 264), and ARCH 211 or (ARCH 381 and ARCH 382). This course is a continuation of ARCH 296.

ARCH 396. Architecture Studio VI. 4 credits, 9 contact hours (0;0;9).
Prerequisites: ARCH 395 or ARCH 363. A continuation of ARCH 395.

ARCH 408. Investigations in the Contemporary Landscape. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 211. Introduces the design, construction and management of contemporary landscape projects through case studies, field trips, and personal contact with prominent practicing landscape architects. A historical perspective of landscape architecture is used as a context for discussion.

ARCH 410. Co-Op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ARCH 310 or approval of the school and permission of the Office of Cooperative Education and Internships. Provides major-related work experience. A designated faculty member monitors and evaluates the student's work and project. Requirements include mandatory participation in seminars and completion of a report and/or project.

ARCH 423. Advanced Construction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 224. In this course students will learn about the relationship of contemporary architecture and current developments in the building industry and how this translates into tectonic systems. The course introduces students to manufacturing processes, assembly processes of building systems offsite and onsite, unconventional building materials and forms of representations and documentation at the intersection of design and building processes.

ARCH 429. Advanced Structures. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ARCH 304. This course covers advanced topics in structural analysis, design of reinforced concrete structures, design of steel connections, in addition to some topics in masonry structures. The course also includes design examples in relation to various types of foundation systems. It focuses on indeterminate structures in structural analysis and integrated structural systems in designing structures. Case studies of some well-known buildings are covered. Some BIM applications with computerized calculations are included.

ARCH 432. P3 Post Presentation Processing. 3 credits, 5 contact hours (2;3;0).
The project is deemed Architecture, with a capital A, but there remains nagging questions: What would the project be like if viewed stereoscopically? If it were rendered as a 360 degree panoramic view, what would the space be like? If it was accurately superimposed into the site (lighting, color, texture, camera angle), does the design improve when in the context? Would rendering styles using "natural media" be more descriptive? What would the architecture be like at night?.

ARCH 461. Resilient Structural Design and Construction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 304. This course discusses the topic of structural building design and construction for various hazards such as earthquakes, high winds/hurricanes, and floods. Each type of hazard is discussed separately. The structural design process is outlined based on the requirements of the latest codes and standards. Guidelines and recommendations for better design and construction in hazard areas are given. Design examples are used to illustrate the various design methods along with some practical building design projects. The standard procedures used in the safety assessment and evaluation of damaged buildings in the aftermath of hurricanes and earthquakes are introduced.

ARCH 463. Options Studio I. 5 credits, 11 contact hours (0;0;11).
Prerequisites: (ARCH 396 or ARCH 364), (ARCH 304 or ARCH 329), (ARCH 314 or ARCH 327) and ARCH 324. Studio methodology allows the students to select from various building programs, the nature of design dealing with technology, environment and the social order. Lecture hour coordinates with studio subject matter. Course materials purchase required.

ARCH 464. Option Studio II. 5 credits, 11 contact hours (0;0;11).
Prerequisites: ARCH 396 or ARCH 364 and ARCH 304 or ARCH 329 and ARCH 314 or ARCH 327 and ARCH 324. Studio methodology allows students to select from various building programs, the nature of design dealing with technology, environment and the social order.

ARCH 472. Professional Practice I. 3 credits, 3 contact hours (3;0;0).
Restrictions: senior standing. Covers the essentials for programming a building and understanding the full scope of project development that precedes and follows the programming phase. Identify major stakeholders in the building design and production process and examine their roles. Lectures and assignments include: user requirements and client values, methods of pro forma analysis for project development and approval, and how the development process changes over time.

ARCH 475. Professional Practice II. 3 credits, 3 contact hours (3;0;0).
Restrictions: senior standing. A forum for examination of the structure and practices of the profession of architecture. The formal and informal relationships between architects, and between architects and clients, government officials, and consultants are studied. Basic principles of office management for the small and large architectural firm are introduced.

ARCH 483. ST:. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ARCH 224, ARCH 304, ARCH 314. Technology Elective.

ARCH 491. Independent Study. 1 credit, 1 contact hour (0;0;1).

ARCH 493. Independent Study. 3 credits, 3 contact hours (0;0;3).

ARCH 495. Advanced Architecture Studio I. 5 credits, 11 contact hours (0;0;11).
Prerequisites: ARCH 396 or ARCH 364, ARCH 304 or ARCH 329, ARCH 314 or ARCH 327, ARCH 324. Architectural Studios, which introduce design methods and processes that synthesis a range of design determinants while integrating technical requirements. Projects consider a variety of interrelated scales and conditions including: site, environment, user and regulatory requirements, accessibility and life safety, structural and environmental systems, building envelope design and performance, architectural and cultural history; all of which influence architectural design, both creatively and technically.

ARCH 506. Advanced Design Options II. 5 credits, 13 contact hours.
Prerequisite: ARCH 504G. Required vertical studio electives; must be taken sequentially. Covers arange of advanced design issues in depth: integration of organizational, social, technical, spatial, and aesthetic issues within consistently articulated applied design solutions.

ARCH 510. Co-op Work Experience III. 0 credits, 3 contact hours.
Restriction: Approval of the school and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Students are required to complete and present miterm and final projects and/or reports. A designated faculty member monitors and evaluates the student's work and project.

ARCH 530. Methods of Architectural Research. 3 credits, 3 contact hours.
Prerequisite: ARCH 211. This course examines the essential methodologies of architectural research directed towards advanced undergraduates in the professional program. Methods of research will include those related to qualitative and quantitative analysis, historical investigations, critical interpretation, archival and field work, and diverse approaches to design-as-research.

ARCH 531. History of Modern Architecture. 3 credits, 3 contact hours.
Prerequisites: ARCH 211. This course examines the major tendencies of architectural practice and theory in the 20th century. Formal and cultural evolution of modernism is considered in relation to social, political, economic, and technological developments that informed its key buildings, projects, and texts.

ARCH 533. History of American Architecture. 3 credits, 3 contact hours.
Prerequisite: ARCH 211. This course investigates the emergence and development of architecture and urbanism in what is now the United States, from before European contact to the early 20th century. Focus is on building typologies and urban morphologies that contributed to a definition of a distinctive "American" approach to form, style, and settlement. The complex and enduring influence of colonization, enslavement, industrialization, and immigration is emphasized throughout.

ARCH 534. Aspects of Urban + Suburban Form. 3 credits, 3 contact hours.
Prerequisite: ARCH 211. This course examines major forms and patterns of urban and suburban development under modernity, focusing on the industrial and metropolis and its global influence. Changing concepts of the central city and the metropolitan periphery are examined in relation to cultural, socio-economic, and political developments.

ARCH 535. History of Architectural Ideas. 3 credits, 3 contact hours.
Prerequisite: ARCH 211. Discusses seminal architectural ideas in the western world from Vitruvius to the present day. Read books written by leading architectural theorists and analyze them in detail.

ARCH 536. Landscape and American Culture. 3 credits, 3 contact hours.
Prerequisites: ARCH 324. As in architecture, the parallel discipline of landscape architecture involves artistic intention set in conjunction with utilitarian concerns. As such, designs on the land include the integration of the arts and sciences of human culture with nature. Discusses landscape as a manifestation of American culture.

ARCH 537. Cable and Tension Structures. 3 credits, 3 contact hours.
Prerequisite: ARCH 304. The course covers the structural technology, history and design considerations of cable-suspended, cable-stayed, tensioned fabric and air-supported structures, and the use of light-tensile structures in architecture. The course also offers an overview of the engineering standards that provide guidelines and recommendations for their design. A long list of well-known cable and tensioned fabric structures will be used to illustrate the structural design concepts. The examples focus mainly on buildings and roof structures. The tensioned fabric roof examples include some of the impressive projects of Geiger Berger Associates and Horst Berger Partners who pioneered the evolution of tensioned fabric structures in the US and elsewhere.

ARCH 538. Sustainable Architecture. 3 credits, 3 contact hours.
Prerequisites: ARCH 314 or INT 222. Follows two precepts: accepting responsibility for the consequences of design decisions upon human well-being, and the long-term viability of natural systems. Topics include sustainable site design and development, environmentally sensitive building materials, lifecycle assessment and cost benefit analysis of building systems, and adaptive reuse.

ARCH 541. Material Systems in Design. 3 credits, 4 contact hours.
Prerequisites: ARCH 396. This seminar will allow students to exam material systems that give design agency to matter as a creative and technical force in the making of architecture. In doing so, it will provide students an opportunity to understand and explore the role material matters play in contemporary architectural theory and praxis. Focused on the exploration and understanding of material systems, this course will provide students with the intellectual underpinnings for the re-conceptionalization of matter within their own design processes.

ARCH 543. Lighting. 3 credits, 3 contact hours.
Prerequisites: ARCH 314 or INT 222. Explores, through modeling and calculation, the means by which architectural form and detail influence the luminous environment. Perceptual responses such as visual comfort and delight are examined. Topics include daylighting footprints, model design and testing, and computer-assisted light level analysis. Areas of investigation include the relationship between daylight and electric light in architecture; the variations of light with time; analysis of seasonal and weather differences; role of task in lighting strategies; and means of control for light quantity and quality.

ARCH 545. Case Studies in Architectural Technology. 3 credits, 3 contact hours.
Prerequisite: ARCH 224. Technological systems involved in the construction and use of buildings. Students conduct in-depth investigation of technology-related problems in architecture and construction. Case study method is used. Construction documents and reports are analyzed. Field visits are required.

ARCH 546. Designing and Optimizing the Building Enclosure. 3 credits, 3 contact hours.
Prerequisite: ARCH 224. Considers the building envelope, the boundary dividing the inside of a structure from the outside environment. Study and design optimal enclosures considering energy exchange, the relationship between energy and light, and life cycle costs.

ARCH 557. Problems in Modern Housing. 3 credits, 3 contact hours.
Prerequisite: ARCH 211. Attempts to provide decent, affordable and well-designed housing for broad segments of society are examined. Dwelling is examined through analysis of proto-typical design solutions in urban environments.

ARCH 559. Social Issues in Housing. 3 credits, 3 contact hours.
Prerequisites: ARCH 211. Lecture/seminar explores the historical, economic, social, technological, and political basis for current American housing policy and practice. Examines government, community-based and private sector attempts, both failed and successful, at providing decent, affordable, and well-designed housing for broad segments of society. Student teams analyze and discuss, in a series of classroom debates, the housing and planning implications of controversial social problems from homelessness and racial segregation to caring for the elderly and people with HIV/AIDS with an emphasis on the role of the architect.

ARCH 561. Synthesis Seminar. 3 credits, 3 contact hours.
Prerequisite: ARCH 495. Design research, analysis, application and presentation of the contextual, programmatic, regulatory and technical aspects of professional architectural practice as applied to an architectural design project in the Advanced Architectural Studio II.

ARCH 566. Advanced Architectural Design Studio. 5 credits, 12 contact hours.
Prerequisite: ARCH 564. This is an advanced architectural design studio, post Comprehensive Studio, studying contemporary design theories, design methods and construction technologies. Emphasis is placed upon independent design research as it relates to the broad range of architectural practice. Exploratory and experimental architectural projects are the focus of the course.

ARCH 571. Sustainable City. 3 credits, 3 contact hours.
Prerequisites: ARCH 110. This course will focus on sustainability issues (economic, social and environmental) at an urban scale. The course will provide an overview of existing frameworks and goals and speculate on solutions. This course will focus on recent descriptions and critiques of urban space and proposals for change.

ARCH 572. Mapping Urbanism. 3 credits, 3 contact hours.
Prerequisites: ARCH 211. This seminar provides the critical tools necessary to examine the city as both a representation and a reality in flux. Through an interdisciplinary framework, students study urban history, theory, visual thinking and information design. Parallel to learning about global cities, their urban challenges, and transformative design strategies, students learn to employ a diverse set of representational techniques to create inventive mappings.

ARCH 574. Case Studies in Community and Urban Design. 3 credits, 3 contact hours.
Prerequisites: ARCH 396. In-depth investigation of specific real-world problems of urban or community design carried out using case method approach. Current practices in the U.S. and other countries studied using interviews with designers, developers, community groups and government agencies. Site visits, reports and other documents provide important sources of information. Final report with supporting documentation required.

ARCH 576. Architecture of Utopia. 3 credits, 3 contact hours.
Prerequisites: ARCH 211. Seminar for the review of utopian projects that have attempted to embody and strengthen social ideas through transformations in the structuring of space. Architectural implications of different literary and philosophical utopias analyzed with an emphasis on those experimental proposals which were realized, in whole or in part, in built form.

ARCH 583. ST:. 3 credits, 3 contact hours.
Group investigation of problem of special interest in architecture.

ARCH 591. Independent Study. 1 credit, 1 contact hour.

ARCH 592. Independent Study. 2 credits, 2 contact hours.

ARCH 593. Independent Study. 3 credits, 3 contact hours.

ARCH 595. Advanced Architecture Studio II. 5 credits, 11 contact hours.
Prerequisites: ARCH 495 or ARCH 563. Corequisites: ARCH 561. Architectural Studios developing require design proposals that synthesis a diverse range of design determinants while integrating technical requirements and performance. Projects consider a variety of interrelated scales and conditions including: site, environment, user and regulatory requirements, accessibility and life safety, structural and environmental systems, building systems design and performance, architectural and cultural history; all of which influence architectural design, both creatively and technically.

B.S. in Architecture

(120 credits minimum)

First Year		
1st Semester		**Credits**
ARCH 195	Architecture Studio I	4
ARCH 110	Tools and Techniques I: Introduction to Architecture Thinking	3
ENGL 101	English Composition: Introduction to Academic Writing	3

CS 104	Computer Programming and Graphics Problems	3
MATH 107	University Mathematics A	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
ARCH 196	Architecture Studio II	4
ARCH 156	Tools and Techniques II: Introduction to Architecture Making	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics	3
Social Sciences GER (p. 114)		3
	Term Credits	**16**
Second Year		
1st Semester		
ARCH 295	Architecture Studio III	4
ARCH 210	History of Architecture I	3
ARCH 223	Construction I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
	Term Credits	**14**
2nd Semester		
ARCH 296	Architecture Studio IV	4
ARCH 211	History of Architecture II	3
ARCH 224	Construction II	3
Natural Science GER (p. 113)		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
ARCH 395	Architecture Studio V	4
ARCH Elective		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
ARCH Elective (Technology)		3
ARCH Elective		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
ARCH Elective (Technology)		3
ARCH Elective (History/Theory)		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
ARCH Elective (History/Theory)		3
ARCH Elective		3

ARCH Elective		3
ARCH Elective		3
	Term Credits	**12**
	Total Credits	**120**

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses“

Graduation is contingent upon the maintenance of a 2.0 average and the successful completion of the minimum credit requirement of prescribed courses within the select curriculum: Bachelor of Science in Architecture (B.S. Arch) requires 120 credits.

B.S. in Architecture and M.B.A. in Management of Technology

B.S. in Architecture Requirements

First Year		
1st Semester		**Credits**
ARCH 195	Architecture Studio I	4
ARCH 110	Tools and Techniques I: Introduction to Architecture Thinking	3
ENGL 101	English Composition: Introduction to Academic Writing	3
CS 104	Computer Programming and Graphics Problems	3
MATH 107	University Mathematics A	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
ARCH 196	Architecture Studio II	4
ARCH 156	Tools and Techniques II: Introduction to Architecture Making	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics	3
Social Sciences GER (p. 114)		3
	Term Credits	**16**
Second Year		
1st Semester		
ARCH 295	Architecture Studio III	4
ARCH 210	History of Architecture I	3
ARCH 223	Construction I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
	Term Credits	**14**
2nd Semester		
ARCH 296	Architecture Studio IV	4
ARCH 211	History of Architecture II	3
ARCH 224	Construction II	3
Natural Science GER (p. 113)		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
ARCH 395	Architecture Studio V	4
ARCH Elective		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**

2nd Semester	
ARCH Elective (Technology)	3
ARCH Elective	3
ARCH Elective	3
Free Elective	3
History and Humanities GER 300+ level (p. 108)	3
Term Credits	**15**
Fourth Year	
1st Semester	
ARCH Elective (Technology)	3
ARCH Elective (History/Theory)	3
ARCH Elective	3
Free Elective	3
History and Humanities GER 300+ level (p. 108)	3
Term Credits	**15**
2nd Semester	
ARCH Elective (History/Theory)	3
ARCH Elective	3
ARCH Elective	3
ARCH Elective	3
Term Credits	**12**
Total Credits	**120**

See the **General Education Requirements** for more information on electives.

Graduation is contingent upon the maintenance of a 2.0 average and the successful completion of the minimum credit requirement of prescribed courses within the select curriculum: Bachelor of Science in Architecture (B.S. Arch) requires 120 credits.

M.B.A. in Management of Technology Requirements

Code	Title	Credits
Architectural Management Requirements		
ARCH 650	Economy Of Building [1]	3
ARCH 651	Public and Private Development [1]	3
ARCH 652	Architectural Project Management [1]	3
Technology Module - Core Courses		
FIN 516	Principles of Financial Management	3
MGMT 620	Management of Technology	3
MGMT 625	Distribution Logistics	3
MGMT 630	Decision Analysis	3
MGMT 635	Data Mining and Analysis	3
or MATH 661	Applied Statistics	
MIS 620	E-Commerce Technologies	3
MIS 645	Information Systems Principles	3
Essential Business Processes - Core Courses		
ACCT 615	Management Accounting	3
FIN 600	Corporate Finance I	3
FIN 618	Public and Private Financing of Urban Areas	3
HRM 601	Organizational Behavior	3
MRKT 620	Global Marketing Management	3
MGMT 680	Entrepreneurial Strategy	3
or MGMT 692	Strategic Management	
Total Credits		**48**

[1] The 3 credits for this course may be used toward the 6 total credits allowed toward the B.S. and the M.B.A.

B.S. in Architecture and M.S. in Civil Engineering

The New Jersey School of Architecture and the Department of Civil and Environmental Engineering have established a dual degree program that permits students to obtain a B.S. Arch. and a Master of Science (M.S.) in Civil Engineering with a concentration in construction engineering and management. There is no reduction in the degree requirements for the professional degree in architecture. The dual degree program permits students to obtain an M.S. in Civil Engineering in substantially less time, in some cases with only one additional year of study.
All bridge courses are required. All students in this dual-degree program must take MATH 112 and 105 or equivalent courses. Equivalency for courses taken at other institutions is determined by NCE Graduate Advisor.

Up to 6 credits of graduate-level coursework may be applied to both the B.S Arch. and M.S. Students may take additional courses at the graduate level during their undergraduate career, up to a maximum of 21 credits, but no additional graduate courses beyond the first 12 credits can be counted toward the undergraduate degree requirements and students are charged at the graduate course rate.

All prerequisite courses must be completed prior to taking bridge courses. All bridge courses must be completed prior to taking CoAD graduate courses counting toward both degrees. All CoAD graduate courses counting toward both degrees must be taken before taking any NCE graduate courses counting only toward the MSCE. The BS Arch degree must be completed before formal admission to the MSCE. No more than a total of 21 graduate credits (12 counted toward both degrees, 9 counted only to the graduate degree) may be taken prior to completion of undergraduate degree. The program requires at least one semester of full-time study as a graduate student, following completion of undergraduate degree.

Eligible students should contact the Office of Graduate Studies in their junior or third year regarding the process for admission to the dual degree program. The Office of Graduate Studies will coordinate the process with the undergraduate program director in the School of Architecture and later with the graduate advisor and the Office of Graduate Admissions as the student nears completion of the undergraduate degree. In order to be eligible for initial and continued participation in the dual degree program, the student must maintain a 3.0 cumulative GPA and take the GRE during the senior or final undergraduate year.

B.S. in Architecture Requirements

First Year		
1st Semester		**Credits**
ARCH 195	Architecture Studio I	4
ARCH 110	Tools and Techniques I: Introduction to Architecture Thinking	3
ENGL 101	English Composition: Introduction to Academic Writing	3
CS 104	Computer Programming and Graphics Problems	3
MATH 107	University Mathematics A	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
ARCH 196	Architecture Studio II	4
ARCH 156	Tools and Techniques II: Introduction to Architecture Making	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics	3
Social Sciences GER (p. 114)		3
	Term Credits	**16**
Second Year		
1st Semester		
ARCH 295	Architecture Studio III	4
ARCH 210	History of Architecture I	3
ARCH 223	Construction I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
	Term Credits	**14**
2nd Semester		
ARCH 296	Architecture Studio IV	4
ARCH 211	History of Architecture II	3

ARCH 224	Construction II	3
Natural Science GER (p. 113)		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
ARCH 395	Architecture Studio V	4
ARCH Elective		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
ARCH Elective (Technology)		3
ARCH Elective		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
ARCH Elective (Technology)		3
ARCH Elective (History/Theory)		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
ARCH Elective (History/Theory)		3
ARCH Elective		3
ARCH Elective		3
ARCH Elective		3
	Term Credits	**12**
	Total Credits	**120**

See the **General Education Requirements** for more information on electives.

Graduation is contingent upon the maintenance of a 2.0 average and the successful completion of the minimum credit requirement of prescribed courses within the select curriculum: Bachelor of Science in Architecture (B.S. Arch) requires 120 credits.

M.S. in Civil Engineering Requirements

Code	Title	Credits
Bridge Courses [1]		
CE 200	Surveying	
CE 200A	Surveying Laboratory	
CE 341	Soil Mechanics	
CE 341A	Soil Mechanics Laboratory (take as ARCH or FREE Elective in undergraduate program) *	
MATH 105	Elementary Probability and Statistics	
MATH 112	Calculus II	
ARCH 329		
ARCH 429	Advanced Structures	
OR		
MECH 320	Statics and Strength of Materials	

MATH 113	Finite Mathematics and Calculus I	
MATH 112	Calculus II	
PHYS 102	General Physics	
Courses counted to both degrees (select two courses)		6
MIP 631	History and Theory of Infrastructure	
MIP 652		
MIP 655		
MIP 673	Infrastructure Planning in Practice	
MIP 675	Elements of Infrastructure Planning	
ARCH 569G	Professional Practice I	
ARCH 647	Visualizing Urbanism	
ARCH 649	Life Safety Issues in Contemporary Buildings	
ARCH 650	Economy Of Building	
ARCH 651	Public and Private Development	
ARCH 652	Architectural Project Management	
ARCH 663	Introduction to Sustainable Architecture	
ARCH 664		
ARCH 665		
ARCH 666		
Civil and Environmental Engineering Core Courses (required)		**12**
CE 610	Construction Management	
CE 611	Project Planning and Control	
CE 616	Construction Cost Estimating	
EM 632	Legal Aspects in Construction	
Elective Credits in Civil & Environmental Engineering		
Select four of the following:		12
CE 615	Infrastructure and Facilities Remediation	
CE 617	Historic Preservation	
CE 631	Advanced Reinforced Concrete Design	
CE 642	Foundation Engineering	
CE 702	Special Topics in Civil Engineering	
CE 644	Geology in Engineering	
CE 671	Performance and Risk Analysis of Infrastructure Systems	
CE 711	Methods Improvement in Construction	
ENE 662	Site Remediation	
ENE 671	Environmental Impact Analysis	
Total Credits		**30**

[1] Bridge courses are required as prerequisites for admission to the M.S. program. These courses may count as free electives in the B.Arch., but do not count toward the M.S.

* Prereq courses for CE 341 for B.S. Arch Students are MATH 112 & 105, ARCH 329 & 429

B.S. in Architecture and M.S. in Management

B.S. in Architecture Requirements

First Year		
1st Semester		**Credits**
ARCH 195	Architecture Studio I	4
ARCH 110	Tools and Techniques I: Introduction to Architecture Thinking	3
ENGL 101	English Composition: Introduction to Academic Writing	3
CS 104	Computer Programming and Graphics Problems	3
MATH 107	University Mathematics A	3

FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
ARCH 196	Architecture Studio II	4
ARCH 156	Tools and Techniques II: Introduction to Architecture Making	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics	3
Social Sciences GER (p. 114)		3
	Term Credits	**16**
Second Year		
1st Semester		
ARCH 295	Architecture Studio III	4
ARCH 210	History of Architecture I	3
ARCH 223	Construction I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
	Term Credits	**14**
2nd Semester		
ARCH 296	Architecture Studio IV	4
ARCH 211	History of Architecture II	3
ARCH 224	Construction II	3
Natural Science GER (p. 113)		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
ARCH 395	Architecture Studio V	4
ARCH Elective		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
ARCH Elective (Technology)		3
ARCH Elective		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
ARCH Elective (Technology)		3
ARCH Elective (History/Theory)		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
ARCH Elective (History/Theory)		3
ARCH Elective		3
ARCH Elective		3

ARCH Elective		3
	Term Credits	**12**
	Total Credits	**120**

See the **General Education Requirements** for more information on electives.

Graduation is contingent upon the maintenance of a 2.0 average and the successful completion of the minimum credit requirement of prescribed courses within the select curriculum: Bachelor of Science in Architecture (B.S. Arch) requires 120 credits.

M.S. in Management Requirements

Code	Title	Credits
ARCH 650	Economy Of Building	3
ARCH 651	Public and Private Development	3
ARCH 652	Architectural Project Management	3
HRM 601	Organizational Behavior	3
FIN 516	Principles of Financial Management	3
FIN 600	Corporate Finance I	3
FIN 618	Public and Private Financing of Urban Areas	3
MIS 620	E-Commerce Technologies	3
MGMT 680	Entrepreneurial Strategy	3
or MGMT 692	Strategic Management	
Select three of the following:		9
ACCT 615	Management Accounting	
FIN 624	Corporate Finance II	
MGMT 640	New Venture Management	
MGMT 645	New Venture Finance	
MIS 645	Information Systems Principles	
MRKT 630	Models Of Consumer Behavior	
MRKT 638	Sales Management for Technical Professionals	
Total Credits		**36**

In addition to existing architecture courses, the M.S. in Management comprises 36 credits. Note: This program was under revision at press time. Students should contact Elly Matzko, student advisor, for the current curriculum.

B.S. in Architecture and M.U.D.

B.S. in Architecture Requirements

(120 credits minimum)

First Year		
1st Semester		**Credits**
ARCH 195	Architecture Studio I	4
ARCH 110	Tools and Techniques I: Introduction to Architecture Thinking	3
ENGL 101	English Composition: Introduction to Academic Writing	3
CS 104	Computer Programming and Graphics Problems	3
MATH 107	University Mathematics A	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
ARCH 196	Architecture Studio II	4
ARCH 156	Tools and Techniques II: Introduction to Architecture Making	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics	3

Social Sciences GER (p. 114)		3
	Term Credits	**16**
Second Year		
1st Semester		
ARCH 295	Architecture Studio III	4
ARCH 210	History of Architecture I	3
ARCH 223	Construction I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
	Term Credits	**14**
2nd Semester		
ARCH 296	Architecture Studio IV	4
ARCH 211	History of Architecture II	3
ARCH 224	Construction II	3
Natural Science GER (p. 113)		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
ARCH 395	Architecture Studio V	4
ARCH Elective		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
ARCH Elective (Technology)		3
ARCH Elective		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
ARCH Elective (Technology)		3
ARCH Elective (History/Theory)		3
ARCH Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
ARCH Elective (History/Theory)		3
ARCH Elective		3
ARCH Elective		3
ARCH Elective		3
	Term Credits	**12**
	Total Credits	**120**

M.U.D. Requirements

Required Courses

The following courses are required, subject to those waived in individual cases; however, no waivers will be given for studio courses. A typical full-time study plan over two semesters is shown below.

First Year		
1st Semester		**Credits**
ARCH 601 Urban Design Studio		6
ARCH 636 History and Theory of Urban Planning and Design		3
ARCH 677 Geographic Information Systems		3
Urban Design Elective		3
	Term Credits	**15**
2nd Semester		
ARCH 602 Urban Design Studio		6
ARCH 684 Topics of Sustainable Urbanism		3
ARCH 651 Public and Private Development		3
Urban Design Elective		3
	Term Credits	**15**
	Total Credits	**30**

[1] Or substitute selected with the approval of Graduate Advisor.

Bachelor of Architecture

First Year		
1st Semester		**Credits**
ARCH 195	Architecture Studio I	4
ARCH 110	Tools and Techniques I: Introduction to Architecture Thinking	3
ENGL 101	English Composition: Introduction to Academic Writing	3
CS 104	Computer Programming and Graphics Problems	3
MATH 107	University Mathematics A [ii]	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
ARCH 196	Architecture Studio II	4
ARCH 156	Tools and Techniques II: Introduction to Architecture Making	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics [ii]	3
Social Sciences GER (p. 114)		3
	Term Credits	**16**
Second Year		
1st Semester		
ARCH 295	Architecture Studio III	4
ARCH 210	History of Architecture I	3
ARCH 223	Construction I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
	Term Credits	**14**
2nd Semester		
ARCH 296	Architecture Studio IV	4
ARCH 211	History of Architecture II	3
ARCH 224	Construction II	3

Natural Science GER (p. 113)		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
ARCH 395	Architecture Studio V	4
ARCH 303	Structures I	3
ARCH 309	Environmental Control Systems I	3
ARCH 324	Landscape and Urbanism	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
ARCH 396	Architecture Studio VI	4
ARCH 304	Structures II	3
ARCH 314	Environmental Control Systems II	3
ARCH Elective [iii]		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
Fourth Year		
1st Semester		
ARCH 495	Advanced Architecture Studio I	5
ARCH 472	Professional Practice I	3
ARCH Elective (Technology)		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
2nd Semester		
ARCH 463	Options Studio I	5
ARCH 475	Professional Practice II	3
ARCH Elective (Technology)		3
ARCH Elective [iii]		3
	Term Credits	**14**
Fifth Year		
1st Semester		
ARCH 595	Advanced Architecture Studio II	5
ARCH 561	Synthesis Seminar	3
ARCH Elective (History/Theory)		3
ARCH Elective [iii]		3
	Term Credits	**14**
2nd Semester		
ARCH 464 or ARCH 566	Option Studio II or Advanced Architectural Design Studio	5
ARCH Elective (History/Theory)		3
ARCH Elective [iii]		3
ARCH Elective [iii]		3
	Term Credits	**14**
	Total Credits	**150**

i Students must maintain continuous enrollment in the ENGL101/ENGL102 sequence every Fall and Spring semester until successful completion.
ii Students must maintain continuous enrollment in the Math sequence every Fall and Spring semester until successful completion.
iii Courses listed under ARCH Elective (Technology) and ARCH Elective (History/Theory) can be counted as ARCH Electives.

ARCH Electives (Technology)

Code	Title	Credits
ARCH 301	Digital Modeling and Fabrication	3
ARCH 316	Structural Computer Applications BIM	3
ARCH 337	Building Information Modeling	3
ARCH 361	Adaptive Paradigms in Architecture	3
ARCH 423	Advanced Construction	3
ARCH 429	Advanced Structures	3
ARCH 461	Resilient Structural Design and Construction	3
ARCH 483	ST:	3
ARCH 537	Cable and Tension Structures	3
ARCH 538	Sustainable Architecture	3
ARCH 541	Material Systems in Design	3
ARCH 543	Lighting	3
ARCH 545	Case Studies in Architectural Technology	3
ARCH 546	Designing and Optimizing the Building Enclosure	3

ARCH Electives (History/Theory)

Code	Title	Credits
ARCH 331	Formal Principles of Landscape Design Traditions Across the Globe	3
ARCH 332	Architecture: Image and Word I	3
ARCH 333	Architecture:Image and Word II	3
ARCH 335	Digital Tectonics	3
ARCH 408	Investigations in the Contemporary Landscape	3
ARCH 530	Methods of Architectural Research	3
ARCH 531	History of Modern Architecture	3
ARCH 533	History of American Architecture	3
ARCH 534	Aspects of Urban + Suburban Form	3
ARCH 535	History of Architectural Ideas	3
ARCH 536	Landscape and American Culture	3
ARCH 557	Problems in Modern Housing	3
ARCH 559	Social Issues in Housing	3
ARCH 571	Sustainable City	3
ARCH 572	Mapping Urbanism	3
ARCH 574	Case Studies in Community and Urban Design	3
ARCH 576	Architecture of Utopia	3
ARCH 583	ST:	3
INT 350	History of Furniture	3

ARCH Electives

Code	Title	Credits
ARCH 283	Special Topics	3
ARCH 317	Advanced Architectural Graphics	3
ARCH 432	P3 Post Presentation Processing	3
AD 150	Color and Composition	3
AD 325	Entrepreneurship for Designers	3
AD 340	Photography and Imaging	3
DD 320	Robotics for Architects and Designers	3
DD 321	Interactive and Reactive Environments	3
DD 334	Simulated Environments	3
DD 449	Imaginary Worlds: Architecture in Motion Pictures	3
ID 340	Materials and Processes	3

ID 341	Sustainable Materials and Processes	3
ID 370	New Product Testing	3
INT 351	Furniture Design	3

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses“

Bachelor of Architecture and M.B.A. in Management of Technology

The New Jersey School of Architecture and the School of Management have established a dual degree program that permits students to obtain a Bachelor of Architecture degree with a Master of Business Administration (M.B.A.) in Management of Technology.

There is no reduction in the degree requirements for the professional degree in architecture. The dual degree program permits students to obtain an M.B.A. in Management of Technology in substantially less time, in some cases with only one additional year of study. Up to 12 credits of graduate-level coursework may be applied to both the B.Arch. and M.B.A.

Students may take additional courses at the graduate level during their undergraduate career, but these courses do not count toward the undergraduate degree requirements and students are charged at the graduate course rate.

Eligible students should contact the Office of Graduate Studies in their junior or third year regarding the process for admission to the dual degree program. The Office of Graduate Studies will coordinate the process with the undergraduate program director in the New Jersey School of Architecture and later with the graduate advisor and the Office of Graduate Admissions as the student nears completion of the undergraduate degree. In order to be eligible for initial and continued participation in the dual degree program, the student must maintain a 3.0 cumulative GPA and take the GMAT during the senior or final undergraduate year. A GMAT score of 550 is required for admission to graduate study in the School of Management.

The M.B.A. in Management of Technology is a 60-credit program. However, 12 credits in management background courses are waived for architecture graduates. Therefore, in addition to completion of the architecture program requirements, the M.B.A. comprises 48 credits. Note: This program was under revision at press time. Students should contact their advisor, for the current curriculum.

B.Arch. Requirements

First Year		
1st Semester		**Credits**
ARCH 195	Architecture Studio I	4
ARCH 110	Tools and Techniques I: Introduction to Architecture Thinking	3
ENGL 101	English Composition: Introduction to Academic Writing	3
CS 104	Computer Programming and Graphics Problems	3
MATH 107	University Mathematics A [ii]	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
ARCH 196	Architecture Studio II	4
ARCH 156	Tools and Techniques II: Introduction to Architecture Making	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics [ii]	3
Social Sciences GER (p. 114)		3
	Term Credits	**16**
Second Year		
1st Semester		
ARCH 295	Architecture Studio III	4
ARCH 210	History of Architecture I	3
ARCH 223	Construction I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
	Term Credits	**14**
2nd Semester		
ARCH 296	Architecture Studio IV	4
ARCH 211	History of Architecture II	3
ARCH 224	Construction II	3

Natural Science GER (p. 113)		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
ARCH 395	Architecture Studio V	4
ARCH 303	Structures I	3
ARCH 309	Environmental Control Systems I	3
ARCH 324	Landscape and Urbanism	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
ARCH 396	Architecture Studio VI	4
ARCH 304	Structures II	3
ARCH 314	Environmental Control Systems II	3
ARCH Elective [iii]		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
Fourth Year		
1st Semester		
ARCH 495	Advanced Architecture Studio I	5
ARCH 472	Professional Practice I	3
ARCH Elective (Technology)		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
2nd Semester		
ARCH 463	Options Studio I	5
ARCH 475	Professional Practice II	3
ARCH Elective (Technology)		3
ARCH Elective [iii]		3
	Term Credits	**14**
Fifth Year		
1st Semester		
ARCH 595	Advanced Architecture Studio II	5
ARCH 561	Synthesis Seminar	3
ARCH Elective (History/Theory)		3
ARCH Elective [iii]		3
	Term Credits	**14**
2nd Semester		
ARCH 464 or ARCH 566	Option Studio II or Advanced Architectural Design Studio	5
ARCH Elective (History/Theory)		3
ARCH Elective [iii]		3
ARCH Elective [iii]		3
	Term Credits	**14**
	Total Credits	**150**

i Students must maintain continuous enrollment in the ENGL101/ENGL102 sequence every Fall and Spring semester until successful completion.
ii Students must maintain continuous enrollment in the Math sequence every Fall and Spring semester until successful completion.
iii Courses listed under ARCH Elective (Technology) and ARCH Elective (History/Theory) can be counted as ARCH Electives.

ARCH Electives (Technology)

Code	Title	Credits
ARCH 301	Digital Modeling and Fabrication	3
ARCH 316	Structural Computer Applications BIM	3
ARCH 337	Building Information Modeling	3
ARCH 361	Adaptive Paradigms in Architecture	3
ARCH 423	Advanced Construction	3
ARCH 429	Advanced Structures	3
ARCH 461	Resilient Structural Design and Construction	3
ARCH 483	ST:	3
ARCH 537	Cable and Tension Structures	3
ARCH 538	Sustainable Architecture	3
ARCH 541	Material Systems in Design	3
ARCH 543	Lighting	3
ARCH 545	Case Studies in Architectural Technology	3
ARCH 546	Designing and Optimizing the Building Enclosure	3

ARCH Electives (History/Theory)

Code	Title	Credits
ARCH 331	Formal Principles of Landscape Design Traditions Across the Globe	3
ARCH 332	Architecture: Image and Word I	3
ARCH 333	Architecture:Image and Word II	3
ARCH 335	Digital Tectonics	3
ARCH 408	Investigations in the Contemporary Landscape	3
ARCH 530	Methods of Architectural Research	3
ARCH 531	History of Modern Architecture	3
ARCH 533	History of American Architecture	3
ARCH 534	Aspects of Urban + Suburban Form	3
ARCH 535	History of Architectural Ideas	3
ARCH 536	Landscape and American Culture	3
ARCH 557	Problems in Modern Housing	3
ARCH 559	Social Issues in Housing	3
ARCH 571	Sustainable City	3
ARCH 572	Mapping Urbanism	3
ARCH 574	Case Studies in Community and Urban Design	3
ARCH 576	Architecture of Utopia	3
ARCH 583	ST:	3
INT 350	History of Furniture	3

ARCH Electives

Code	Title	Credits
ARCH 283	Special Topics	3
ARCH 317	Advanced Architectural Graphics	3
ARCH 432	P3 Post Presentation Processing	3
AD 150	Color and Composition	3
AD 325	Entrepreneurship for Designers	3
AD 340	Photography and Imaging	3
DD 320	Robotics for Architects and Designers	3
DD 321	Interactive and Reactive Environments	3
DD 334	Simulated Environments	3
DD 449	Imaginary Worlds: Architecture in Motion Pictures	3
ID 340	Materials and Processes	3

ID 341	Sustainable Materials and Processes	3
ID 370	New Product Testing	3
INT 351	Furniture Design	3

M.B.A. in Management of Technology Requirements

Code	Title	Credits
Architectural Management Requirements		
ARCH 650	Economy Of Building	3
ARCH 651	Public and Private Development	3
ARCH 652	Architectural Project Management	3
Technology Module - Core Courses		
FIN 516	Principles of Financial Management	3
MGMT 620	Management of Technology	3
MGMT 625	Distribution Logistics	3
MGMT 630	Decision Analysis	3
MGMT 635	Data Mining and Analysis	3
or MATH 661	Applied Statistics	
MIS 620	E-Commerce Technologies	3
MIS 645	Information Systems Principles	3
Essential Business Processes - Core Courses		
ACCT 615	Management Accounting	3
FIN 600	Corporate Finance I	3
FIN 618	Public and Private Financing of Urban Areas	3
HRM 601	Organizational Behavior	3
MRKT 620	Global Marketing Management	3
MGMT 680	Entrepreneurial Strategy	3
or MGMT 692	Strategic Management	
Total Credits		**48**

Bachelor of Architecture and M.S. in Civil Engineering

The New Jersey School of Architecture and the Department of Civil and Environmental Engineering have established a dual degree program that permits students to obtain a B.Arch. and a Master of Science (M.S.) in Civil Engineering with a concentration in construction engineering and management. There is no reduction in the degree requirements for the professional degree in architecture. The dual degree program permits students to obtain an M.S. in Civil Engineering in substantially less time, in some cases with only one additional year of study.

Up to 12 credits of graduate-level coursework may be applied to both the B.Arch. and M.S. Students may take additional courses at the graduate level during their undergraduate career, but these courses do not count toward the undergraduate degree requirements and students are charged at the graduate course rate.

Eligible students should contact the Office of Graduate Studies in their junior or third year regarding the process for admission to the dual degree program. The Office of Graduate Studies will coordinate the process with the undergraduate program director in the School of Architecture and later with the graduate advisor and the Office of Graduate Admissions as the student nears completion of the undergraduate degree. In order to be eligible for initial and continued participation in the dual degree program, the student must maintain a 3.0 cumulative GPA and take the GRE during the senior or final undergraduate year.

B.Arch. Requirements

First Year		
1st Semester		**Credits**
ARCH 195	Architecture Studio I	4
ARCH 110	Tools and Techniques I: Introduction to Architecture Thinking	3
ENGL 101	English Composition: Introduction to Academic Writing	3
CS 104	Computer Programming and Graphics Problems	3
MATH 107	University Mathematics A [ii]	3

FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
ARCH 196	Architecture Studio II	4
ARCH 156	Tools and Techniques II: Introduction to Architecture Making	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics [ii]	3
Social Sciences GER (p. 114)		3
	Term Credits	**16**
Second Year		
1st Semester		
ARCH 295	Architecture Studio III	4
ARCH 210	History of Architecture I	3
ARCH 223	Construction I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
	Term Credits	**14**
2nd Semester		
ARCH 296	Architecture Studio IV	4
ARCH 211	History of Architecture II	3
ARCH 224	Construction II	3
Natural Science GER (p. 113)		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
ARCH 395	Architecture Studio V	4
ARCH 303	Structures I	3
ARCH 309	Environmental Control Systems I	3
ARCH 324	Landscape and Urbanism	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
ARCH 396	Architecture Studio VI	4
ARCH 304	Structures II	3
ARCH 314	Environmental Control Systems II	3
ARCH Elective [iii]		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
Fourth Year		
1st Semester		
ARCH 495	Advanced Architecture Studio I	5
ARCH 472	Professional Practice I	3
ARCH Elective (Technology)		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
2nd Semester		
ARCH 463	Options Studio I	5
ARCH 475	Professional Practice II	3
ARCH Elective (Technology)		3
ARCH Elective [iii]		3
	Term Credits	**14**

Fifth Year		
1st Semester		
ARCH 595	Advanced Architecture Studio II	5
ARCH 561	Synthesis Seminar	3
ARCH Elective (History/Theory)		3
ARCH Elective [iii]		3
	Term Credits	**14**
2nd Semester		
ARCH 464 or ARCH 566	Option Studio II or Advanced Architectural Design Studio	5
ARCH Elective (History/Theory)		3
ARCH Elective [iii]		3
ARCH Elective [iii]		3
	Term Credits	**14**
	Total Credits	**150**

i Students must maintain continuous enrollment in the ENGL101/ENGL102 sequence every Fall and Spring semester until successful completion.
ii Students must maintain continuous enrollment in the Math sequence every Fall and Spring semester until successful completion.
iii Courses listed under ARCH Elective (Technology) and ARCH Elective (History/Theory) can be counted as ARCH Electives.

ARCH Electives (Technology)

Code	Title	Credits
ARCH 301	Digital Modeling and Fabrication	3
ARCH 316	Structural Computer Applications BIM	3
ARCH 337	Building Information Modeling	3
ARCH 361	Adaptive Paradigms in Architecture	3
ARCH 423	Advanced Construction	3
ARCH 429	Advanced Structures	3
ARCH 461	Resilient Structural Design and Construction	3
ARCH 483	ST:	3
ARCH 537	Cable and Tension Structures	3
ARCH 538	Sustainable Architecture	3
ARCH 541	Material Systems in Design	3
ARCH 543	Lighting	3
ARCH 545	Case Studies in Architectural Technology	3
ARCH 546	Designing and Optimizing the Building Enclosure	3

ARCH Electives (History/Theory)

Code	Title	Credits
ARCH 331	Formal Principles of Landscape Design Traditions Across the Globe	3
ARCH 332	Architecture: Image and Word I	3
ARCH 333	Architecture:Image and Word II	3
ARCH 335	Digital Tectonics	3
ARCH 408	Investigations in the Contemporary Landscape	3
ARCH 530	Methods of Architectural Research	3
ARCH 531	History of Modern Architecture	3
ARCH 533	History of American Architecture	3
ARCH 534	Aspects of Urban + Suburban Form	3
ARCH 535	History of Architectural Ideas	3
ARCH 536	Landscape and American Culture	3
ARCH 557	Problems in Modern Housing	3

ARCH 559	Social Issues in Housing	3
ARCH 571	Sustainable City	3
ARCH 572	Mapping Urbanism	3
ARCH 574	Case Studies in Community and Urban Design	3
ARCH 576	Architecture of Utopia	3
ARCH 583	ST:	3
INT 350	History of Furniture	3

ARCH Electives

Code	Title	Credits
ARCH 283	Special Topics	3
ARCH 317	Advanced Architectural Graphics	3
ARCH 432	P3 Post Presentation Processing	3
AD 150	Color and Composition	3
AD 325	Entrepreneurship for Designers	3
AD 340	Photography and Imaging	3
DD 320	Robotics for Architects and Designers	3
DD 321	Interactive and Reactive Environments	3
DD 334	Simulated Environments	3
DD 449	Imaginary Worlds: Architecture in Motion Pictures	3
ID 340	Materials and Processes	3
ID 341	Sustainable Materials and Processes	3
ID 370	New Product Testing	3
INT 351	Furniture Design	3

M.S. in Civil Engineering Requirements

(30 credits)

Code	Title	Credits
Bridge Courses		
Select 10 credits from the following: 1		10
CE 200	Surveying	
CE 200A	Surveying Laboratory	
CE 501	Introduction to Soil Behavior	
MATH 105	Elementary Probability and Statistics	
Courses Counting Toward Both Degrees		
ARCH 650	Economy Of Building	3
ARCH 651	Public and Private Development	3
ARCH 647 or ARCH 675	Visualizing Urbanism	3
MIS 645	Information Systems Principles	3
Civil and Environmental Engineering Electives		
Select two of the following:		6
CE 615	Infrastructure and Facilities Remediation	
CE 631	Advanced Reinforced Concrete Design	
CE 642	Foundation Engineering	
CE 702	Special Topics in Civil Engineering	
CE 711	Methods Improvement in Construction	
ENE 662	Site Remediation	3
Total Credits		**31**

Bachelor of Architecture and M.S. in Management

The New Jersey School of Architecture and the School of Management have established a dual degree program, which permits students to obtain a B.Arch. with a Master of Science (M.S.) in Management.

There is no reduction in the degree requirements for the professional degree in Architecture. The dual degree program permits students to obtain an M.S. in Management in substantially less time, in some cases with only one more semester of study. Up to 12 credits of graduate-level coursework may be applied to both the B.Arch. and M.S. in Management degrees.

Students may take additional courses at the graduate level during their undergraduate career, but these courses do not count toward the undergraduate degree requirements and students are charged at the graduate course rate. Eligible students should contact the Office of Graduate Studies in their junior or third year regarding the process for admission to the dual degree program. The Office of Graduate Studies will coordinate the process with the undergraduate program director in the School of Architecture and later with the graduate advisor and the Office of Graduate Admissions as the student nears completion of the undergraduate degree. In order to be eligible for initial and continued participation in the dual degree program, the student must maintain a 3.0 cumulative GPA and take the GMAT during the senior or final undergraduate year. A GMAT score of 550 is required for admission to graduate study in the School of Management.

B.Arch. Requirements

First Year		
1st Semester		**Credits**
ARCH 195	Architecture Studio I	4
ARCH 110	Tools and Techniques I: Introduction to Architecture Thinking	3
ENGL 101	English Composition: Introduction to Academic Writing	3
CS 104	Computer Programming and Graphics Problems	3
MATH 107	University Mathematics A [ii]	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
ARCH 196	Architecture Studio II	4
ARCH 156	Tools and Techniques II: Introduction to Architecture Making	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics [ii]	3
Social Sciences GER (p. 114)		3
	Term Credits	**16**
Second Year		
1st Semester		
ARCH 295	Architecture Studio III	4
ARCH 210	History of Architecture I	3
ARCH 223	Construction I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
	Term Credits	**14**
2nd Semester		
ARCH 296	Architecture Studio IV	4
ARCH 211	History of Architecture II	3
ARCH 224	Construction II	3
Natural Science GER (p. 113)		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
ARCH 395	Architecture Studio V	4
ARCH 303	Structures I	3
ARCH 309	Environmental Control Systems I	3

ARCH 324	Landscape and Urbanism	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
ARCH 396	Architecture Studio VI	4
ARCH 304	Structures II	3
ARCH 314	Environmental Control Systems II	3
ARCH Elective [iii]		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
Fourth Year		
1st Semester		
ARCH 495	Advanced Architecture Studio I	5
ARCH 472	Professional Practice I	3
ARCH Elective (Technology)		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
2nd Semester		
ARCH 463	Options Studio I	5
ARCH 475	Professional Practice II	3
ARCH Elective (Technology)		3
ARCH Elective [iii]		3
	Term Credits	**14**
Fifth Year		
1st Semester		
ARCH 595	Advanced Architecture Studio II	5
ARCH 561	Synthesis Seminar	3
ARCH Elective (History/Theory)		3
ARCH Elective [iii]		3
	Term Credits	**14**
2nd Semester		
ARCH 464 or ARCH 566	Option Studio II or Advanced Architectural Design Studio	5
ARCH Elective (History/Theory)		3
ARCH Elective [iii]		3
ARCH Elective [iii]		3
	Term Credits	**14**
	Total Credits	**150**

i Students must maintain continuous enrollment in the ENGL101/ENGL102 sequence every Fall and Spring semester until successful completion.
ii Students must maintain continuous enrollment in the Math sequence every Fall and Spring semester until successful completion.
iii Courses listed under ARCH Elective (Technology) and ARCH Elective (History/Theory) can be counted as ARCH Electives.

ARCH Electives (Technology)

Code	Title	Credits
ARCH 301	Digital Modeling and Fabrication	3
ARCH 316	Structural Computer Applications BIM	3
ARCH 337	Building Information Modeling	3
ARCH 361	Adaptive Paradigms in Architecture	3
ARCH 423	Advanced Construction	3
ARCH 429	Advanced Structures	3

ARCH 461	Resilient Structural Design and Construction	3
ARCH 483	ST:	3
ARCH 537	Cable and Tension Structures	3
ARCH 538	Sustainable Architecture	3
ARCH 541	Material Systems in Design	3
ARCH 543	Lighting	3
ARCH 545	Case Studies in Architectural Technology	3
ARCH 546	Designing and Optimizing the Building Enclosure	3

ARCH Electives (History/Theory)

Code	Title	Credits
ARCH 331	Formal Principles of Landscape Design Traditions Across the Globe	3
ARCH 332	Architecture: Image and Word I	3
ARCH 333	Architecture:Image and Word II	3
ARCH 335	Digital Tectonics	3
ARCH 408	Investigations in the Contemporary Landscape	3
ARCH 530	Methods of Architectural Research	3
ARCH 531	History of Modern Architecture	3
ARCH 533	History of American Architecture	3
ARCH 534	Aspects of Urban + Suburban Form	3
ARCH 535	History of Architectural Ideas	3
ARCH 536	Landscape and American Culture	3
ARCH 557	Problems in Modern Housing	3
ARCH 559	Social Issues in Housing	3
ARCH 571	Sustainable City	3
ARCH 572	Mapping Urbanism	3
ARCH 574	Case Studies in Community and Urban Design	3
ARCH 576	Architecture of Utopia	3
ARCH 583	ST:	3
INT 350	History of Furniture	3

ARCH Electives

Code	Title	Credits
ARCH 283	Special Topics	3
ARCH 317	Advanced Architectural Graphics	3
ARCH 432	P3 Post Presentation Processing	3
AD 150	Color and Composition	3
AD 325	Entrepreneurship for Designers	3
AD 340	Photography and Imaging	3
DD 320	Robotics for Architects and Designers	3
DD 321	Interactive and Reactive Environments	3
DD 334	Simulated Environments	3
DD 449	Imaginary Worlds: Architecture in Motion Pictures	3
ID 340	Materials and Processes	3
ID 341	Sustainable Materials and Processes	3
ID 370	New Product Testing	3
INT 351	Furniture Design	3

M.S. in Management Requirements

Code	Title	Credits
ARCH 650	Economy Of Building	3
ARCH 651	Public and Private Development	3

ARCH 652	Architectural Project Management	3
HRM 601	Organizational Behavior	3
FIN 516	Principles of Financial Management	3
FIN 600	Corporate Finance I	3
FIN 618	Public and Private Financing of Urban Areas	3
MIS 620	E-Commerce Technologies	3
MGMT 680	Entrepreneurial Strategy	3
or MGMT 692	Strategic Management	
Select three of the following:		9
ACCT 615	Management Accounting	
FIN 624	Corporate Finance II	
MGMT 640	New Venture Management	
MGMT 645	New Venture Finance	
MRKT 630	Models Of Consumer Behavior	
MRKT 638	Sales Management for Technical Professionals	
Total Credits		**36**

In addition to existing architecture courses, the M.S. in Management comprises 36 credits. Note: This program was under revision at press time. Students should contact Elly Matzko, student advisor, for the current curriculum.

Bachelor of Architecture and M.U.D.

The New Jersey School of Architecture has established a dual degree program within the school that permits students to obtain a B.Arch. with a Master in Infrastructure Planning (M.I.P.). There is no reduction in the degree requirements for the professional degree in architecture. The dual degree program permits students to obtain an M.I.P. in substantially less time.

Up to 12 credits of graduate-level coursework may be applied to both the B.Arch. and M.I.P. Students may take additional courses at the graduate level during their undergraduate career, but these courses do not count toward the undergraduate degree requirements and students are charged at the graduate course rate.

Eligible students should contact the Office of Graduate Studies in their junior or third year regarding the process for admission to the dual degree program. The Office of Graduate Studies will coordinate the process with the undergraduate program director in the School of Architecture and later with the graduate advisor and the Office of Graduate Admissions as the student nears completion of the undergraduate degree. In order to be eligible for initial and continued participation in the dual degree program, the student must maintain a 3.0 cumulative GPA and take the GRE during the senior or final undergraduate year.

B.Arch. Requirements

First Year		
1st Semester		**Credits**
ARCH 195	Architecture Studio I	4
ARCH 110	Tools and Techniques I: Introduction to Architecture Thinking	3
ENGL 101	English Composition: Introduction to Academic Writing	3
CS 104	Computer Programming and Graphics Problems	3
MATH 107	University Mathematics A [ii]	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
ARCH 196	Architecture Studio II	4
ARCH 156	Tools and Techniques II: Introduction to Architecture Making	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics [ii]	3
Social Sciences GER (p. 114)		3
	Term Credits	**16**

Second Year		
1st Semester		
ARCH 295	Architecture Studio III	4
ARCH 210	History of Architecture I	3
ARCH 223	Construction I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
	Term Credits	**14**
2nd Semester		
ARCH 296	Architecture Studio IV	4
ARCH 211	History of Architecture II	3
ARCH 224	Construction II	3
Natural Science GER (p. 113)		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
ARCH 395	Architecture Studio V	4
ARCH 303	Structures I	3
ARCH 309	Environmental Control Systems I	3
ARCH 324	Landscape and Urbanism	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
ARCH 396	Architecture Studio VI	4
ARCH 304	Structures II	3
ARCH 314	Environmental Control Systems II	3
ARCH Elective [iii]		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
Fourth Year		
1st Semester		
ARCH 495	Advanced Architecture Studio I	5
ARCH 472	Professional Practice I	3
ARCH Elective (Technology)		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
2nd Semester		
ARCH 463	Options Studio I	5
ARCH 475	Professional Practice II	3
ARCH Elective (Technology)		3
ARCH Elective [iii]		3
	Term Credits	**14**
Fifth Year		
1st Semester		
ARCH 595	Advanced Architecture Studio II	5
ARCH 561	Synthesis Seminar	3
ARCH Elective (History/Theory)		3
ARCH Elective [iii]		3
	Term Credits	**14**

2nd Semester		
ARCH 464 or ARCH 566	Option Studio II or Advanced Architectural Design Studio	5
ARCH Elective (History/Theory)		3
ARCH Elective [iii]		3
ARCH Elective [iii]		3
	Term Credits	**14**
	Total Credits	**150**

i Students must maintain continuous enrollment in the ENGL101/ENGL102 sequence every Fall and Spring semester until successful completion.
ii Students must maintain continuous enrollment in the Math sequence every Fall and Spring semester until successful completion.
iii Courses listed under ARCH Elective (Technology) and ARCH Elective (History/Theory) can be counted as ARCH Electives.

ARCH Electives (Technology)

Code	Title	Credits
ARCH 301	Digital Modeling and Fabrication	3
ARCH 316	Structural Computer Applications BIM	3
ARCH 337	Building Information Modeling	3
ARCH 361	Adaptive Paradigms in Architecture	3
ARCH 423	Advanced Construction	3
ARCH 429	Advanced Structures	3
ARCH 461	Resilient Structural Design and Construction	3
ARCH 483	ST:	3
ARCH 537	Cable and Tension Structures	3
ARCH 538	Sustainable Architecture	3
ARCH 541	Material Systems in Design	3
ARCH 543	Lighting	3
ARCH 545	Case Studies in Architectural Technology	3
ARCH 546	Designing and Optimizing the Building Enclosure	3

ARCH Electives (History/Theory)

Code	Title	Credits
ARCH 331	Formal Principles of Landscape Design Traditions Across the Globe	3
ARCH 332	Architecture: Image and Word I	3
ARCH 333	Architecture:Image and Word II	3
ARCH 335	Digital Tectonics	3
ARCH 408	Investigations in the Contemporary Landscape	3
ARCH 530	Methods of Architectural Research	3
ARCH 531	History of Modern Architecture	3
ARCH 533	History of American Architecture	3
ARCH 534	Aspects of Urban + Suburban Form	3
ARCH 535	History of Architectural Ideas	3
ARCH 536	Landscape and American Culture	3
ARCH 557	Problems in Modern Housing	3
ARCH 559	Social Issues in Housing	3
ARCH 571	Sustainable City	3
ARCH 572	Mapping Urbanism	3
ARCH 574	Case Studies in Community and Urban Design	3
ARCH 576	Architecture of Utopia	3
ARCH 583	ST:	3
INT 350	History of Furniture	3

ARCH Electives

Code	Title	Credits
ARCH 283	Special Topics	3
ARCH 317	Advanced Architectural Graphics	3
ARCH 432	P3 Post Presentation Processing	3
AD 150	Color and Composition	3
AD 325	Entrepreneurship for Designers	3
AD 340	Photography and Imaging	3
DD 320	Robotics for Architects and Designers	3
DD 321	Interactive and Reactive Environments	3
DD 334	Simulated Environments	3
DD 449	Imaginary Worlds: Architecture in Motion Pictures	3
ID 340	Materials and Processes	3
ID 341	Sustainable Materials and Processes	3
ID 370	New Product Testing	3
INT 351	Furniture Design	3

M.U.D. Requirements

Required Courses

The following courses are required, subject to those waived in individual cases; however, no waivers will be given for studio courses. A typical full-time study plan over two semesters is shown below.

First Year	
1st Semester	**Credits**
ARCH 601 Urban Design Studio	6
ARCH 636 History and Theory of Urban Planning and Design	3
ARCH 677 Geographic Information Systems	3
Urban Design Elective	3
Term Credits	**15**
2nd Semester	
ARCH 602 Urban Design Studio	6
ARCH 684 Topics of Sustainable Urbanism	3
ARCH 651 Public and Private Development	3
Urban Design Elective	3
Term Credits	**15**
Total Credits	**30**

[1] Or substitute selected with the approval of Graduate Advisor.

Art and Design

The School of Art + Design offers a trio of studio-centric four-year bachelor's degree design programs—interior design, digital design and industrial design—and a BFA in fine arts, which provides unique opportunities for aspiring artists to explore the nexus between art and technology, and become part of a the cultural experience that underscores the use of digital media and information technology. With a vibrant assemblage of design disciplines and opportunities for expression, research and independent study, the School of Art + Design provides an exciting environment in which to invent and create.

Interior Design

Interior design students have the opportunity to learn from an innovative, creative faculty that participates in all phases of the design and construction process: architects, engineers and interior, product and industrial designers. The robust, studio-centric curriculum fully accredited by the Council for Interior Design Accreditation (CIDA)—is chockfull of design courses such as building and interior systems, history of furniture and building information modeling and prepares students to enter the profession of interior design, first as interns, and ultimately take the National CIDA Qualification examination. More than 90 percent of all graduates are either working in a field related to their study or are in a graduate program within six months of graduation. Students broaden their exposure to a variety of traditional or digital media-based courses or specialize in one or more areas related to a topic of interest.

Digital Design

Drawing on NJIT's well-established legacy as a pioneer and innovator in the application of digital and information technology, the Digital Design Program, after a foundation year of exposure to a variety of media, offers students two tracks of study: entertainment and interactive media/production. In addition to a two-year studio sequence, the curriculum provides opportunities for students to take a variety of related classes such as environment design in motion pictures, SFX/VFX in movies, digital audio, history of games, video and animation, 2D and 3D character design and modeling, game level design and more. There is additional flexibility built into the curriculum, allowing students to use free academic and design electives to either broaden their overall education or elect to focus on one or more areas to prepare them for a specialized field or graduate study.

Industrial Design

As part of a comprehensive university with a variety of design disciplines, students enrolled in the Industrial Design Program find themselves in a unique and creative environment, where a multi-faceted mission includes the creation of new knowledge while educating future designers in design and preparing them to contribute to 21st century society. In this context, students take advantage of the technological environment of the university to gain a broad understanding of design, materials, methods of production, user needs, and market trends. After completing six semesters of design studio, students take a variety of management, fabrication and design courses, including modeling and prototyping, principles of management, human factors/ergonomics, ethnographic and mechanics and electronics. The program exposes undergraduate students to the various potential fields within the profession and provides them with opportunities to study robotics and advanced materials.

NJIT Faculty

A

Alcala, Jose M., University Lecturer

B

Bales, Ervin, Research Professor

Bess, Mark E., University Lecturer

Brothers, David A., Senior University Lecturer

Burgermaster, Matthew A., Assistant Professor

C

Cays, John M., Associate Dean for Academics, College of Architecture and Design

Celik, Zeynep, Distinguished Professor

D

Dart, James, University Lecturer

Decker, Martina, Assistant Professor

De Sousa Santos, Antonio P., Professor Emeritus

E

Elwell, David H., Associate Professor Emeritus

Esperdy, Gabrielle, Associate Professor

F

Franck, Karen A., Professor

G

Garber, Richard J., Associate Professor

Garcia Figueroa, Julio C., University Lecturer

Gauchat, Urs P., Professor

Goldman, Glenn, Professor

Greenfield, Sanford R., Professor Emeritus

H

Harp, Cleveland J., University Lecturer

Hurtado De Mendoza Wahrolen, Maria A., Associate Professor

K

Krumwiede, Keith A., Associate Professor

L

LeCavalier, Jesse, Assistant Professor

M

Moore, Sandy, Associate Professor

Mostoller, G. Michael, Distinguished Professor

N

Narahara, Taro, Assistant Professor

Navin, Thomas R., University Lecturer

O

Ogorzalek, Thomas, University Lecturer

P

Papademetriou, Peter C., Professor Emeritus

R

Russo, John Rhett, Associate Professor

S

Schuman, Anthony W., Associate Professor

Siegel, Joy W., University Lecturer

Sollohub, Darius T., Associate Professor

T

Taher, Rima, Senior University Lecturer

Theodore, Georgeen, Associate Professor

W

Wall, Donald R., Associate Professor Emeritus

Weisman, Leslie K., Professor Emeritus

Wendell, Augustus E., University Lecturer

West, Troy, Associate Professor Emeritus

Wood, Timothy Daniel, University Lecturer

Z

Zarzycki, Andrzej, Associate Professor

Zdepski, Michael, S., Associate Professor

Programs

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- Industrial Design - B.S. (p. 193)
- Interior Design - B.A. (p. 192)

School of Art + Design Courses

AD 111. Communication in Art and Design - Traditional Media. 3 credits, 6 contact hours (1;0;5).
Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. This course will explore a range of subjects from object still life to the human figure to landscape and will deal with specific issues of line, value, composition, structure, proportion and perspective. The aim of this course is to achieve a critical approach to hand-eye coordination and ideational sketching, through both direct observation and conceptual diagramming.

AD 112. Communication in Art and Design - Digital Media. 3 credits, 6 contact hours (1;0;5).
Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. This course will help students develop a critical attitude and analytical language to explore 3D and 2D issues involved in the study of design ideas but work will be focused primarily on digital techniques and modes of expression. It will cover drawing basics and digital modeling and extracted drawing techniques and critical analysis of these techniques and other methods of graphic (and architectural) representation.

AD 150. Color and Composition. 3 credits, 4 contact hours (2;2;0).
Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. Introduction to principles of 2D composition with emphasis on color use and color theory. Students are introduced to traditional media (watercolor and collage) and digital raster graphics (painting, image processing, and compositioning). Applications that include interior design, product/industrial design, advertising, web design, and fine arts are discussed. Concepts include grids and hierarchy, color models and mixing, color interaction, human response to color, printing, etc. Creative projects.

AD 161. History of Art And Design I. 3 credits, 3 contact hours (3;0;0).
This foundation history course surveys the principle aesthetic/functional themes and theories of the twentieth century. Students will explore how various individuals have used art and design to develop products that enriched society culturally and/or that resolved particular societal needs. The course will begin with how optics revolutionized painting, sculpture, architecture, film, etc, and explore how the modern movement broke with or reinterpreted the past through a series of flashbacks.

AD 162. History of Art And Design II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: AD 161. This course explores the major art and design movements and influences of the 20th century post 1930 that set the stage for today's 21st century art and design works that increasingly deal with issues of globalization and technology and ecology. Students will investigate the cultural meaning and historical significance of the art/design product throughout the 20th and 21st century.

AD 201. Human Factors/Ergonomics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Computing Literacy GER course, AD 150, AD 112. Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. Through lectures and "hands-on" experiments, this course will challenge the student to explore objects and environments as sensory and psychological experiences that effect human comfort, efficiency, function and emotion. Emphasis will be put on empathizing with the user with particular attention to those individuals with special physical, cognitive or occupational needs.

AD 325. Entrepreneurship for Designers. 3 credits, 3 contact hours (3;0;0).

AD 340. Photography and Imaging. 3 credits, 4 contact hours (2;2;0).
Prerequisites: AD 150 or ARCH 396 or permission of instructor. Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. Photography is introduced as an artistic medium in a digital context. General photographic principles and techniques will be discussed including digital flash photography, image processing, in/on-camera filters and post-processing filters, camera controls, and compositional elements. Photographic student projects will be required. Students must provide their own DSLR camera for use throughout the semester.

AD 463. Collaborative Design Studio. 5 credits, 11 contact hours (0;0;11).
Prerequisites: (DD 364 or ID 364 or INT 364 or ARCH 364) and PHYS 102. Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. Interdisciplinary and multi-disciplinary design studio where students work both individually and collaboratively on team project(s) that require the integration of different design disciplines.

AD 490. Special Topics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: DD 264 or ID 264 or INT 264 or ARCH 363. Restrictions: For Digital Design, Industrial Design, and Interior Design majors only; other majors require department approval to register. As determined by individual section and topic. Group investigation of problems or topics of special interest in art and design including, but not limited to, fine arts, industrial design, interior design, and digital design.

AD 491. Independent Study. 1 credit, 1 contact hour (0;0;1).
Restriction: Permission of instuctor and departmental/school approval. Individual investigation of problems or topics of special interest in art and design including, but not limited to, fine art, industrial design, interior design, and digital design. Subjects may include the overlap between these areas and related areas including art/architectural history and architecture. Provides opportunities to work on a project with individual guidance from an instructor in the School of Art + Design.

AD 492. Independent Study. 2 credits, 2 contact hours (0;0;2).
Restriction: Permission of instuctor and departmental/school approval. Individual investigation of problems or topics of special interest in art and design including, but not limited to, fine art, industrial design, interior design, and digital design. Subjects may include the overlap between these areas and related areas including art/architectural history and architecture. Provides opportunities to work on a project with individual guidance from an instructor in the School of Art + Design.

AD 493. Independent Study. 3 credits, 3 contact hours (0;0;3).
Restriction: Permission of instuctor and departmental/school approval. Individual investigation of problems or topics of special interest in art and design including, but not limited to, fine art, industrial design, interior design, and digital design. Subjects may include the overlap between these areas and related areas including art/architectural history and architecture. Provides opportunities to work on a project with individual guidance from an instructor in the School of Art + Design.

DD 263. Digital Design Studio I. 4 credits, 9 contact hours (0;0;9).
Prerequisites: AD 111, AD 112. Corequisite: AD 150. Restrictions: For Digital Design majors only, or with department approval. Foundations of three dimensional design and image making. Project based applications focusing on the design and digital representation of narrative sequences and architectural or environmental settings for games, theater, advertisements, books, or similar contexts. Course includes modeling with different geometries (e.g. NURBS, polygonal) and advanced techniques in rendering with lighting and materials as well as issues of production design.

DD 264. Digital Design Studio II. 4 credits, 9 contact hours (0;0;9).
Prerequisites: AD 111, AD 112, AD 150, and DD 263. Restrictions: For Digital Design majors only, or with department approval. Foundations of motion based design and narrative exploring concepts of linear, motion-based two-dimensional media including motion graphics, live action filming, particle systems, digital video editing and digital video compression. Project based applications focusing on the design, production and post production of motion sequences for cinema, games, theater, advertisements, or similar contexts.

DD 275. History of Games. 3 credits, 5 contact hours (2;3;0).
Prerequisites: AD 111, AD 112 and AD 162 or ARCH 163, ARCH 263 and ARCH 251. Restrictions: For Digital Design majors only, or with department approval. A guided exploration through the world of games. Students will experiment, play, and analyze various aspects of games - from early traditional games to current generation electronically-mediated games; from individual games to collaborative online games. Game types will be analyzed with particular attention paid to the virtual environments in which these games take place. The expressive and persuasive aspects of games will also be explored.

DD 284. Video and Animation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 112 and AD 150 or equivalent with instructor's and program permission. Restrictions: For Digital Design majors only, or with department approval. Laboratory course exploring concepts of linear, motion-based two-dimensional media and includes motion graphics, live action filming, particle systems, digital video editing and digital video compression. Projects include the design and production of multiple projects addressing both technical and creative decision making.

DD 301. Acting Fundamentals for Animators. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 111, AD 112, AD 150 and DD 263. Introduction to the historical contexts of acting. Survey of acting techniques and principles and their relationship to successful visual storytelling. Topics covered include movement, empathy and dialogue. Application of acting to two-and three-dimensional animation. Students will study examples from animation as well as film and theater. Required projects include both in-class acting exercises as well as storyboard creation and directed computer graphics character animation.

DD 303. Foundations of Sound and Music. 3 credits, 3 contact hours (3;0;0).
Restrictions: For Digital Design majors only, or with department approval. A multimedia course to give an understanding of music theory and musicology. Survey of the history of music and musical movements, and the use of music in motion pictures, digital media, and interactive entertainment. An introduction to instrumentation, music notation, music theory world musicology, and ear training as well as the relationship between music and culture. Visual and audio components are included.

DD 320. Robotics for Architects and Designers. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 112, AD 150; or ARCH 295; or instructor approved equivalents. This course is for students who would like to explore and produce interactive and kinetic products or building prototypes using microcontrollers (Arduino), sensors, and actuators. The course will focus on producing creative and aesthetically articulated applications of robotic technologies. Topics include applications of adaptable, responsive, and distributed systems to various fields of design. The course will take a hands-on approach to learn about sensors (such as light, sound, motion, and gesture-tracking sensors, for example, Microsoft Kinect sensor), actuators (such as servo motors), graphic/game design/simulation software (Processing, Unreal Engine, and Unity3D), and prototyping using available digital fabrication tools such as laser cutters, 3-D printers, and CNC machines at the CoAD and others. Topics from IoT (Internet of Things) will be also explored for those who are interested in creating smart products. Recommended for 5th-, 4th-, and 3rd-year students with basic knowledge on programming, 3-D modeling, and digital fabrication skills. Open to students from any college. Non-CoAD students with appropriate backgrounds are welcome to join the course.

DD 321. Interactive and Reactive Environments. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 112, AD 150 and DD 284, or ARCH 295, or instructor permission. This course will investigate contemporary attitudes toward digital public spaces, from mainstream media facades, interactive art installations, and mobile applications to guerrilla-like techniques such as tactical media, activist gaming, and electronic civil disobedience. Based on their research of relevant precedents, students will design a 2D and/or 3D interactive environment.

DD 334. Simulated Environments. 3 credits, 3 contact hours (3;0;0).
Prerequisites: DD 263, DD 264 or ARCH 295. Pre or Corequisites: DD 275. Restrictions: Digital Design majors only, all others with permission of the department. This course will explore the application of desktop, non-immersive virtual reality to the representation of architecture. Course exercises and projects are designed to uncover both advantages and limitations of this emerging technology, on both practical and theoretical levels. The major focus of the course will be personal evaluation of these tools in the design of both object-specific and the spatial in architectural problem solving. The collaborative nature of the toolkit will inform design decisions vis-a-vis observation of participant behavior and open discussion with interactive critics.

DD 363. Digital Design Studio III. 5 credits, 11 contact hours (0;0;11).
Prerequisites: DD 263, DD 264, AD 161, AD 162, AD 150. Prerequisites or corequisites: DD 275, ARCH 251. Three-dimensional design in a digital milieu. Project-based applications focusing on the design and digital representation of architectural or environmental settings for games, theater, advertisements, books, or similar contexts. Course includes modeling with different geometries (e.g. NURBS, polygonal) and advanced techniques in rendering with lighting and materials as well as issues of production design.

DD 364. Digital Design Studio IV. 5 credits, 11 contact hours (0;0;11).
Prerequisites: ARCH 382, DD 275, DD 363, IT 201. Design studio focusing on two-and three-dimensional visual communication of data, including interactive and scripted/animated communication as well as still-image utilization. Applications may include website creation, information kiosks, exhibit design, educational videos, scientific visualization, and other graphics-intensive projects.

DD 403. Digital Sound and Music. 3 credits, 3 contact hours (3;0;0).
Restrictions: For Digital Design majors only, or with department approval. A studio class that provides a baseline understanding of sound design within an animated video and video game environment. Course includes an introduction to sampling, field recording, sound effects, production techniques, and general sound design for the purpose of integrating and managing the integration of audio in motion pictures, television, and video games. Analytical and creative projects are required.

DD 415. Web/Exhibit Development. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 150, DD 284, IT 201. Instructor may waive or accept alternate prerequisite(s) based on individual student preparation. Overview of multimedia exhibit design dealing with issues of graphic identity human-computer interactions, and information visualization as tools for comprehension, enhanced communication, and effective decision-making. Exhibit types include educational symposia, museum/gallery shows, and online environments. Analyses and creative project(s) are required.

DD 442. Visual and Special Effects in Movies. 3 credits, 3 contact hours (3;0;0).
Restrictions: For Digital Design majors only, or with department approval. The creating of narrative-dependent moving images pushes the boundaries of entertainment technology. This class investigates the progress of visual and special effects as viewing moved from the Kinetoscope to 4K digital projection. The use of mirrors, cameras, and other analog devices along with information technology enabled effects including computer generated imagery are studies. Analytical and creative projects are required.

DD 443. 2-Dimensional Character Design. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 111, DD 275 and DD 284 This course focuses on the design of charaters for 2-Dimensional media such as graphic novels, 2D video games, model sheets for 3D creation, concept art and so on. Students will create both humanoid and creature-based charaters by using a variety of skillsets, including basic anatomy, illustrating age, acting (through characters), prop and costume design, etc. Students will also learn pre-production tools such as reference gathering, concept sketches and mood boards.

DD 444. 3-Dimensional Character Devel. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 111, DD 275, DD 284 and DD 301 In-depth exploration of 3D character design, modeling and animation for video games and cinematographic production. Conceptual and technical/production topics are considered. Precedent studies are required from sources including illustration, gaming and video/animation disciplines as well as theatrical and cinematographic choreography including fashion designers and make-up artists. 3D modeling, UV unwrapping, texturing and rigging as well as pipeline production processes are also included.

DD 449. Imaginary Worlds: Architecture in Motion Pictures. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 112, AD 161, AD 162 or ARCH 211, ARCH 395. Restrictions: DD cohort designation for DD majors only. Like childhood photographs in family albums, movies are part of our collective memories and become a unique way of "remembering" an era or place even one that has never existed or could exist. The study of imaginary worlds in motion pictures provides students with opportunities to gain an awareness of architecture and study it from different perspectives. Movies studied will be limited to those that postulate new, or unique, environments rather than those films that faithfully document reality. Discussions will focus on architectural issues raised by the movies studied as well as those found in critical essays.

DD 464. Digital Design Studio III. 5 credits, 11 contact hours (0;0;11).
Prerequisite: DD 364. Continuation of Digital Design Studio II with projects of greater complexity requiring the selection and use of multiple media (including time-based media) in the preparation and completion of creative work. Independent research and production by each student is required for all projects. Production of both passive and interactive projects will be part of the studio program.

ID 203. Past, Present and Future of Design. 3 credits, 3 contact hours (3;0;0).
Restriction: Sophomore level or higher. Intensive survey course marking pivotal design paradigm shifts from ancient cultures through the industrial revolution, the present day and projecting into the future, this course focuses on the human activity called design. Case studies of selected cultures and designers will expose the student to the forces, history, methods, styles and meanings that shape the human ecology.

ID 216. Modeling and Prototyping. 3 credits, 3 contact hours (3;0;0).
Corequisite: ID 263. Restrictions: Sophomore level or higher. For Industrial Design majors only, or with department approval. Introduction to the drafting skills, techniques and methods needed to communicate a design for fabrication as well as the materials, tools and techniques to make full size working prototypes. The drafting component of the course will cover orthographic, isometric, line weight, dimensioning and specifications. Building from the drafting component of the course, the prototypes component will - through work in the model shop - introduce the student to the most common fabrication techniques, tools and methods used to build appearance and working prototypes in various materials.

ID 217. Modeling and Manufacturing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ID 216. Corequisite: ID 264. Restriction: For Industrial Design majors only, or with department approval. This course will build on the computer modeling techniques of the ID 216 course and combine it with the programs, tools and facilities used in Computer-Aided Manufacturing (CAM). The student will take computer-generated designs and feed them directly into the manufacturing system. The course will also explore Computer Aided Manufacturing as a means of facilitating mass customization: the process of creating small batches of products that are custom designed to suit each particular user.

ID 263. Industrial Design Studio I. 4 credits, 9 contact hours (0;0;9).
Prerequisites: AD 111 and AD 112. Corequisite: AD 150. Restriction: For Industrial Design majors only, or with department approval. Students are introduced to designing objects, environments and systems through a series of exercises in conceptual, abstract, and strategic thinking as it applies to the small and large-scale artifact. The relationship between function structure materiality, production aesthetics and human needs are introduced and tested.

ID 264. Industrial Design Studio II. 4 credits, 9 contact hours (0;0;9).
Prerequisites: AD 150 and ID 263. Restrictions: For Industrial Design majors only, or with department approval. This course is a continuation of ID 263 with the focus shifting toward selected problems derived from the areas of work, health, education, recreation and communication. Introduction to the case study method of analyzing existing products.

ID 301. Industrial Design Specialization. 3 credits, 3 contact hours (3;0;0).
Corequisite: ID 363 (or higher) or INT 363 (or higher). Restriction: Permission of Art + Design Advisor. This project-based course will expose the student to one of many specialties within the Industrial Design profession that may include industry-specific design explorations and case studies in areas that include the design of furniture, consumer products, toys, footwear and apparel, jewelry, lighting, exhibits, way-finding graphics, transportation, etc.

ID 310. Ethnographic and Marketing Research. 3 credits, 3 contact hours (3;0;0).
Restriction: Junior level or higher. Research methodologies will be explored and conducted as a means to lend an objective understanding of user needs, desires and motivations. This will occur through well documented interviews, surveys, observations and interventions. The information gathered will be used to shape new products, add value to existing products or give insite to yet unexplored products or marketing opportunities.

ID 312. Mechanics and Electronics. 3 credits, 3 contact hours (3;0;0).
Corequisite: ID 263. Restrictions: Sophomore level or higher. For Industrial Design majors only, or with department approval. This is an advanced research course that addresses products which employ electronics predominantly as the major factor of design, then products that employ mechanical systems as the major determining factor, finally, the interpolanation of the mechanical with the electronic with a focus on the human interface with these products.

ID 340. Materials and Processes. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 201 or ARCH 295. Restrictions: Junior level or higher. The student will be introduced to the basic materials and processes used in manufacturing of both short run and mass-produced objects. The course will comprise of lectures, field trips and design exercises employing both traditional and state-of-the-art manufacturing processes.

ID 341. Sustainable Materials and Processes. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 201 or ARCH 295. Restrictions: Junior level or higher. The course will comprise of lectures and field trips that take a critical look at the traditional materials and processes used in manufacturing and evaluate alternatives based on research and experimentation. Each student will perform a Life Cycle Analysis (LCA) on an existing product by following the products life from the mining of raw materials to disposal taking particular attention to energy usage, use of natural resources, toxicity and decomposition.

ID 363. Industrial Design Studio III. 5 credits, 11 contact hours (0;0;11).
Prerequisite: ID 216, ID 217 and ID 264. This project specific studio will address real-world needs, parameters, and research as it applies to market trends and industry focused development. Companies and entrepreneurs will be invited to submit industry or need specific project briefs to the studio which will become the project for the semester. The students will experience first-hand the challenges of designing, building and testing within a real-life, interdisciplinary framework. The company will participate as sponsor, mentor and partner to the students.

ID 364. Industrial Design Studio IV. 5 credits, 11 contact hours (0;0;11).
Corequisites: ID 216, ID 363, AD 201. A knowledge and evidence-based studio that addresses real-world needs, parameters, and research. Work and product design(s) may be derived from requirements that include governmental and non-governmental not-for-profit organizations as well as from research about needs that can affect the social, physical, and economic health of individuals.

ID 370. New Product Testing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: AD 201 or ARCH 295 or permission of instructor. A hybrid course combining hands-on physical testing of products with lectures, readings, and case study presentations (both group and individual- oral and written). Multiple evaluative criteria (e.g safety, value, sustainability) will be discussed, established, and tested on a variety product types. Students may be required to provide/purchase a limited number of items for destructive testing. In-class student participation required.

ID 410. Professional Practice and Ethics. 3 credits, 3 contact hours (3;0;0).
Restriction: Senior level. This course covers the concepts of legal rights, copyrights, responsibilities and obligations of the designer, re: liabilities, contract review, patents, royalties, etc. The course also covers areas of responsibility in owner-offices, within corporate offices, working with design consultants and procedures for establishing a professional design practice. The course will also focus on the ethics of practice, research and marketing within a social, political and cultural context.

ID 463. Industrial Design Studio V. 5 credits, 11 contact hours (0;0;11).
Prerequisite: ID 364. This studio will draw from the vast academic talent at NJIT by partnering Industrial Design students with students in the other colleges and departments on campus such as engineering, architecture, management and computing. The students will develop methodologies for achieving effective collaboration and integration of industrial design with other disciplines, especially in the early phases of product development, through an industry specific design project.

ID 464. Industrial Design Studio V. 5 credits, 11 contact hours (0;0;11).
Prerequisites: ID 364 and PHYS 102. A comprehensive studio with projects (including multi-disciplinary projects) of advanced design and complexity. Students will work to initiate research and development of projects within the studio to demonstrate a full range of professional competencies, including but not limited to, the ability to independently critique work in progress. Completed work and presentation materials are expected to be exhibitable quality.

INT 221. Building and Interior Systems I. 3 credits, 3 contact hours (3;0;0).
Restrictions: For Interior Design majors only, or with department approval. An introduction to, and overview of, large-scale systems used in and affecting the design of building interiors. The operation and impacts of heating, ventilating, and air conditioning equipment on building space and layout are emphasized. Additional topics include the design of plumbing and waste systems as they affect building planning and the design of related spaces (including kitchens and bathrooms) and the use and design requirements for vertical transportation in building interiors.

INT 222. Building and Interior Systems II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 102. Restriction: For Interior Design majors only, or with department approval. An introduction to, and overview of, small-scale systems used in and affecting the design of building interiors. The needs and scope of design potentials in electrical systems (including requirements for media installations) and lighting design as they are used in, affect the design of, interiors are emphasized. Also included is an introduction to building acoustics and how basic principles affect design layout and material and furniture selection for a variety of building and construction types.

INT 263. Interior Design Studio I. 4 credits, 9 contact hours (0;0;9).
Prerequisites: AD 111, AD 112. Corequisite: INT 221. Pre or Corequisite: AD 150. Restriction: For Industrial Design majors only, or with department approval. A hands-on studio based introduction to the basic principles and elements of design for interior design students. Emphasis on design methods using multiple media, manipulating form and space. Course includes lectures, readings, analytical exercises, and (primarily three-dimensional) design projects.

INT 264. Interior Design Studio II. 4 credits, 9 contact hours (0;0;9).
Prerequisites: AD 150, INT 263. Corequisite: INT 222. Restriction: For Interior Design majors only, or with department approval. A continuation of Interior Design Studio I. A hands-on studio course that expands introductory design problems into commercial interiors and public spaces. Interior design as a knowledge-based discipline is introduced. Emphasis is placed on the development of an iterative and reflective design process as well as the production and presentation of interior design proposals. Preliminary integration of multiple technical variables is included.

INT 321. Methods and Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 111, AD 112, AD 150 or ARCH 334, AD 161, AD 162 and ARCH 251. Restriction: For Interior Design majors only, or with department approval. The study of materials, products, and assemblies used in interior design. The course covers code requirements and life safety, specification, installation, performance of materials (including fabrics and textiles), and sustainability of material selection and utilization. Also covered are the impacts of materials utilization on health and interior environmental quality.

INT 322. Contract Documents. 3 credits, 3 contact hours (3;0;0).
Prerequisites: INT 321, INT 363. Pre or Corequisites: ARCH 282. Restrictions: For Interior Design majors only, or with department approval. The course addresses issues of standards and methods of ethical and professional practice. It covers the production of contracts between the professional design service provider and clients as well as various project deliverables used in initial design phases through project close out. Document types covered include letters of agreement, contract document drawing sets and addenda sketches, specifications, schedules and budgets.

INT 350. History of Furniture. 3 credits, 3 contact hours (3;0;0).
Prerequisites: AD 161 and AD 162 or equivalent; or ARCH 295. Survey course studying the history and characteristics of furniture design from antiquity to the present day. Study of social and design forces influencing furniture. Students will analyze furniture in terms of style, aesthetic intent, construction and materials, ergonomics, universal/barrier-free accessibility, sustainability, and technology. Major stylistic movements will be discussed.

INT 351. Furniture Design. 3 credits, 5 contact hours (2;0;3).
Prerequisites: INT 264 or ID 264 or DD 364 or FA 264 or ARCH 211. Corequisite: Studio enrollment. This course is an introduction to the concepts, materials and construction technologies involved in the design and fabrication of furniture. It explores the relationship between ergonomics, comfort and function in the design of furniture for both site-specific environments and mass-produced applications. Course includes lectures, field trips and a variety of drawn, modeled, and built design projects.

INT 363. Interior Design Studio III. 5 credits, 11 contact hours (0;0;11).
Prerequisites: INT 222, INT 264. Pre or Corequisites: INT 221, INT 321, INT 350. Design studio focusing on residential design. The course includes a study of the relationship of human behavior to design emphasizing dwelling, security, comfort, and home. The correlation between furniture use and selection and residential space is explored. Variables studied include aesthetics and design organization, as well as the link between residential design and interior systems like lighting and plumbing.

INT 364. Interior Design Studio IV. 5 credits, 11 contact hours (0;0;11).
Prerequisites: INT 221, INT 222, INT 321, INT 363. Pre or Corequisites: ARCH 282. A continuation of the studio sequence with design and space planning projects of increasing complexity selected within the context of commercial and institutional building types - from office environments and healthcare facilities to religious venues and community facilities. Students are expected to further develop skills to simultaneously resolve conceptual, technical, aesthetic, and functional aspects of designs.

INT 464. Interior Design Studio V. 5 credits, 11 contact hours (0;0;11).
Prerequisites: ARCH 282, ARCH 337, INT 321, INT 322, INT 364. Corequisite: AD 201. A comprehensive studio with projects of advanced design and programming complexity concentrating on larger multi-level institutional and/or mixed-use building types. Students will work to initiate research and development through all design phases to synthesize the functional, sociological, aesthetic, regulatory, and project-specific technical requirements of their projects as they relate to interior design.

B.A. in Digital Design

The Digital Design curriculum is separated into two tracks: Entertainment Track, and Interactive Media/Production Track. Students will select their track of study in the second year and follow their chosen track to completion. Please refer to the appropriate track for proper curriculum requirements.

Graduation is contingent upon the successful completion of the prescribed courses within the select track of the 120-credit Digital Design curriculum and the maintenance of both a minimum overall cumulative GPA of 2.0 and a minimum 2.0 GPA for all major-specific requirements. Students are required to maintain an annual studio average of 2.0 or higher to advance to the next studio level each succeeding year and to complete the final 4th-year studio course sequence.

(120 credits)

Entertainment Track

First Year		
1st Semester		**Credits**
AD 150	Color and Composition	3
AD 161	History of Art And Design I	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 107 or MATH 113	University Mathematics A or Finite Mathematics and Calculus I	3
CS 100 or CS 115	Roadmap to Computing or Introduction to Computer Science in C++	3
FYS SEM	First-Year Student Seminar	0
PE Elective		1
	Term Credits	**16**
2nd Semester		
AD 111	Communication in Art and Design - Traditional Media	3
AD 112	Communication in Art and Design - Digital Media	3
AD 162	History of Art And Design II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics	3
	Term Credits	**15**
Second Year		
1st Semester		
ARCH 382	History of Architecture IV	3
DD 275	History of Games	3

DD 263	Digital Design Studio I	4
DD 303	Foundations of Sound and Music	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
	Term Credits	**17**
2nd Semester		
DD 264	Digital Design Studio II	4
IT 201	Information Design Techniques	3
DD 403	Digital Sound and Music	3
Natural Science GER (p. 113)		3
PSY 210 or R830 101	Introduction to Psychology or Principles Of Psychology I	3
	Term Credits	**16**
Third Year		
1st Semester		
AD 201	Human Factors/Ergonomics	3
DD 334	Simulated Environments	3
IT 265 or IT 266	Game Architecture and Design or Game Modification Development	3
DD 363	Digital Design Studio III	5
	Term Credits	**14**
2nd Semester		
DD 364	Digital Design Studio IV	5
DD 301	Acting Fundamentals for Animators	3
Social Sciences GER (p. 114)		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**14**
Fourth Year		
1st Semester		
AD 463	Collaborative Design Studio	5
DD 443 or DD 444	2-Dimensional Character Design or 3-Dimensional Character Devel	3
History and Humanities GER 300+ level (p. 108)		3
Free Elective		3
	Term Credits	**14**
2nd Semester		
DD 464	Digital Design Studio III	5
DD 449 or DD 442	Imaginary Worlds: Architecture in Motion Pictures or Visual and Special Effects in Movies	3
Design Elective: AD/DD/ID/FA/INT/ARCH		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
	Total Credits	**120**

(120 credits)

Interactive Media/Production Track

First Year		
1st Semester		**Credits**
AD 150	Color and Composition	3
AD 161	History of Art And Design I	3
ENGL 101	English Composition: Introduction to Academic Writing	3

MATH 107 or MATH 113	University Mathematics A or Finite Mathematics and Calculus I	3
CS 100 or CS 115	Roadmap to Computing or Introduction to Computer Science in C++	3
PE Elective		1
	Term Credits	**16**
2nd Semester		
AD 111	Communication in Art and Design - Traditional Media	3
AD 112	Communication in Art and Design - Digital Media	3
AD 162	History of Art And Design II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics	3
	Term Credits	**15**
Second Year		
1st Semester		
ARCH 382	History of Architecture IV	3
DD 275	History of Games	3
DD 263	Digital Design Studio I	4
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
Social Sciences GER (p. 114)		3
	Term Credits	**17**
2nd Semester		
DD 264	Digital Design Studio II	4
IT 201	Information Design Techniques	3
Natural Science GER (p. 113)		3
Design Elective: AD/DD/ID/FA/INT/ARCH		3
PSY 210 or R830 101	Introduction to Psychology or Principles Of Psychology I	3
	Term Credits	**16**
Third Year		
1st Semester		
DD 334	Simulated Environments	3
DD 363	Digital Design Studio III	5
AD 201	Human Factors/Ergonomics	3
MRKT 330	Principles of Marketing	3
	Term Credits	**14**
2nd Semester		
DD 364	Digital Design Studio IV	5
MRKT 331	Customer Insights	3
IT 202	Internet Applications	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**14**
Fourth Year		
1st Semester		
AD 463	Collaborative Design Studio	5
IT 380	Educational Software Design	3
History and Humanities GER 300+ level (p. 108)		3
Free Elective		3
	Term Credits	**14**
2nd Semester		
DD 464	Digital Design Studio III	5

DD 415	Web/Exhibit Development	3
MRKT 360	Digital Marketing	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
	Total Credits	**120**

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

B.A. in Interior Design

The Interior Design program at NJIT is a four-year professional degree program accredited by the Council for Interior Design Accreditation (CIDA).

Graduation is contingent upon the successful completion of the prescribed courses of the 120-credit Interior Design curriculum and the maintenance of both a minimum overall cumulative GPA of 2.0 and a minimum 2.0 GPA for all major-specific requirements. Students are required to maintain an annual studio average of 2.0 or higher to advance to the next studio level each succeeding year and to complete the final 4th-year studio course sequence.

Students interested in pursuing graduate studies in Architecture (either at NJIT or elsewhere) are strongly advised to take (MATH 113 Finite Mathematics and Calculus I, Students should consult admissions requirements for any program and/or institution they are considering.

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

(120 credits minimum)

First Year		
1st Semester		**Credits**
AD 150	Color and Composition	3
AD 161	History of Art And Design I	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 107	University Mathematics A	3
CS 104	Computer Programming and Graphics Problems	3
FYS SEM	First-Year Student Seminar	0
PE Elective		1
	Term Credits	**16**
2nd Semester		
AD 111	Communication in Art and Design - Traditional Media	3
AD 112	Communication in Art and Design - Digital Media	3
AD 162	History of Art And Design II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics	3
	Term Credits	**15**
Second Year		
1st Semester		
INT 263	Interior Design Studio I	4
INT 221	Building and Interior Systems I	3
ARCH 382	History of Architecture IV	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
INT 350	History of Furniture	3
	Term Credits	**17**
2nd Semester		
INT 264	Interior Design Studio II	4
INT 222	Building and Interior Systems II	3
ARCH 282	Structural Principles	3

PSY 210 or R830 101	Introduction to Psychology or Principles Of Psychology I	3
Natural Science GER (p. 113)		3
	Term Credits	**16**
Third Year		
1st Semester		
INT 363	Interior Design Studio III	5
INT 321	Methods and Materials	3
ARCH 337	Building Information Modeling	3
MGMT 390	Principles of Business	3
	Term Credits	**14**
2nd Semester		
INT 364	Interior Design Studio IV	5
INT 322	Contract Documents	3
AD 201	Human Factors/Ergonomics	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**14**
Fourth Year		
1st Semester		
AD 463	Collaborative Design Studio	5
Design Elective: AD/DD/ID/FA/INT/ARCH		3
History and Humanities GER 300+ level (p. 108)		3
Free Elective		3
	Term Credits	**14**
2nd Semester		
INT 464	Interior Design Studio V	5
Design Elective: AD/DD/ID/FA/INT/ARCH		3
Free Elective		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
	Total Credits	**120**

B.S. in Industrial Design

Graduation is contingent upon the successful completion of the prescribed courses of the 120-credit Industrial Design curriculum and the maintenance of both a minimum overall cumulative GPA of 2.0 and a minimum 2.0 GPA for all major-specific requirements. Students are required to maintain an annual studio average of 2.0 or higher to advance to the next studio level each succeeding year and to complete the final 4th-year studio course sequence.

(120 credits)

First Year		
1st Semester		**Credits**
AD 150	Color and Composition	3
AD 161	History of Art And Design I	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 113	Finite Mathematics and Calculus I	3
CS 104	Computer Programming and Graphics Problems	3
FYS SEM	First-Year Student Seminar	0
PE Elective		1
	Term Credits	**16**
2nd Semester		
AD 111	Communication in Art and Design - Traditional Media	3
AD 112	Communication in Art and Design - Digital Media	3
AD 162	History of Art And Design II	3

ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics	3
	Term Credits	**15**
Second Year		
1st Semester		
ID 263	Industrial Design Studio I	4
ID 203	Past, Present and Future of Design	3
ID 216	Modeling and Prototyping	3
ID 312	Mechanics and Electronics	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
	Term Credits	**17**
2nd Semester		
ID 264	Industrial Design Studio II	4
AD 201	Human Factors/Ergonomics	3
ID 217	Modeling and Manufacturing	3
PSY 210 or R830 101	Introduction to Psychology or Principles Of Psychology I	3
Science GER Elective (p. 113)		3
	Term Credits	**16**
Third Year		
1st Semester		
ID 363	Industrial Design Studio III	5
ID 340	Materials and Processes	3
ID 310	Ethnographic and Marketing Research	3
Social Sciences GER (p. 114)		3
	Term Credits	**14**
2nd Semester		
ID 364	Industrial Design Studio IV	5
ID 341	Sustainable Materials and Processes	3
Design Elective: AD/DD/ID/FA/INT/ARCH		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**14**
Fourth Year		
1st Semester		
AD 463	Collaborative Design Studio	5
ID 410	Professional Practice and Ethics	3
Design Elective: AD/DD/ID/FA/INT/ARCH		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**14**
2nd Semester		
ID 464	Industrial Design Studio V	5
Design Elective: AD/DD/ID/FA/INT/ARCH		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
Free Elective		3
	Term Credits	**14**
	Total Credits	**120**

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Ying Wu College of Computing

The mission of the Ying Wu College of Computing, which was established in 2001, is to bring education in a broad range of computing disciplines to students on campus and at a distance to carry out cutting-edge research while working closely in the industry. Ying Wu College of Computing offers bachelor's, master's and doctoral degrees in multiple fields of computing science, Web and information systems and a multidisciplinary undergraduate degree in information technology.

Ying Wu College of Computing resides on one of the most computing-intensive campuses in the world, helping NJIT educate one of the largest groups of information technology students in the nation in the applications of new technologies as learning tools. Not coincidentally, New Jersey is one of the leading states for computing and high technology businesses. Thirty of the nation's fastest-growing technology companies are based in the state, and New Jersey ranks seventh in the nation as a cyberstate and eighth for venture capital investment— $3.5 billion—in information technology and software. Additionally, New Jersey offers the second-highest wages in the nation for technology workers. Ying Wu College of Computing graduates frequently land creatively satisfying and intellectually challenging jobs at major companies like IBM, Mercedes-Benz and Pfizer.

Programs

- Business and Information Systems - B.S. (p. 237)
- Computer Science - B.A. (p. 214)
- Computer Science - B.S. (p. 216)
- Computing and Business - B.S. (p. 221)
- Data Science - B.S. (p. 254)
- Human-Computer Interaction - B.S. (p. 240)
- Information Systems - B.A. (p. 233)
- Information Technology - B.S. (p. 242)
- Web & Information Systems - B.S. (p. 248)

Accelerated Programs (p. 102)

- Information Technology - Accelerated B.S. and J.D. (p. 232) (with Seton Hall School of Law)

Double Majors (p. 102)

- Computer Science and Applied Physics - B.S. (p. 218)
- Computer Science and Mathematical Sciences - B.S (p. 219)
- Computer Science and Mathematical Sciences - Computational Mathematics - B.S. (p. 222)
- Science, Technology and Society/Business and Information Systems - B.S. (p. 247)

- Computer Science Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/computer-science/minor/) (not for Computer Engineering majors)
- Computer Science Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/computer-science/minor-computer-engineering/) (for Computer Engineering majors)
- Data Analytics (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/data-analytics-minor/)
- Design of the User Experience Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/human-computer-interaction-minor/)
- Business and Information Systems Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/bis-minor-not-computing-science-majors/) (not for Computing Sciences majors)
- Business and Information Systems Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/bis-minor-computing-science-majors/) (for Computing Sciences majors)
- Information Technology Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/minor/) (not for Computing Sciences majors)
- Information Technology Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/minor-computing-science-majors/) (for Computing Sciences majors)
- Mobile and Web Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/computing-sciences/informatics/web-information-systems-minor/)

Programs

- Bioinformatics - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/computing-sciences/computer-science/bioinformatics-ms/)
- Business & Information Systems - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/computing-sciences/informatics/business-information-systems-ms/)
- Computer Science - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/computing-sciences/computer-science/ms/)

- Computing and Business - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/computing-sciences/computer-science/computing-business-ms/)
- Cyber Security and Privacy - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/computing-sciences/computer-science/cyber-security-privacy-ms/)
- Data Science - M.S – Computational Track (http://catalog.njit.edu/archive/2022-2023/graduate/computing-sciences/data-science/data-science-ms/)
- Information Systems - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/computing-sciences/informatics/ms/)
- Information Technology and Administration Security - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/computing-sciences/informatics/administration-security-ms/)
- Software Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/computing-sciences/computer-science/software-engineering-ms/)

Programs

- Computer Science - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/computing-sciences/computer-science/phd/)
- Information Systems - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/computing-sciences/informatics/phd/)

Ying Wu College of Computing Courses

BNFO 135. Programming for Bioinformatics. 3 credits, 3 contact hours (3;0;0).
The ability to use existing programs and to write small programs to access bioinformatics information or to combine and manipulate various existing bioinformatics programs has become a valuable part of the skill set of anyone working with biomolecular or genetic data. This course provides an understanding of the architecture of bioinformatics toolkits and experience in writing small bioinformatics programs using one or more of the scripting ("glue") languages frequently employed for such tasks.

BNFO 236. Programming for Bioinformatics II. 3 credits, 3 contact hours (3;0;0).

BNFO 330. Princ of Bioinformatics II. 3 credits, 3 contact hours (3;0;0).

BNFO 340. Data Analysis for Bioinformatics II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BNFO 240 and R120 101 or equivalent or permission of instructor. Advanced data analysis skills with applications to bioinformatics problems.

BNFO 482. Databases and Data Mining in Bioinformatics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BNFO 240 or equivalent or permission of instructor. Surveys biological databases and tools for managing them. Covers concepts and principles of data mining in bioinfomratics. Hands-on experience for mining genomic data using ORACLE and SQL.

BNFO 488. Independent Study in Bioinformatics. 3 credits, 3 contact hours (0;0;3).

BNFO 491. Bioinformatics Senior Project. 3 credits, 3 contact hours (0;0;3).
Prerequisite: CS 490. Restriction: Senior standing in the Honors College and project proposal approval. A course similar to CS 491, with a project of greater depth and scope.

CS 100. Roadmap to Computing. 3 credits, 3 contact hours (3;0;0).
An introduction to programming and problem solving skills using Python or other very high level language. Topics include basic strategies for problem solving, constructs that control the flow of execution of a program and the use of high level data types such as lists, strings and dictionaries in problem representation. The course also presents an overview of selected topics in computing, such as networking and databases.

CS 101. Computer Programming and Problem Solving. 3 credits, 3 contact hours (3;0;0).
An introductory course that is designed for engineering freshmen. This course introduces students to the engineering problem solving process in the context of MATLAB. The emphasis is on the logical analysis of a problem and the formulation of a computer program leading to its solution. Topics include basic concepts of computer systems, algorithm design, programming languages and data abstraction. At the end of class, a comparison between MATLAB and C/C++ will be discussed to provide students a better understanding of the general concept of computer programming.

CS 103. Computer Science with Business Problems. 3 credits, 3 contact hours (3;0;0).
An introductory course in computer science, with applications to business and managerial decision making. Topics include basic concepts of computer systems, software engineering, algorithm design, programming languages and abstraction, with applications.

CS 104. Computer Programming and Graphics Problems. 3 credits, 3 contact hours (3;0;0).
An introductory course in computer science with applications in computer graphics for architecture. Emphasis on programming methodology using a high level language as the vehicle to illustrate the concepts. Topics include basic concepts of computer systems, software engineering, algorithm design, programming languages and data abstraction, with applications.

CS 106. Roadmap to Computing for Engineers. 3 credits, 3 contact hours (3;0;0).
An introduction to programming and problem solving skills for engineering majors using Python programming languages. Topics include basic strategies for problem solving, constructs that control the flow execution of a program and the use of high level data types such as lists, strings, and dictionaries in problem representation. The course also presents an overview of selected "big idea" topics in computing.

CS 113. Introduction to Computer Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 100 or CS 103 with a grade C or better. Intensive introduction to computer science. Problem solving decomposition. Writing, debugging, and analyzing computer programs. Introduction to arrays and lists. Iteration and recursion. The Java language is introduced and used to highlight these concepts. A student receiving degree credit for CS 113 cannot receive degree credit for CS 115.

CS 114. Introduction to Computer Science II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 113 with a grade C or better. A study of advanced programming topics with logical structures of data, their physical representation, and the design of computer algorithms operating on the structures. Course covers program specifications, correctness and efficiency, data abstraction, and algorithm analysis. Students receiving degree credit for CS 114 cannot receive degree credit for CS 116 or CS 505.

CS 115. Introduction to Computer Science in C++. 3 credits, 3 contact hours (3;0;0).
Fundamentals of computer science are introduced, with emphasis on programming methodology and problem solving. Topics include basic concepts of computer systems, software engineering, algorithm design, programming languages and data abstraction, with applications. The high level language C++ is fully discussed and serves as the vehicle to illustrate many of the concepts. CS majors should enroll in CS 113.

CS 116. Introduction to Computer Science II in C++.. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 115 with a grade C or better. A study of advanced programming topics with logical structures of data, their physical representation, design and analysis of computer algorithms operating on the structures, and techniques for program development and debugging. Course covers program specifications, correctness and efficiency, data abstraction, basic aspects of simple data structures, internal searching and sorting, recursion and string processing. Algorithmic analysis is also discussed. Students receiving degree credit for CS 116 cannot receive degree credit for CS 505 or CS 114.

CS 241. Foundations of Computer Science I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 and MATH 112 with a grade C or better. An introduction to the foundations of computer science with emphasis on the development of techniques for the design and proof of correctness of algorithms and the analysis of their computational complexity. Reasoning techniques based on propositional and predicate logic and relational calculus operations with applications to databases will also be introduced. Auxiliary topics such as combinatorics of finite sets, functions and relations, and graph-theory definitions and graph storage alternatives will also be examined.

CS 266. Game Modification Development. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 102 or IT 114 or CS 114 or CS 116 with a grade C or better. This course introduces students to the basic concepts of game programming and development. Students will learn how to reprogram a professional game engine, or Modification (Mod) development as it is referred to in the industry. Students will work with C extensively. Students will work on their own game projects utilizing the professional game engine.

CS 276. 2D Game Development. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (CS 265 and CS 266) or (IT 265 and IT 266) with a grade C or better. This course introduces students to the core concepts and skills necessary for the development of games utilizing 2D graphics. Students will learn how to set up and program their own 2D graphics based game engine. The engine will integrate 2D graphics, audio, input handling and network socket programming. Students will learn how to utilize their own custom 2D graphics and sounds into their projects. Once complete, students will have created two fully functional games.

CS 280. Programming Language Concepts. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 or CS 116 or IT 114 or equivalent with a grade C or better. Conceptual study of programming language syntax, semantics and implementation. Course covers language definition structure, data types and structures, control structures and data flow, run-time consideration, and interpretative languages.

CS 288. Intensive Programming in Linux. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 100 and CS 280 with a grade C or better. The course covers Linux programming with Apache Web and MySql database using Php/Python and C as primary languages. It consists of four stages: basic tools such as Bash and C programming; searching trees and matrix computing, end-to-end applications such as one that constantly presents top 100 stocks; and extending the applications to run on multiple machines. The course provides students with hands-on experience for programming relatively large applications.

CS 301. Introduction to Data Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 and MATH 333 with a grade C or better. This course is designed for CS BS students to equip them with introductory principles as well as hands-on skills that are required to solve data science problems. The first part of the course focuses on learning models, formalism, and algorithmic techniques that are popular in data science and heavily used in practice. In the second part of the course, students are introduced to data science tools (e.g., Excel, Python).

CS 331. Database System Design & Mgmt. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 or CS 116 or IT 114 or equivalent with a grade C or better. Database system architecture; data modeling using the entity-relationship model; storage of databases; the hierarchical, network and relational data models; formal and commercial query languages; functional dependencies and normalization for relational database design; relation decomposition; concurrency control and transactions management. Student projects involve the use of a DBMS package.

CS 332. Principles of Operating Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 or CS 116 or IT 114 or equivalent with a grade C or better. Organization of operating systems covering structure, process management and scheduling; interaction of concurrent processes; interrupts; I/O, device handling; memory and virtual memory management and file management.

CS 333. Introduction to UNIX Operating Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 332 or equivalent and knowledge of C language. The course covers the UNIX system kernel including initialization, scheduling, context switching, process management, memory management, device management, and the file system. The course also includes the organization of shells, editors, utilities, and programming tools of the UNIX operating system.

CS 337. Performance Modeling in Computing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 and (MATH 333 or MATH 341) with a grade C or better. Introduction to probability models and techniques useful in computer science. Performance evaluation, discrete-event simulation, classification and optimization are covered.

CS 341. Foundations of Computer Science II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (CS 241 or MATH 226) and CS 280 with a grade C or better. This course provides an introduction to automata theory, computability theory, and complexity theory. Theoretical models such as finite-state machines, push-down stack machines, and Turing machines are developed and related to issues in programming language theory. Also, the course covers undecidability and complexity classes P, NP, and NPC.

CS 345. Web Search. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 280 and CS 241 with a grade C or better. An introductory course on web searching. The architecture of a search engine. Information vs. data retrieval. Web crawling. Processing text (tokenization, stemming, stopwords, link analysis). The indexing process and inverted indexes. Query processing. Ranking algorithms based on indexes and links (e.g. Kleinberg's HITS, Google's PAGERANK). Retrieval Models. Search engine evaluation. Case studies (e.g. Google cluster architecture).

CS 350. Intro to Computer Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 280 with a grade C or better. An introduction to the organization and architecture of computer systems, including the standard Von Neumann model and more recent architectural concepts. Among the topics covered are numeric data representation, assembly language organization, memory addressing, memory systems, both real and virtual, coding and compression, input/output structures treated as programmed, interrupt, and direct memory access, and functional organization of the CPU and the computer system.

CS 351. Introduction to Cybersecurity. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 241 and CS 356 with a grade C or better. This course will give a broad overview of cybersecurity. There are two main goals of this course. First, students will learn fundamental concepts of cybersecurity. Second, this course will help students gain knowledge of the applications to computer systems and communication security. Topics include basics of cryptography, access control, malware, software security, storage and file security, operating-system security, database security and secure communication protocols.

CS 356. Introduction to Computer Networks. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 280 with a grade C or better. This course provides an introduction to computer networks, with a special focus on Internet architecture and protocols. Topics include layered-network architectures, addressing, naming, forwarding, routing, communication reliability, the client-server model, web and email protocols. Besides the theoretical foundations, students acquire practical experience by programming reduced versions of real Internet protocols.

CS 357. Fundamentals of Network Security. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 356 or IT 420 with a grade C or better. This course is designed for Computer Science and Information Technology students. They must have a networking course before taking CS 357. IT students take IT 420 and Computer Science students take CS 356. This course offers an in-depth study of network security issues, types of computer and network attacks, and effective defenses. It provides both a theoretical foundation in the area of security and hands-on experience with various attack tools, firewalls, and intrusion-detection systems. Topics include: network scanning, TCP/IP stack fingerprinting, system vulnerability analysis, buffer overflows, password cracking, session hijacking, denial-of-service attacks, intrusion detection.

CS 366. 3D Game Development. 3 credits, 3 contact hours (3;0;0).
This course introduces students to the core concepts and skills necessary for the development of games utilizing 3D graphics. Students will learn how to set up and program their own 3D graphics based game engine using OpenGL. Students will learn how to load and display custom 3D models created using existing 3D modeling tools. Once complete, students will have created two fully functional 3D games and tools to work with them.

CS 370. Introduction to Artificial Intelligence. 3 credits, 4 contact hours (3;1;0).
Prerequisites: CS 114 and (MATH 226 or CS 241) with a grade C or better. An exploration of concepts, approaches and techniques of artificial intelligence. Emphasizes both underlying theory and applications. Topics include knowledge representation, parsing language, search, logic, adduction, uncertainty, and learning. LISP and Prolog programming languages are used extensively. Students are required to do programming assignments, complete a programming term project and review case studies.

CS 375. Introduction to Machine Learning. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 100 or CS 115 and MATH 333 or ECE 321 with a grade C or better. This is an introductory course to Machine Learning (ML). It consists of: (i) A smooth, example-based presentation of the fundamental notions of ML via simple algorithms and visualizable "toy" data sets. (ii) A tour of a selection of widely-used machine learning algorithms, including supervised, unsupervised, and reinforcement-based techniques, with applications on real data sets. The students are expected to implement basic algorithms and experiment with existing widely-used ML software libraries on real datasets. They will also gain exposure to the full development of an ML system via a course project.

CS 388. Android Application Development. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 288 with a grade C or better. This course introduces mobile application development for the Android platform. Students will learn skills necessary for creating and deploying applications with the Android Software Development Kit (SDK). The course is designed to introduce and familiarize students with programming in the Android environment. It starts with an examination of the basic components and concepts that define the Android platform, and then moves on to cover the specific structure that comprises an Android application. An overview of the most common tools and techniques for writing Android applications is included. The Android approach to user interfaces is described along with a discussion of some of the more common user-interface elements. Storage strategies for persistent information are also covered, including the use of the available SQLite Database features. The unique characteristics of programming for a mobile environment are introduced and explained. Hands on experience in the form of exercises and programming projects are included throughout the course to reinforce material that has been presented in lecture form.

CS 408. Cryptography and Internet Security. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 351 with a grade C or better. Covers security requirements for telecommunication over the Internet and other communication networks, various conventional and public-key encryption protocols, digital encryption standard, RSA and ElGamal cryptographic systems, digital signature algorithm and analysis of its cryptoimmunity, and access-sharing schemes. Students receiving credit for CS 408 may not enroll in CS 608.

CS 433. Introduction to Linux Kernel Programming. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 288, CS 332, and CS 350. An introductory study of how the Linux operating system is built from scratch. AS a hands-on course, students will perform intensive programming using the Linux kernel. The contents include booting, segmentation and paging, creating and destroying processes, process switching and scheduling, handling exceptions and interrupts, software interrupts, creating system calls, creating file systems, networking with TCP/IP, device driver writing and module programming. At the end of the course, students will be able to modify the Linux operating system to create their own.

CS 434. Advanced Database Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 331 with a grade C or better. The course covers the basic concepts of traditional files and file processing, provides a "classic" introduction to the relational data model and its languages, and discusses database design methodology and application developments. Students are expected to learn the design of database application systems through a small project and to get some practical hands-on experience with commercial database management systems (DBMS) by writing application programs using the commercial DBMS query languages.

CS 435. Advanced Data Structures and Algorithm Design. 3 credits, 4 contact hours (3;1;0).
Prerequisites: CS 241 and CS 288 with a grade C or better. Advanced topics in data structures and algorithms, involving sequences, sets, and graphs such as searching, sorting, order statistics, balanced search tree operations, hash tables, graph traversals, graph connectivity and path problems. Algebraic and numeric algorithms. Performance measures, analysis techniques, and complexity of such algorithms.

CS 438. Interactive Computer Graphics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 or CS 116 with a grade C or better. This course introduces fundamental concepts of interactive graphics oriented toward computer-aided design systems. Such systems emerge in engineering, architecture, and manufacturing. Topics include computer data structures for representation of two- and three-dimensional objects and algorithms for definition, modification, and display of these objects in applications. This course will also discuss a selection of special topics in interactive graphics.

CS 439. Image Processing and Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 and MATH 333. This course is an intensive study of the fundamentals of image processing, analysis and understanding. Topics to be covered include: a brief review of the necessary mathematical tools, human visual perception, sampling and quantization, image transformation, enhancement, restoration, compression, reconstruction, image geometric transformation, matching, segmentation, feature extraction, representation and description, recognition and interpretation.

CS 440. Computer Vision. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 333. This course introduces basic concepts and methodologies of computer vision, and focuses on material that is fundamental and has a broad scope of applications. Topics include contemporary developments in all mainstream areas of computer vision e.g., Image Formation, Feature Representation, Classification and Recognition, Motion Analysis, Camera Calibration, Stereo Vision, Shape From X (shading, texture, motion, etc.), and typical applications such as Biometrics.

CS 441. Database Programming. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 114 or equivalent with a grade C or better. Many technologies have been developed due to the interplay between World-Wide Web development and databases on one hand and the growth of database applications in e-commerce on the other hand. Today, practically every e-commerce application has at least a Web component and a database component. Many languages have been developed in order to deal with these interactions. The course will focus on accessing databases through the Web but also cover new developments in the field.

CS 444. Big Data Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 288 and CS 301 with a grade C or better. This course provides a broad coverage of topics on big data generation, transfer, storage, management, computing, and analytics with focus on state-of-the-art technologies and tools used in big data systems such as Hadoop. Real-life big-data applications and workflows in various domains are introduced as use cases to illustrate the development and execution of emerging big data-oriented solutions using HDFS, HBase, MapReduce/Spark, etc. deployed in cloud-based cluster environments.

CS 450. Data Visualization. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 288 and CS 301 with a grade C or better. The course provides students an introduction to computer graphics and the knowledge for designing, developing, and applying techniques for both information and volume visualization. Software tools such as Tableau and programing languages such as Python will be used to represent and interpret information in various visual forms, and volumetric visualization algorithms such as marching cubes and ray casting will be used for big data visualization of 3D datasets in scientific domains. Students will gain knowledge about theoretical design principles and apply them directly on real-world data, as part of assignments and course projects.

CS 458. Technologies-Network Security. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 351 with a grade C or better. This course provides both an in-depth theoretical study and a practical exposure to technologies that are critical in providing secure communication over the Internet. Topics include remote access security, web security, wireless security, e-mail security, spam and spam filtering techniques, computer viruses and internet worms, honeypots and honeynets, security liability issues and compliance.

CS 482. Data Mining. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 331 with a grade C or better. The course covers the concepts and principles of advanced data mining systems design; presents methods for association and dependency analysis, classification; prediction; and clustering analysis.

CS 485. Selected Topics In CS. 3 credits, 3 contact hours (3;0;0).
Restriction: junior standing and/or department approval. The study of new and/or advanced topics in an area of computer science not regularly covered in any other CS course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course. A student may register for no more than two semesters of Special Topics.

CS 486. Topics in Computer Science/Information Systems. 3 credits, 3 contact hours (3;0;0).
Restriction: junior standing and/or department approval. A continuation of CS 485.

CS 488. Independent Study in Computer Science. 3 credits, 0 contact hours (0;0;0).
Restriction: Open only to Computer Science majors and who have the prior approval of the department and the CS faculty member who will guide the independent study. Independent studies, investigations, research, and reports on advanced topics in computer science. Students must prepare, in collaboration with their faculty mentor and in the semester prior to enrolling in this course, a detailed plan of topics and expected accomplishments for their independent study. This must have the approval of both the department and the faculty mentor. A student may register for no more than one semester of Independent Study.

CS 490. Guided Design in Software Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 280 and CS 288 with a grade C or better. This course focuses on the methodology for developing software systems. Methods and techniques for functional requirements analysis and specifications, design, coding, testing and proving, integration and maintenance are discussed.

CS 491. Senior Project. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 490 with a grade C or better. Restriction: Senior standing and project proposal approval. An opportunity for the student to integrate the knowledge and skills gained in previous computer science work into a team-based project. The project involves investigation of current literature as well as computer implementation of either a part of a large program or the whole of a small system.

CS 492. Data Science Capstone I. 3 credits, 3 contact hours (3;0;0).
Restrictions: Senior standing. The Data Science (DS) Capstone Project spans two semesters and is intended to provide a real-world project-based learning experience for seniors in the BS DS program. The overall objectives of this course are to investigate the nature and techniques of a data-oriented computing development project. Projects are provided by faculty members or industry partners, or proposed by students who wish to become entrepreneurs. In DS Capstone I, teams of project participants will carry out market research, identify appropriate data science problems, collect and preprocess the needed data, define performance metrics, perform risk analysis, and finish an overall design of their solution that integrates various data analytics techniques. The course instructor will mentor and evaluate all projects in conjunction with an entrepreneurship board of industry, faculty, and alumni advisors.

CS 493. Data Science Capstone II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 492 with a grade C or better. The Data Science (DS) Capstone Project spans two semesters and is intended to provide a real-world project-based learning experience for seniors in the BS DS program. The overall objectives of this course are to investigate the nature and techniques of a data-oriented computing development project. Projects are provided by faculty members or industry partners, or proposed by students who wish to become entrepreneurs. In DS Capstone II, teams of project participants will refine their design, implement and integrate component techniques into a complete software solution, present data analysis results, evaluate the system performance, and validate the proposed solution. The course instructor will mentor and evaluate all projects in conjunction with an entrepreneurship board of industry, faculty, and alumni advisors.

IS 117. Introduction to Website Development. 3 credits, 3 contact hours (3;0;0).
This course discusses the concepts and skills required to plan, design and build websites. It will be taught in a lab to ensure hands-on experience with each of these tasks. The course begins with an overview of web technologies. Students learn to plan websites, which includes determining the business and end-user requirements for the site. Design includes learning to develop "mockups" of how the site will look and how people will use it. The major tools for building websites will be industry standard HTML and XHTML to describe webpage content, and Cascading Style Sheets (CSS) for flexibly formatting the content. Using XHTML and CSS makes it relatively simple to change formats across the entire site, as well as "future-proofs" a website, allowing it to be viewed on every major web browser (such as Firefox or Chrome) and easily adapt to changes in future browser technology. The course features substantial hands-on projects comprising websites of several interlinked pages and images, enabling students to thoroughly learn the course's important concepts and skills.

IS 218. Building Web Applications. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (IS 117 or IT 202) and (CS 100, CS 113, or CS 115). This course provides a critical, hands-on introduction to the design of Web-based Information Systems. We will explore and discuss emerging trends, capabilities, and limitations of web technologies used to capture, store, access, and disseminate information for both businesses and online communities. Students, working in groups, will design and develop different types of web applications, which will then be analyzed and critiqued by the students as to their usability in actual public and private settings. An open-source web content management system will be utilized throughout the course.

IS 219. Adv Website Development. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (IS 117 or IT 202) and (CS 100, CS 113, or CS 115). IS 218 is strongly encouraged as additional foundation knowledge. This course discusses the concepts and skills required to plan, design and build advanced websites, with a focus on sophisticated user interaction enabled by programming the web browser (such as Internet Explorer or Chrome). Such programming is known as client-side scripting. These interactive websites utilize forms to gather user inputs, and vary both the content and display of the webpages based on the current user tasks and preferences. This includes designing and dynamically changing tabs and menus, as well as expanding and contracting sections of pages. Students will develop a thorough understanding of website usability (designing effective sites that people like, security and user privacy, browser capability (ensuring websites work on every major web browser), and the tools and skills that web developers use to add interactive features to websites. These skills include Javascript (for programming interactive features), the Document Object Model or DOM (specifying the internal structure of web pages), JQuery (to access information utilizing this internal structure, create animations and generally streamline Javascript), browser variables (providing information about the browser characteristics), HTML input forms, form validation (ensuring correctness of user input), securing user input (to ensure user privacy), cookies (tracking user information), basic communication with the web server (which processes the information users input into forms), and AJAX (which integrates many of these technologies). The course will be taught in a lab to ensure hands-on experience and will include substantial design and development projects.

IS 245. Information Technology Systems: Hardware/Software. 3 credits, 3 contact hours (3;0;0).
This course reviews hardware/software technologies in order to enable system developers to understand tradeoffs in the design of computer architectures for effective computer systems. Also covered are operating systems and systems architecture for networked computing systems. Topics include Hardware (CPU architecture, memory, registers, addressing modes, busses, instruction sets, multi processors versus single processors, and peripheral devices), Operating systems (processes, process management, memory and file system management), and Telecommunications (basic network components, switches, multiplexers and media, installation and configuration of multi-user operating systems).

IS 247. Designing the User Experience. 3 credits, 3 contact hours (3;0;0).
This course covers the design and evaluation of the human-computer interface in interactive computer systems. Among the topics covered are approaches to interface design such as menus, commands, direct manipulation; screen layout strategies; metaphor models; models of human information processes; evaluation approaches such as protocol for analysis, interactive monitoring, use of surveys; and requirements for documentation and help. Students are expected to design interface mockups and evaluate them.

IS 265. Introduction to Information Systems. 3 credits, 3 contact hours (3;0;0).
Information systems is the study of how organizations use information technology. This course is an overview of the information systems discipline, the role of information systems in organizations, and the changing nature of information technology. Computer tools for analysis and presentation are used.

IS 270. Designing the Multimedia Experience. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Completion of 100 level course in the computing sciences: CS 101 or CS 111 or CS 113 or CS 115 or IS 118. Multimedia combines text, graphics, sound, video, and animation in a single application. Preparation for creating multimedia information systems, and understanding the crucial issues involving technology, design and effectiveness of multimedia applications. Programming techniques for integrating video, sound, animation, and graphics, and design strategies for multimedia information systems.

IS 310. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

IS 322. Mobile Applications: Design, Interface, Implementation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IS 218, IS 219, or IT 202. This course is a practical introduction to building applications for mobile devices. The course combines hands on design and development experience, with a conceptual overview and discussion of design and practical development issues. Taken into account will be constraints and requirements of devices with small screen sizes, limited battery power, limited computational power, etc. Tools used for building an application in the context of a specific device such as iPhone or an Android based device will be discussed. Students build a mobile application to demonstrate their understanding of mobile web constraints and tools.

IS 331. Database Design Management and Applications. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IS 218 or IT 202. Businesses use databases extensively for analysis and decision-making because they provide efficient, large-scale information storage and rapid retrieval. Databases support the "back end functionality" of most large web systems. This course gives students extensive, pragmatic experience in designing, building, querying, updating, maintaining and managing relational databases, using the Structured Query Language (SQL). Proper database design principles are emphasized throughout the course, beginning with high level descriptions of relational databases using data modeling tools (such as entity-relationship or ER diagrams)and progressing to relational database design principles based on higher order normalizations. We will examine some poorly designed databases and show how these can be transformed into well designed databases. SQL will be extensively covered, and students will design and implement sophisticated SQL queries invoking self-joins, outer joins, correlated subqueries and related concepts. Students will explore and utilize design methodologies for input data validation and maintaining database integrity, and study issues of database privacy and security. Advanced topics to be discussed include the role of the Database Administrator (DBA), database life cycle activities, database denormalization, read-only databases and data warehouses. Hands-on experience will be gained by working with actual databases using industry-standard database management systems such as Oracle.

IS 333. Social Network Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Completion of computing GUR (CS 100, CS 101, CS 103, CS 104, CS 111, CS 113, CS 115 or BNFO 135) AND statistical GUR (MATH 105, MATH 120, MATH 225, MATH 244, MATH 279, MATH 305, MATH 333, IE 331, ECE 321 or MNET 315). In this intensive hands-on course, students will learn how to design computer programs to “grab” information from social networking systems such as Facebook, and analyze this to reveal useful but hidden information about the users and their interconnections. Since math is the only language that computers understand, the goal of this class is to build connections between the human language one finds in social network postings and profiles, and mathematical formulas. The skills and techniques utilized in the course will prepare students for advanced courses in data mining and business analytics. This course requires basic statistical knowledge and Java programming skills.

IS 344. Computing Applications in Business. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MIS 245 or IS 265 or ACCT 115 or ACCT 117 or MGMT 390. A comprehensive overview of the various types of computing applications used by businesses in order to run effectively and efficiently. All the major functional departments within organizations are examined and evaluated to see how applications are integrated to implement "business processes" that flow across department boundaries, and from suppliers to customers. Students will learn to model business situations and the design of applicable software solutions. A full-semester hands-on student project will provide experience in designing solutions to changes in the business environment.

IS 350. Computers, Society and Ethics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: GER (CS 100, CS 101, CS 103, CS 104, CS 113, CS 115, or BNFO 135), and any History and Humanities GER 200 level course and ENGL 101. Examines the historical evolution of computer and information systems and explores their implications in the home, business, government, medicine and education. Topics include automation and job impact, privacy, and legal and ethical issues.

IS 373. Content Management Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IS 117 or IT 202. This course provides a hands-on introduction to the design and implementation of enterprise-scale web systems built upon web based content management systems (CMS). CMS manage the creation, storage, retrieval, dissemination, and collection of information in order to meet the needs of businesses, organizations and individuals. Students learn to how to create blogs, discussion boards, wiki, intranets, and dynamic websites using popular CMS packages such as Wordpress and Drupal. Throughout the course students learn how to overcome common challenges that impact the design of these systems such as security for multi-user systems, content strategy, marketing and performance.

IS 375. Discovering User Needs for UX. 3 credits, 3 contact hours (3;0;0).
What new digital products or services need to be developed? How do you anticipate someone’s needs before they do? How do you understand how people interact with products? These are key questions that both interaction designers and start-up entrepreneurs need to answer. It’s all about understanding the user. We need to work with users to investigate or "research" their needs and how they interact with the product or service. In this course, we take a deep dive into qualitative user experience (UX) research. UX research is the process of understanding why and how people use products and services. This course will teach you a set of research tools to discover user needs, investigate the user experience, and enhance the user experience by deriving design recommendations. We will cover techniques like ethnography, focus groups, interviewing, and analyzing qualitative data. We will be talking with user experience researchers at major companies and getting involved with actual user research. This practical, hands-on course will give you an insight into the psychology of user behavior and lay the foundation for students who are pursuing careers designing, evaluating, or marketing products for people.

IS 385. Special Topics in IS. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in an area of information systems and the computing sciences not regularly covered in any other IS course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course.

IS 390. Requirements Analysis and Systems Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 103, CS 113, CS 115, IS 218 or IT 202 A study of the information systems development life-cycle, from the initial stages of information requirements analysis and determination to the ultimate activities involving systems design. Theory, methodologies and strategies for information requirements analysis, including the assessment of transactions and decisions, fact-finding methodologies, structured analysis development tools, strategies of prototype development, and an overview of computer-aided software engineering (CASE) tools. Theory, methodologies and strategies for systems design, including design of user-interfaces, particularly menu-driven and keyword dialogue strategies, and issues in the proper design of computer output.

IS 392. Web Mining and Information Retrieval. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IS 218, IT 114, or CS 114. This course introduces the design, implementation and evaluation of search engines and web mining applications. Topics include: automatic indexing, natural language processing, retrieval algorithms, web page classification and clustering, information extraction, summarization, search engine optimization, and web analytics. Students will gain hands-on experience applying theories in case studies.

IS 410. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: IS 310 or its equivalent, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and/or project. Note: Normal grading applies to this COOP Experience.

IS 421. Advanced Web Applications. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IS 219 and (IS 331 or CS 331). This course focuses on the design, development, and management of cloud-based web information systems, within the context of startup companies and established organizations. Within the course, we examine business, organizational and technical challenges faced by developers, project managers, and the business development professionals that create web-based software products. The course consists of readings, discussions, and a final team project that demonstrates modular design, planned scalability, maintainability, and the creation of a set of organizational processes that supports the continued support and development of the application. Some of the topics covered in the course are: continuous deployment, continuous integration, automated unit testing, modular design, software team management, agile development, Kanban, customer focused development, and the technologies used to scale cloud applications.

IS 448. Usability & Measuring UX. 3 credits, 3 contact hours (3;0;0).
Prerequistes: Statistics GUR (MATH 105, MATH 120, MATH 225, MATH 244, MATH 279, MATH 305, MATH 333, IE 331, ECE 321 or MNET 315). User experience research is the process of understanding why and how people use products and services. Usability refers to the ease of use and learnability of such a product or service. The primary function of usability is to be able to measure and assess the optimal use of a product from the perspective of the user. This course will teach students a set of quantitative tools to understand user needs, derive design recommendations, and evaluate the user experience. Students will receive an overview of the different quantitative methods being used in industry and academia, such as eye-tracking, big social media data analysis, and physiological tests. They will then get an in-depth knowledge of how to design, execute, and analyze data from experiments and surveys using both descriptive and inferential statistics. The course will incorporate a hands-on approach and be comprised completely of individual and group project assignments.

IS 455. IS Mgmt & Business Processes. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (IS 265 or MIS 245) and IS 390. Grade of C or better. This course will emphasize how information systems enable core and supportive business processes, as well as those that interface with suppliers, partners and customers. It will discuss basic administrative, management and policy issues associated with the impact of information systems on the user and organization. The second part of the course looks at business processes in organizations: what the business process view is and why it is important, how information systems can improve processes, and how Enterprise Resource Planning systems help with that improvement. Hands-on use of a major ERP system (SAP) is included.

IS 461. Systems Simulation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: completion of a 100-level GUR course in computing; MATH 333. This course introduces computer simulation as an algorithmic problem solving technique. Includes discrete simulation models, elementary theory, stochastic processes, use of simulation languages, random number generators, simulation of probabilistic processes, design of simulation experiments, validation of models, queueing systems, and applications to the design and analysis of operational systems. The GPSS language is covered in detail.

IS 465. Advanced Information Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Statistical GER (MATH 105, MATH 120, MATH 225, MATH 244, MATH 279, MATH 305, MATH 333, IE 331, ECE 321 or MNET 315), and (IS 265 or MIS 245) and IS 344, and (IS 331 or CS 331). This course serves as an introduction to data analysis, probability and statistics from an information systems perspective, including many of the techniques that are most relevant to the profession of Data Scientist for business, data and web analytics, as well as current research areas. The course emphasizes manipulation and analysis of relevant data sets. Course topics include the rudiments of probability and random variables, estimation, hypothesis testing, graphics and visualization, data warehousing and OLAP analysis, dashboard, scorecard, data mining algorithms, optimization techniques, DSS and knowledge systems. Students will get hands-on experience in designing and building a data warehouse. They will get hands-on experience building a dashboard with real-world data, and they will apply various data mining algorithms learned in class to solve real world problems.

IS 485. Special Topics in Information Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: junior standing and/or department approval. The study of new and/or advanced topics in an area of IS not regularly covered in any other IS course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course. A student may register for no more than two semesters of Special Topics.

IS 486. Topics in Information Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Same as for IS 485. A continuation of IS 485.

IS 488. Independent Study in Information Systems. 3 credits, 0 contact hours (0;0;0).
Prerequisites: Open to students in the Albert Dorman Honors College or to any student who intends to apply to the Informatics Undergraduate Thesis program. Students need approval from the Informatics department and the Informatics faculty member who will guide the independent study. Independent studies, investigations, research, and reports on advanced topics in Informatics. Students must prepare, in collaboration with their faculty mentor and in the semester prior to enrolling in this course, a detailed plan of topics and expected accomplishments for their independent study. This must have the approval of both the department and the faculty mentor. A student may register for no more than one semester of Independent Study.

IS 489. INFO Undergrad Thesis Research. 3 credits, 3 contact hours (3;0;0).
Students continue their research in preparation for completing a Research Thesis.

IS 491. Senior Project - IS. 3 credits, 3 contact hours (0;0;3).
Prerequisites: IS 331 or CS 331 and senior standing. Integration of knowledge and skills gained in previous information systems courses into an individual research project. The project entails investigation of current literature and the design, implementation and evaluation of an information system.

IT 101. Introduction to Information Technology. 3 credits, 3 contact hours (3;0;0).
The foundations of information technology (IT), including basic computer architecture, various kinds of computer hardware, and networking technology, are introduced. Various data representation schemes, such as the binary number systems, are covered. Different levels of software are examined, including aspects of the operating systems from the perspective of the IT professional. The software development process is discussed. Database management software and SQL are dealt with, as are applications and languages developed around the internet and Web infrastructure. Overall, fundamental knowledge required of today's IT professional is obtained along with an appreciation of IT's impact on business and society. Hands-on experience with some important elements of the IT field is gained through various laboratory assignments.

IT 114. Advanced Programming for Information Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 113 or CS 115. Problem solving techniques and program design knowledge are expanded with an eye toward IT-related applications. Various kinds of data structures are introduced, including classic containers such as lists, stacks, queues, and trees. Sorting and searching techniques are examined. The fundamentals of client/server programming and the use of sockets are covered. Recursion and its various applications are studied. The built-in class library features of an object-oriented programming language are exploited throughout.

IT 120. Introduction to Network Technology. 3 credits, 3 contact hours (3;0;0).
An introduction to the basics of networking in a modern operating system environment. Emphasis is placed on the application and management of networking technology. Topics to be covered include: the OSI model, network hardware and technologies, network protocols, wired and wireless networks, TCP/IP. Whenever possible, concepts will be explained through the use of hands-on exercises that reinforce the lecture material.

IT 201. Information Design Techniques. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 101. This course presents an introduction to the theory and practice of information design. Topics covered include the theoretical foundations of information design, graphic design, content design, interaction design, usability, multimedia design, sound and video, animation, and an introduction to 3D modeling.

IT 202. Internet Applications. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 100 or CS 113 or CS 115 or a course in a high-level programming language as approved by department. This course presents the concepts and software technologies that underline web-oriented, three-tier software architectures and applications. The enabling software mechanism include the markup languages (HTML5 and CSS3) used by browsers, client-side scripting languages and libraries (Javascript and AJAX), web servers and server-side-scripting languages (Apache, PHP, HTTP protocol), and background databases (SQL, MySQL). The course uses a hands-on, guided development approach with substantial assignments to illustrate the fundamental computing concepts systems, and technologies considered and to provide direct experience in their use.

IT 220. Wireless Networks. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 120 or CS 356. This course introduces the students to the applied topic of Wireless Networks, focusing on applied methods, tools and technologies, as well as practical experience in designing & implementing wireless networks. Topics include hardware, software, data, applications, communication, design & installation of wireless networks, together with the implementation, performance, security and limitations of such systems.

IT 230. Computer and Network Security. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 120 or CS 356. This course introduces the applied topic of Computer Security, presenting the evolution of computer security, the main threats, attacks & mechanisms, applied computer operations & security protocols, main data transmission & storage protection methods via cryptography, ways of identifying, understanding & recovery from attacks against computer systems, various methods of security breach prevention, network systems availability, applications security, recovery & business continuation procedures and counter systems penetrations techniques and the role of the US Government in security of national computer infrastructure.

IT 240. Scripting for System Administration. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 113 or CS 115. This course will introduce task automation using shell scripting in a multi-OS environment using the Shell and the Perl programming languages. Topics covered will include scripting commands, control structures, functions, scalar data and lists, regular expressions, hashing, automating administration functions and debugging. Lessons will be enhanced through the use of hands-on exercises to strengthen comprehension.

IT 265. Game Architecture and Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 201 or equivalent. Course introduces students to the core concepts and design methodologies integral to designing and developing games and other Entertainment Software.

IT 266. Game Modification Development. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 113 or CS 115. This course introduces students to the basic concepts of game programming and development. Students will learn how to reprogram a professional game engine, or Modification (Mod) development as it is referred to in the industry. Students will work with C intensively. Students will work on their own game projects utilizing the professional game engine.

IT 276. Game Development. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 266. This course introduces students to the core concepts and skills necessary for the development of games utilizing 2D graphics. Students will learn how to set up and program their own 2D graphics based game engine. The engine will integrate 2D graphics, audio, input handling and network socket programming. Students will learn how to utilize their own custom 2D graphics and sounds into their projects. Once complete, students will have created two fully functional games.

IT 286. Foundations of Game Production. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 202 and IT 265. This class introduces students to many of the tools and design methodologies needed for electronic game production. This class will focus heavily on scripting, level design and content control as applied to game development. Students will learn a few scripting languages that are used in the games industry such as Unreal Script and Python. Students will work on projects to develop the levels, controls and scripts in order to create a new game experience with a professional game.

IT 287. Advanced Game Production. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 286 or COM 266. This course will build on tools and techniques presented in Foundations of Game Production and guide students through the development cycle of game levels. This will be a hands-on class that will teach students the development styles and revision techniques used in the professional game industry. Upon completion of the course, students will have first hand experience producing professional quality content for electronic games and a portfolio of work.

IT 302. Advanced Internet Applications. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 202 or IS 218. This course covers Internet-related software technologies in a more comprehensive, in-depth manner than IT 202. Topics considered include: client-side technologies like HTML5 and jQuery, JQuery UI (user interface) library, jQuery Mobile, CSS3 (transitions, animations), feature detection and polyfills using jQuery UI and Modernizr, advanced Javascript DOM and JSON (Javascript Object Notation), basic web services applications, JSONP. Advanced PHP topics considered include: sessions, cookies, HTTP exchanges, encryption, graphics library (CAPTCHA?s), and as time permits regular expressions and remote file access. An introduction to the Model-View-Controller (MVC) paradigm is presented using Ruby-on-Rails environment. Programming assignments are required which provide experience with the concepts covered.

IT 303. Model View Controller Software Architecture. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 202 or instructor approval. The Model View Controller(MVC) software architecture or pattern separates the concerns of application or domain logic, interface design, and the view of the system presented to the user, with the objective of more effective design, development and testing. This course covers environments and frameworks for modeling, developing and programming Internet Applications with emphasis on the Model View Controller paradigm. Design and development, applicability of principles, integrated test-driven development applicability of major external libraries like JQuery and Prototype, deployment, scaling and security issues will be examined. Case studies will be used to illustrate the concepts and frameworks considered. A substantial development project will be required.

IT 310. E-Commerce Technology. 3 credits, 3 contact hours (3;0;0).
An overview of the technologies relevant to electronic commerce. Communications and networking, web authoring tools, system security, databases and archiving, EDI, transaction processing, and factory/warehouse data networks. Provides competency to appraise tools such as HTTP servers, secure transaction software and firewalls, low and high-end database systems, heterogeneous networks, NNTP Servers, client software, procurement systems, and intelligent agents. Covers e-commerce models including agent-based and Java-based, electronic contracts and the electronic exchange of technical data, electronic cash systems and user security.

IT 311. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Completion of the sophomore year, approval of the program coordinator, and permission of the Office of Cooperative Education and Internship. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

IT 320. Virtual Instrumentation. 3 credits, 3 contact hours (3;0;0).
Cross-listed with OPSE 310. Prerequisite: CS 113 or CS 115. Covers the basics of virtual instrumentation including use of IEEE GPIB, RS232 interfaces, and data acquisition boards. Interface a computer to various instruments for data acquisition and instrument control using a state-of-the-art software platform such as National Instrument's LABVIEW. Emphasis is on the practical aspects of interfacing a computer to various instruments including timing issues, real-time data acquisition and instrument control, instrument status, and acquisition speed.

IT 330. Computer Forensic. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 120 or CS 356. This course introduces students to the applied topic of Computer Forensic, the study of obtaining and analyzing digital information from computers that have been used to commit illegal actions (computer crime), for use as evidence in civil, criminal, or administrative cases.

IT 331. Privacy and Information Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Computing GUR. This course will introduce the legal, social and technical issues involving information privacy. Topics covered will include the historical development of information privacy law; law enforcement, technology and surveillance; government databases and records; privacy and business records and financial information; privacy and the media; health and genetic privacy and international privacy law.

IT 332. Digital Crime. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Computing GUR. Comprehensive, multidisciplinary overview of the methods and means by which technology is used by the criminal in today's society. An examination of the historical, legal, technological and sociological aspects of cybercrime. The course covers the challenges of a new era of technology has brought to combating crime of all types, including terrorism. Topics covered will include: the sociology of the white collar criminal, the criminal justice system and law enforcement, computer security and deterrence/prevention.

IT 335. Introduction to .NET Framework. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 202 or equivalent. This course introduces students to .NET Framework, a new computational environment that supports more than 25 programming languages and is platform and device independent. Problem solving and system development topics are integrated into the course by using C# languages as a vehicle to illustrate the concepts.

IT 340. Introduction to System Administration. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 120 or CS 356. This course will introduce the tasks and techniques required to perform as a system administrator of Linux systems. Topics to be covered include booting, process control, the file system, managing users and resources, backups, configuration management, networking, the network file system, email servers, security, hardware devices, interoperability, and daemons. Whenever possible, lectures will be augmented with hands-on exercises.

IT 360. Programming for Computer Graphics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 113 or CS 115. Introduction to programming graphics and animation through the use of an appropriate application interface such as openGL. Topics include 2D and 3D graphics with mappings from the real world coordinates to graphics display. Perspective display will be provided by an interface. Basic vector and matrix operations which underlie the concepts of perspective will be covered.

IT 380. Educational Software Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 201. Educational Media Design employs the instructional principles of constructivist pedagogy as the process used to develop a solution to develope courseware for K-12 audience. The course builds on the participatory design model of software engineering in order to develop integrated learning environments that support visual and verbal literacy; enables student to be able to plan, organize, and systematically develop instructional materials. This course implements instructional design theory and pedagogy in order to create an actual application for a computer-based environment. Same as STS 318.

IT 382. User Interfaces for Extended Reality. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 201. The course presents the concepts that address hardware and software technologies and principles of perception for mixed reality (virtual and augmented reality) applications. During the course, the students will have an opportunity to build a virtual or augmented reality application and test it with Oculus, Vive, Magic Leap, or HoloLens. During this course, students will learn to design and develop immersive experiences with VR/AR headsets, stereo displays, and large projection screens. They will incorporate body and eye trackers, follow and discuss the latest AR/VR trends, explore why some games make people feel immersed, and others make people sick. Students will also explore the differences and similarities between computer and human vision. This course is hands-on; It will be utilizing Unity 3D or Unreal Engine. The end of the year project will showcase all the different skills and knowledge acquired throughout the semester.

IT 383. Game Design for Extended Reality. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 201. This course concentrates on game development in cross-reality (XR). Specifically, the course looks at various user interface recommendations for virtual and augmented space including navigation, selection, and manipulation techniques. The course reviews current industry standards, design practices, evaluation approaches, and various types of documentation. By the end of the course, students will design, build, and evaluate a project they can use in their portfolio.

IT 386. 3D Modeling and Animation. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 201. This class introduces students to the concepts of 3D modeling and animation, and putting those concepts into action by working with software. This class will be a hands-on, project focused course, using 3D modeling packages, taking students from design to final render.

IT 400. Information Technology and the Law. 3 credits, 3 contact hours (3;0;0).
This course will provide an introduction to legal concepts, principles and terminology as applied to modern information technology. The historical background and foundations of the various principles of U.S. Statutory and Common Law will be considered and will be used to explore how such principles may be applied to encompass and govern modern legal interactions in the U.S. and internationally. Through assignments and class discussion, which will often involve the Socratic Method, students will be expected to spot potential legal issues and make logical arguments for and against various legal propositions.

IT 411. Co-op Work Experience. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Completion of the sophomore year, approval of the program coordinator, and permission of the Office of Cooperative Education and Internship. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

IT 420. Computer Systems and Networks. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 120 or CS 356. This course provides students with an understanding of methods, tools, and technologies required to work with computer systems and networks. It includes a detailed discussion of Internet/intranet issues, including standards, connectivity, performance, protocols, network configurations, network design, wireless technology, management, and simulation through practical cases, covering both hardware and software systems.

IT 430. Ethical Hacking for System Administrators. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 340 or equivalent. This course will explore the various means that an intruder has available to gain access to computer resources. Traditional security analysis often falls short due to the rapidly evolving threats that exist. The course was developed to teach how system and network vulnerabilities are found and exploited and what steps can be taken to mitigate the risk.

IT 485. Special Topics in Information Technology I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: junior standing and/or advisor approval. The study of new and/or advanced topics in an area of information technology and its application not regularly covered in any other IT course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course. A student may register for no more than two semesters of special topics courses.

IT 486. Special Topics in Information Technology II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: same as for IT 485. A continuation of IT 485.

IT 488. Independent Study in Information Technology. 3 credits, 3 contact hours (0;0;3).
Prerequisites: open only to Information Technology majors who have the prior approval of the program director and the IT faculty who will guide the independent study taking the form of investigations, research, and reports on advanced topics in information technology. Students must prepare, in collaboration with their faculty mentor and in the semester prior to enrolling in this course, a detailed plan of topics and expected accomplishments for their independent study. This must have the approval of both the program director and the faculty mentor. A student may register for no more than one semester of independent study.

IT 490. Systems Integration. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 113 or CS 115, IS 331 or CS 331, and IT 340. The course will introduce the major design, implementation & distributed deployment issues regarding system integration, Network Operating Systems (NOS), cross-platform database integration, e-commerce and e-business applications implementation, cross-servers & multiple locations e-sessions migration, and the related communications security.

IT 491. IT Capstone Project. 3 credits, 3 contact hours (3;0;0).
Prerequisites: senior standing. An opportunity for students to integrate the knowledge and skills gained in previous information technology work into a team research project. The project involves investigation of current literature as well as implementation of either a part of a large application or the whole of a small system.

YWCC 107. Computing as a Career. 1 credit, 1 contact hour (0;0;1).
In this course, students will learn about time management, communication skills, and getting acclimated to NJIT. Through meetings with faculty, upperclassman students and current computing employers, students will explore CCS and learn about many exciting career opportunities within the computing field.

YWCC 207. Computing & Effective Com. 1 credit, 1 contact hour (1;0;0).
Prerequisites: Student of YWCC and sophomore/junior standing. Through encouraging collaboration and communication, this course addresses how to best present oneself via verbal and nonverbal communication. Students will learn how to effectively network, create resumes, interview and best present ideas. The skills learned in this course prepare students for co-op/internship opportunities as well as future employment.

YWCC 307. Professional Dev in Computing. 1 credit, 1 contact hour (1;0;0).
Prerequisite: YWCC 207. This course is designed for junior year students to reflect back on the college experience and to help plan for the future as a computing professional. The course will explore transitional issues that occur during the progression from student to professional through reflection on co-op and/or internship.

YWCC 310. Co-op Work Experience I. 3 credits, 6 contact hours (0;0;6).
Restrictions: Completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this Co-op Experience.

YWCC 410. Co-op Work Experience II. 3 credits, 6 contact hours (0;0;6).
Prerequisites: Completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and/or project. Note: Normal grading applies to this Co-op Experience.

YWCC 411. Co-op Work Experience III. 1 credit, 2 contact hours (0;0;2).
Prerequisites: Completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as co-op/internship and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op office. Mandatory participation in seminars and completion of requirements that include a report and/or project. Credit for this course may not be used towards any YWCC degree.

Computer Science

As the largest computer science department among research universities in the New York metropolitan area, the Department of Computer Science is a bustling stomping ground for students looking to explore computer science on both a technical and liberal arts level.

The department offers B.S., B.A., M.S. and Ph.D. degree programs in computer science and evolving interdisciplinary programs like telecommunication, bioinformatics and computing and business. The B.S. provides a more technical exploration of computer science and is excellent for students planning to pursue advanced study in computer science while the B.A. program is designed for students interested in liberal arts or management. There's also the opportunity to learn beyond the classroom via the Senior Capstone Program, a semester-long course that gives students the chance to draw on their years of studying and apply said knowledge to one of NJIT's 200 industry sponsors and partners, which include Microsoft, Johnson & Johnson and NASA.

NJIT Faculty

B

Basu Roy, Senjuti, Assistant Professor

Borcea, Cristian M., Professor

C

Calvin, James M., Professor

Curtmola, Reza, Associate Professor

D

Dass, Ananya, University Lecturer

Ding, Xiaoning, Assistant Professor

E

Eljabiri, Osama, Senior University Lecturer

G

Gehani, Narain, Professor, Emeritus

Geller, James, Professor

Gerbessiotis, Alexandros, Associate Professor

Gotsman, Craig J., Distinguished Professor and Dean

H

Hung, Daochuan, Associate Professor

I

Itani, Abdul-Rahman M., Faculty

K

Kapleau, Jonathan, J., University Lecturer

Karvelas, Dionissios, Senior University Lecturer

Koutis, Ioannis, Professor

Kwestel, Morty D., Senior University Lecturer

L

Leung, Joseph Y., Distinguished Professor

Li, Jing, Professor

Liu, Chengjun, Professor

M

Mani, Kumar, Professor

McHugh, James, Professor

Mili, Ali, Professor

N

Nakayama, Marvin K., Professor

Nassimi, David, Associate Professor

Neamtiu, Iulian, Associate Professor

Nicholson, Theodore L., Senior University Lecturer

O

Oria, Vincent, Professor

P

Perl, Yehoshua, Professor

Polyakov, Yuriy S., Associate Research Professor

R

Rohloff, Kurt, Associate Professor

Roshan, Usman W., Associate Professor

Rusinkiewicz, Marek E., Professor

Rutkowski, Wallace, Senior University Lecturer

Ryan, Gerard W., Senior University Lecturer

S

Shih, Frank Y., Professor

Sohn, Andrew, Associate Professor

Spirollari, Junilda, Senior University Lecturer

T

Tang, Qiang, Assistant Professor

Theodoratos, Dimitrios, Associate Professor

Thomson, Susan E., Senior University Lecturer

W

Wang, Jason, T., Professor

Wang, Guiling (Grace), Professor

Wei, Zhi, Associate Professor

Wu, Chase Q., Associate Professor

Programs

- Computer Science - B.A. (p. 214)
- Computer Science - B.S. (p. 216)
- Computing and Business - B.S. (p. 221)

Double Majors (p. 102)

- Computer Science and Applied Physics - B.S. (p. 218)
- Computer Science and Mathematical Sciences - B.S. (p. 219)
- Computer Science and Mathematical Sciences - Computational Mathematics - B.S. (p. 222)

- Computer Science Minor (p. 224) (not for Computer Engineering majors)
- Computer Science Minor (p. 224) (for Computer Engineering majors)

Computer Science Courses

BNFO 135. Programming for Bioinformatics. 3 credits, 3 contact hours (3;0;0).
The ability to use existing programs and to write small programs to access bioinformatics information or to combine and manipulate various existing bioinformatics programs has become a valuable part of the skill set of anyone working with biomolecular or genetic data. This course provides an understanding of the architecture of bioinformatics toolkits and experience in writing small bioinformatics programs using one or more of the scripting ("glue") languages frequently employed for such tasks.

BNFO 236. Programming for Bioinformatics II. 3 credits, 3 contact hours (3;0;0).

BNFO 330. Princ of Bioinformatics II. 3 credits, 3 contact hours (3;0;0).

BNFO 340. Data Analysis for Bioinformatics II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BNFO 240 and R120 101 or equivalent or permission of instructor. Advanced data analysis skills with applications to bioinformatics problems.

BNFO 482. Databases and Data Mining in Bioinformatics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BNFO 240 or equivalent or permission of instructor. Surveys biological databases and tools for managing them. Covers concepts and principles of data mining in bioinfomratics. Hands-on experience for mining genomic data using ORACLE and SQL.

BNFO 488. Independent Study in Bioinformatics. 3 credits, 3 contact hours (0;0;3).

BNFO 491. Bioinformatics Senior Project. 3 credits, 3 contact hours (0;0;3).
Prerequisite: CS 490. Restriction: Senior standing in the Honors College and project proposal approval. A course similar to CS 491, with a project of greater depth and scope.

CS 100. Roadmap to Computing. 3 credits, 3 contact hours (3;0;0).
An introduction to programming and problem solving skills using Python or other very high level language. Topics include basic strategies for problem solving, constructs that control the flow of execution of a program and the use of high level data types such as lists, strings and dictionaries in problem representation. The course also presents an overview of selected topics in computing, such as networking and databases.

CS 101. Computer Programming and Problem Solving. 3 credits, 3 contact hours (3;0;0).
An introductory course that is designed for engineering freshmen. This course introduces students to the engineering problem solving process in the context of MATLAB. The emphasis is on the logical analysis of a problem and the formulation of a computer program leading to its solution. Topics include basic concepts of computer systems, algorithm design, programming languages and data abstraction. At the end of class, a comparison between MATLAB and C/C++ will be discussed to provide students a better understanding of the general concept of computer programming.

CS 103. Computer Science with Business Problems. 3 credits, 3 contact hours (3;0;0).
An introductory course in computer science, with applications to business and managerial decision making. Topics include basic concepts of computer systems, software engineering, algorithm design, programming languages and abstraction, with applications.

CS 104. Computer Programming and Graphics Problems. 3 credits, 3 contact hours (3;0;0).
An introductory course in computer science with applications in computer graphics for architecture. Emphasis on programming methodology using a high level language as the vehicle to illustrate the concepts. Topics include basic concepts of computer systems, software engineering, algorithm design, programming languages and data abstraction, with applications.

CS 106. Roadmap to Computing for Engineers. 3 credits, 3 contact hours (3;0;0).
An introduction to programming and problem solving skills for engineering majors using Python programming languages. Topics include basic strategies for problem solving, constructs that control the flow execution of a program and the use of high level data types such as lists, strings, and dictionaries in problem representation. The course also presents an overview of selected "big idea" topics in computing.

CS 113. Introduction to Computer Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 100 or CS 103 with a grade C or better. Intensive introduction to computer science. Problem solving decomposition. Writing, debugging, and analyzing computer programs. Introduction to arrays and lists. Iteration and recursion. The Java language is introduced and used to highlight these concepts. A student receiving degree credit for CS 113 cannot receive degree credit for CS 115.

CS 114. Introduction to Computer Science II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 113 with a grade C or better. A study of advanced programming topics with logical structures of data, their physical representation, and the design of computer algorithms operating on the structures. Course covers program specifications, correctness and efficiency, data abstraction, and algorithm analysis. Students receiving degree credit for CS 114 cannot receive degree credit for CS 116 or CS 505.

CS 115. Introduction to Computer Science in C++. 3 credits, 3 contact hours (3;0;0).
Fundamentals of computer science are introduced, with emphasis on programming methodology and problem solving. Topics include basic concepts of computer systems, software engineering, algorithm design, programming languages and data abstraction, with applications. The high level language C++ is fully discussed and serves as the vehicle to illustrate many of the concepts. CS majors should enroll in CS 113.

CS 116. Introduction to Computer Science II in C++.. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 115 with a grade C or better. A study of advanced programming topics with logical structures of data, their physical representation, design and analysis of computer algorithms operating on the structures, and techniques for program development and debugging. Course covers program specifications, correctness and efficiency, data abstraction, basic aspects of simple data structures, internal searching and sorting, recursion and string processing. Algorithmic analysis is also discussed. Students receiving degree credit for CS 116 cannot receive degree credit for CS 505 or CS 114.

CS 241. Foundations of Computer Science I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 and MATH 112 with a grade C or better. An introduction to the foundations of computer science with emphasis on the development of techniques for the design and proof of correctness of algorithms and the analysis of their computational complexity. Reasoning techniques based on propositional and predicate logic and relational calculus operations with applications to databases will also be introduced. Auxiliary topics such as combinatorics of finite sets, functions and relations, and graph-theory definitions and graph storage alternatives will also be examined.

CS 266. Game Modification Development. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 102 or IT 114 or CS 114 or CS 116 with a grade C or better. This course introduces students to the basic concepts of game programming and development. Students will learn how to reprogram a professional game engine, or Modification (Mod) development as it is referred to in the industry. Students will work with C extensively. Students will work on their own game projects utilizing the professional game engine.

CS 276. 2D Game Development. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (CS 265 and CS 266) or (IT 265 and IT 266) with a grade C or better. This course introduces students to the core concepts and skills necessary for the development of games utilizing 2D graphics. Students will learn how to set up and program their own 2D graphics based game engine. The engine will integrate 2D graphics, audio, input handling and network socket programming. Students will learn how to utilize their own custom 2D graphics and sounds into their projects. Once complete, students will have created two fully functional games.

CS 280. Programming Language Concepts. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 or CS 116 or IT 114 or equivalent with a grade C or better. Conceptual study of programming language syntax, semantics and implementation. Course covers language definition structure, data types and structures, control structures and data flow, run-time consideration, and interpretative languages.

CS 288. Intensive Programming in Linux. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 100 and CS 280 with a grade C or better. The course covers Linux programming with Apache Web and MySql database using Php/Python and C as primary languages. It consists of four stages: basic tools such as Bash and C programming; searching trees and matrix computing, end-to-end applications such as one that constantly presents top 100 stocks; and extending the applications to run on multiple machines. The course provides students with hands-on experience for programming relatively large applications.

CS 301. Introduction to Data Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 and MATH 333 with a grade C or better. This course is designed for CS BS students to equip them with introductory principles as well as hands-on skills that are required to solve data science problems. The first part of the course focuses on learning models, formalism, and algorithmic techniques that are popular in data science and heavily used in practice. In the second part of the course, students are introduced to data science tools (e.g., Excel, Python).

CS 331. Database System Design & Mgmt. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 or CS 116 or IT 114 or equivalent with a grade C or better. Database system architecture; data modeling using the entity-relationship model; storage of databases; the hierarchical, network and relational data models; formal and commercial query languages; functional dependencies and normalization for relational database design; relation decomposition; concurrency control and transactions management. Student projects involve the use of a DBMS package.

CS 332. Principles of Operating Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 or CS 116 or IT 114 or equivalent with a grade C or better. Organization of operating systems covering structure, process management and scheduling; interaction of concurrent processes; interrupts; I/O, device handling; memory and virtual memory management and file management.

CS 333. Introduction to UNIX Operating Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 332 or equivalent and knowledge of C language. The course covers the UNIX system kernel including initialization, scheduling, context switching, process management, memory management, device management, and the file system. The course also includes the organization of shells, editors, utilities, and programming tools of the UNIX operating system.

CS 337. Performance Modeling in Computing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 and (MATH 333 or MATH 341) with a grade C or better. Introduction to probability models and techniques useful in computer science. Performance evaluation, discrete-event simulation, classification and optimization are covered.

CS 341. Foundations of Computer Science II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (CS 241 or MATH 226) and CS 280 with a grade C or better. This course provides an introduction to automata theory, computability theory, and complexity theory. Theoretical models such as finite-state machines, push-down stack machines, and Turing machines are developed and related to issues in programming language theory. Also, the course covers undecidability and complexity classes P, NP, and NPC.

CS 345. Web Search. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 280 and CS 241 with a grade C or better. An introductory course on web searching. The architecture of a search engine. Information vs. data retrieval. Web crawling. Processing text (tokenization, stemming, stopwords, link analysis). The indexing process and inverted indexes. Query processing. Ranking algorithms based on indexes and links (e.g. Kleinberg's HITS, Google's PAGERANK). Retrieval Models. Search engine evaluation. Case studies (e.g. Google cluster architecture).

CS 350. Intro to Computer Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 280 with a grade C or better. An introduction to the organization and architecture of computer systems, including the standard Von Neumann model and more recent architectural concepts. Among the topics covered are numeric data representation, assembly language organization, memory addressing, memory systems, both real and virtual, coding and compression, input/output structures treated as programmed, interrupt, and direct memory access, and functional organization of the CPU and the computer system.

CS 351. Introduction to Cybersecurity. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 241 and CS 356 with a grade C or better. This course will give a broad overview of cybersecurity. There are two main goals of this course. First, students will learn fundamental concepts of cybersecurity. Second, this course will help students gain knowledge of the applications to computer systems and communication security. Topics include basics of cryptography, access control, malware, software security, storage and file security, operating-system security, database security and secure communication protocols.

CS 356. Introduction to Computer Networks. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 280 with a grade C or better. This course provides an introduction to computer networks, with a special focus on Internet architecture and protocols. Topics include layered-network architectures, addressing, naming, forwarding, routing, communication reliability, the client-server model, web and email protocols. Besides the theoretical foundations, students acquire practical experience by programming reduced versions of real Internet protocols.

CS 357. Fundamentals of Network Security. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 356 or IT 420 with a grade C or better. This course is designed for Computer Science and Information Technology students. They must have a networking course before taking CS 357. IT students take IT 420 and Computer Science students take CS 356. This course offers an in-depth study of network security issues, types of computer and network attacks, and effective defenses. It provides both a theoretical foundation in the area of security and hands-on experience with various attack tools, firewalls, and intrusion-detection systems. Topics include: network scanning, TCP/IP stack fingerprinting, system vulnerability analysis, buffer overflows, password cracking, session hijacking, denial-of-service attacks, intrusion detection.

CS 366. 3D Game Development. 3 credits, 3 contact hours (3;0;0).
This course introduces students to the core concepts and skills necessary for the development of games utilizing 3D graphics. Students will learn how to set up and program their own 3D graphics based game engine using OpenGL. Students will learn how to load and display custom 3D models created using existing 3D modeling tools. Once complete, students will have created two fully functional 3D games and tools to work with them.

CS 370. Introduction to Artificial Intelligence. 3 credits, 4 contact hours (3;1;0).
Prerequisites: CS 114 and (MATH 226 or CS 241) with a grade C or better. An exploration of concepts, approaches and techniques of artificial intelligence. Emphasizes both underlying theory and applications. Topics include knowledge representation, parsing language, search, logic, adduction, uncertainty, and learning. LISP and Prolog programming languages are used extensively. Students are required to do programming assignments, complete a programming term project and review case studies.

CS 375. Introduction to Machine Learning. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 100 or CS 115 and MATH 333 or ECE 321 with a grade C or better. This is an introductory course to Machine Learning (ML). It consists of: (i) A smooth, example-based presentation of the fundamental notions of ML via simple algorithms and visualizable "toy" data sets. (ii) A tour of a selection of widely-used machine learning algorithms, including supervised, unsupervised, and reinforcement-based techniques, with applications on real data sets. The students are expected to implement basic algorithms and experiment with existing widely-used ML software libraries on real datasets. They will also gain exposure to the full development of an ML system via a course project.

CS 388. Android Application Development. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 288 with a grade C or better. This course introduces mobile application development for the Android platform. Students will learn skills necessary for creating and deploying applications with the Android Software Development Kit (SDK). The course is designed to introduce and familiarize students with programming in the Android environment. It starts with an examination of the basic components and concepts that define the Android platform, and then moves on to cover the specific structure that comprises an Android application. An overview of the most common tools and techniques for writing Android applications is included. The Android approach to user interfaces is described along with a discussion of some of the more common user-interface elements. Storage strategies for persistent information are also covered, including the use of the available SQLite Database features. The unique characteristics of programming for a mobile environment are introduced and explained. Hands on experience in the form of exercises and programming projects are included throughout the course to reinforce material that has been presented in lecture form.

CS 408. Cryptography and Internet Security. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 351 with a grade C or better. Covers security requirements for telecommunication over the Internet and other communication networks, various conventional and public-key encryption protocols, digital encryption standard, RSA and ElGamal cryptographic systems, digital signature algorithm and analysis of its cryptoimmunity, and access-sharing schemes. Students receiving credit for CS 408 may not enroll in CS 608.

CS 433. Introduction to Linux Kernel Programming. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 288, CS 332, and CS 350. An introductory study of how the Linux operating system is built from scratch. AS a hands-on course, students will perform intensive programming using the Linux kernel. The contents include booting, segmentation and paging, creating and destroying processes, process switching and scheduling, handling exceptions and interrupts, software interrupts, creating system calls, creating file systems, networking with TCP/IP, device driver writing and module programming. At the end of the course, students will be able to modify the Linux operating system to create their own.

CS 434. Advanced Database Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 331 with a grade C or better. The course covers the basic concepts of traditional files and file processing, provides a "classic" introduction to the relational data model and its languages, and discusses database design methodology and application developments. Students are expected to learn the design of database application systems through a small project and to get some practical hands-on experience with commercial database management systems (DBMS) by writing application programs using the commercial DBMS query languages.

CS 435. Advanced Data Structures and Algorithm Design. 3 credits, 4 contact hours (3;1;0).
Prerequisites: CS 241 and CS 288 with a grade C or better. Advanced topics in data structures and algorithms, involving sequences, sets, and graphs such as searching, sorting, order statistics, balanced search tree operations, hash tables, graph traversals, graph connectivity and path problems. Algebraic and numeric algorithms. Performance measures, analysis techniques, and complexity of such algorithms.

CS 438. Interactive Computer Graphics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 or CS 116 with a grade C or better. This course introduces fundamental concepts of interactive graphics oriented toward computer-aided design systems. Such systems emerge in engineering, architecture, and manufacturing. Topics include computer data structures for representation of two- and three-dimensional objects and algorithms for definition, modification, and display of these objects in applications. This course will also discuss a selection of special topics in interactive graphics.

CS 439. Image Processing and Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 114 and MATH 333. This course is an intensive study of the fundamentals of image processing, analysis and understanding. Topics to be covered include: a brief review of the necessary mathematical tools, human visual perception, sampling and quantization, image transformation, enhancement, restoration, compression, reconstruction, image geometric transformation, matching, segmentation, feature extraction, representation and description, recognition and interpretation.

CS 440. Computer Vision. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 333. This course introduces basic concepts and methodologies of computer vision, and focuses on material that is fundamental and has a broad scope of applications. Topics include contemporary developments in all mainstream areas of computer vision e.g., Image Formation, Feature Representation, Classification and Recognition, Motion Analysis, Camera Calibration, Stereo Vision, Shape From X (shading, texture, motion, etc.), and typical applications such as Biometrics.

CS 441. Database Programming. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 114 or equivalent with a grade C or better. Many technologies have been developed due to the interplay between World-Wide Web development and databases on one hand and the growth of database applications in e-commerce on the other hand. Today, practically every e-commerce application has at least a Web component and a database component. Many languages have been developed in order to deal with these interactions. The course will focus on accessing databases through the Web but also cover new developments in the field.

CS 444. Big Data Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 288 and CS 301 with a grade C or better. This course provides a broad coverage of topics on big data generation, transfer, storage, management, computing, and analytics with focus on state-of-the-art technologies and tools used in big data systems such as Hadoop. Real-life big-data applications and workflows in various domains are introduced as use cases to illustrate the development and execution of emerging big data-oriented solutions using HDFS, HBase, MapReduce/Spark, etc. deployed in cloud-based cluster environments.

CS 450. Data Visualization. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 288 and CS 301 with a grade C or better. The course provides students an introduction to computer graphics and the knowledge for designing, developing, and applying techniques for both information and volume visualization. Software tools such as Tableau and programing languages such as Python will be used to represent and interpret information in various visual forms, and volumetric visualization algorithms such as marching cubes and ray casting will be used for big data visualization of 3D datasets in scientific domains. Students will gain knowledge about theoretical design principles and apply them directly on real-world data, as part of assignments and course projects.

CS 458. Technologies-Network Security. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 351 with a grade C or better. This course provides both an in-depth theoretical study and a practical exposure to technologies that are critical in providing secure communication over the Internet. Topics include remote access security, web security, wireless security, e-mail security, spam and spam filtering techniques, computer viruses and internet worms, honeypots and honeynets, security liability issues and compliance.

CS 482. Data Mining. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 331 with a grade C or better. The course covers the concepts and principles of advanced data mining systems design; presents methods for association and dependency analysis, classification; prediction; and clustering analysis.

CS 485. Selected Topics In CS. 3 credits, 3 contact hours (3;0;0).
Restriction: junior standing and/or department approval. The study of new and/or advanced topics in an area of computer science not regularly covered in any other CS course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course. A student may register for no more than two semesters of Special Topics.

CS 486. Topics in Computer Science/Information Systems. 3 credits, 3 contact hours (3;0;0).
Restriction: junior standing and/or department approval. A continuation of CS 485.

CS 488. Independent Study in Computer Science. 3 credits, 0 contact hours (0;0;0).
Restriction: Open only to Computer Science majors and who have the prior approval of the department and the CS faculty member who will guide the independent study. Independent studies, investigations, research, and reports on advanced topics in computer science. Students must prepare, in collaboration with their faculty mentor and in the semester prior to enrolling in this course, a detailed plan of topics and expected accomplishments for their independent study. This must have the approval of both the department and the faculty mentor. A student may register for no more than one semester of Independent Study.

CS 490. Guided Design in Software Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 280 and CS 288 with a grade C or better. This course focuses on the methodology for developing software systems. Methods and techniques for functional requirements analysis and specifications, design, coding, testing and proving, integration and maintenance are discussed.

CS 491. Senior Project. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 490 with a grade C or better. Restriction: Senior standing and project proposal approval. An opportunity for the student to integrate the knowledge and skills gained in previous computer science work into a team-based project. The project involves investigation of current literature as well as computer implementation of either a part of a large program or the whole of a small system.

CS 492. Data Science Capstone I. 3 credits, 3 contact hours (3;0;0).
Restrictions: Senior standing. The Data Science (DS) Capstone Project spans two semesters and is intended to provide a real-world project-based learning experience for seniors in the BS DS program. The overall objectives of this course are to investigate the nature and techniques of a data-oriented computing development project. Projects are provided by faculty members or industry partners, or proposed by students who wish to become entrepreneurs. In DS Capstone I, teams of project participants will carry out market research, identify appropriate data science problems, collect and preprocess the needed data, define performance metrics, perform risk analysis, and finish an overall design of their solution that integrates various data analytics techniques. The course instructor will mentor and evaluate all projects in conjunction with an entrepreneurship board of industry, faculty, and alumni advisors.

CS 493. Data Science Capstone II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 492 with a grade C or better. The Data Science (DS) Capstone Project spans two semesters and is intended to provide a real-world project-based learning experience for seniors in the BS DS program. The overall objectives of this course are to investigate the nature and techniques of a data-oriented computing development project. Projects are provided by faculty members or industry partners, or proposed by students who wish to become entrepreneurs. In DS Capstone II, teams of project participants will refine their design, implement and integrate component techniques into a complete software solution, present data analysis results, evaluate the system performance, and validate the proposed solution. The course instructor will mentor and evaluate all projects in conjunction with an entrepreneurship board of industry, faculty, and alumni advisors.

B.A. in Computer Science

(120 credits minimum)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
MATH 111	Calculus I	4
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
CS 113	Introduction to Computer Science	3
MATH 112	Calculus II	4
ENGL 102	English Composition: Introduction to Writing for Research	3
Science with Lab Elective (p. 113)		4
	Term Credits	**14**
Second Year		
1st Semester		
CS 114	Introduction to Computer Science II	3
MATH 333	Probability and Statistics	3
CS/IS/IT Elective 200 or above [3]		3
Science Literacy GER (p. 113)		3

History and Humanities GER 200 level (p. 106)		3
	Term Credits	**15**
2nd Semester		
CS 280	Programming Language Concepts	3
IS 350	Computers, Society and Ethics	3
CS 241	Foundations of Computer Science I	3
COM 312 or COM 313	Oral Presentations or Technical Writing	3
Free Elective [1]		3
YWCC 207	Computing & Effective Com	1
	Term Credits	**16**
Third Year		
1st Semester		
Free Elective [1]		3
CS 331	Database System Design & Mgmt	3
Social Science GER (p. 114)		3
CS 288	Intensive Programming in Linux	3
CS 332	Principles of Operating Systems	3
	Term Credits	**15**
2nd Semester		
CS 356	Introduction to Computer Networks	3
YWCC 307	Professional Dev in Computing	1
CS Elective 300 or above		3
Math/Science Elective [2]		3
CS 350	Intro to Computer Systems	3
CS Elective 300 or above		3
	Term Credits	**16**
Fourth Year		
1st Semester		
CS 490	Guided Design in Software Engineering	3
CS 435	Advanced Data Structures and Algorithm Design	3
History and Humanities GER 300+ level (p. 108)		3
Math or Science Elective [2]		3
Free Elective [1]		3
	Term Credits	**15**
2nd Semester		
CS 491	Senior Project	3
CS Elective 300 or above		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
Free Elective [1]		3
CS/IS/IT Elective 200 or above [3]		3
	Term Credits	**15**
	Total Credits	**120**

1. Free Elective: A minimum of 4 courses (12 credits minimum). Please consult your advisor for appropriate general electives.
2. Math or Science Elective:
   If you took MATH 244 (http://catalog.njit.edu/search/?P=MATH%20244) Introduction to Probability Theory you must take MATH 341 (http://catalog.njit.edu/search/?P=MATH%20341) Statistical Methods II.
   If you took MATH 333 (http://catalog.njit.edu/search/?P=MATH%20333) Probability and Statistics you may take any of the following:
   CS 337 (http://catalog.njit.edu/search/?P=CS%20337) Performance Modeling in Computing,
   MATH 211 (http://catalog.njit.edu/search/?P=MATH%20211) Calculus III A
   MATH 213 (http://catalog.njit.edu/search/?P=MATH%20213) Calculus III B,
   MATH 222 (http://catalog.njit.edu/search/?P=MATH%20222) Differential Equations
   or any Math 300/400 level except MATH 305 (http://catalog.njit.edu/search/?P=MATH%20305) Statistics for Technology.

[3] CS/IS/IT Elective: Two 3-credit CS/IS/IT electives (200-level or above).

Minimum Grades:

Prerequisite grade requirement for Computer Science majors:

Students are expected to earn a grade of B or better in CS 100. Students are expected to earn a grade of C or better in all CS courses that serve as prerequisites in a sequence of courses

Co-op

A GPA of 2.7 is required to enroll in co-op. Students may use up to 6 credits of co-op toward their free elective requirements.

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

B.S. in Computer Science

(120 credits minimum)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
MATH 111	Calculus I	4
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
CS 113	Introduction to Computer Science	3
MATH 112	Calculus II	4
ENGL 102	English Composition: Introduction to Writing for Research	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**14**
Second Year		
1st Semester		
CS 114	Introduction to Computer Science II	3
CS/IS/IT Elective 200 or above [1]		3
MATH 333	Probability and Statistics	3
Science Elective (p. 113)		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**15**
2nd Semester		
CS 241	Foundations of Computer Science I	3
CS 280	Programming Language Concepts	3
IS 350	Computers, Society and Ethics	3
COM 312 or COM 313	Oral Presentations or Technical Writing	3
Free Elective [2]		3
YWCC 207	Computing & Effective Com	1
	Term Credits	**16**
Third Year		
1st Semester		
CS 288	Intensive Programming in Linux	3
CS 332	Principles of Operating Systems	3

Social Sciences GER (p. 114)		3
CS 301	Introduction to Data Science	3
CS 356	Introduction to Computer Networks	3
	Term Credits	**15**
2nd Semester		
CS 331	Database System Design & Mgmt	3
YWCC 307	Professional Dev in Computing	1
CS Elective 300 or above		3
CS 341	Foundations of Computer Science II	3
CS 350	Intro to Computer Systems	3
CS 351	Introduction to Cybersecurity	3
	Term Credits	**16**
Fourth Year		
1st Semester		
CS 435	Advanced Data Structures and Algorithm Design	3
CS 490	Guided Design in Software Engineering	3
History and Humanities GER 300+ level (p. 108)		3
Math or Science Elective [3]		3
CS Elective 300 or above		3
	Term Credits	**15**
2nd Semester		
CS 491	Senior Project	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
CS Elective 300 or above		3
Free Elective [2]		3
CS/IS/IT Elective 200 or above [1]		3
	Term Credits	**15**
	Total Credits	**120**

1 CS/IS/IT Elective: Two 3-credit CS/IS/IT electives (200-level or above).
2 Free Elective: Two courses any level. Please consult your advisor for appropriate free electives.
3 Math or Science Elective:
If you took MATH 244 (http://catalog.njit.edu/search/?P=MATH%20244) Introduction to Probability Theory you must take MATH 341 (http://catalog.njit.edu/search/?P=MATH%20341) Statistical Methods II.
If you took MATH 333 (http://catalog.njit.edu/search/?P=MATH%20333) Probability and Statistics you may take any of the following:
CS 337 (http://catalog.njit.edu/search/?P=CS%20337) Performance Modeling in Computing,
MATH 211 (http://catalog.njit.edu/search/?P=MATH%20211) Calculus III A
MATH 213 (http://catalog.njit.edu/search/?P=MATH%20213) Calculus III B,
MATH 222 (http://catalog.njit.edu/search/?P=MATH%20222) Differential Equations
or any Math 300/400 level except MATH 305 (http://catalog.njit.edu/search/?P=MATH%20305) Statistics for Technology.

Minimum Grades

Prerequisite grade requirement for Computer Science majors:

Students are expected to earn a grade of B or better in CS 100. Students are expected to earn a grade of C or better in all CS courses that serve as prerequisites in a sequence of courses

Co-op

A GPA of 2.7 is required to enroll in co-op. Students may use up to 6 credits of co-op toward their free elective requirements.

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses"

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Computer Science and B.S. in Applied Physics

(134 credits)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
MATH 111	Calculus I	4
ENGL 101	English Composition: Introduction to Academic Writing	3
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**18**
2nd Semester		
CS 113	Introduction to Computer Science	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
MATH 112	Calculus II	4
CHEM 126	General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
	Term Credits	**15**
Second Year		
1st Semester		
CS 114	Introduction to Computer Science II	3
MATH 211	Calculus III A	3
PHYS 234	Physics III	3
PHYS 231A	Physics III Lab	1
MATH 333	Probability and Statistics	3
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**16**
2nd Semester		
CS 280	Programming Language Concepts	3
MATH 222	Differential Equations	4
MATH 335 or MATH 328	Vector Analysis or Mathematical Methods for Scientists and Engineers	3
PHYS 335	Introductory Thermodynamics	3
CS 241	Foundations of Computer Science I	3
	Term Credits	**16**
Third Year		
1st Semester		
CS 288	Intensive Programming in Linux	3
CS 301	Introduction to Data Science	3
OPSE 310	Virtual Instrumentation	3
PHYS 430	Classical Mechanics I	3
PHYS 432	Electromagnetism I	3
	Term Credits	**15**
2nd Semester		
CS 331	Database System Design & Mgmt	3
CS 341	Foundations of Computer Science II	3
Physics 300/400 Elective		3
CS 350	Intro to Computer Systems	3

History and Humanities GER 200 level (p. 106)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
CS 435	Advanced Data Structures and Algorithm Design	3
CS 356	Introduction to Computer Networks	3
CS 490	Guided Design in Software Engineering	3
PHYS 442 or R750 404	Introduction to Quantum Mechanics or Quantum Mechanics	3
CS 332	Principles of Operating Systems	3
	Term Credits	**15**
2nd Semester		
PHYS 485	Computer Modeling of Applied Physics Problems	3
CS 351	Introduction to Cybersecurity	3
IS 350	Computers, Society and Ethics	3
COM 312 or COM 313	Oral Presentations or Technical Writing	3
	Term Credits	**12**
Fifth Year		
1st Semester		
CS 491 or PHYS 490	Senior Project or Independent Study	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
Social Sciences GER (p. 114)		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**12**
	Total Credits	**134**

B.S. in Computer Science and B.S. in Mathematical Sciences, Applied Mathematics

(132 credits)

First Year		
1st Semester		**Credits**
MATH 111	Calculus I	4
CS 100	Roadmap to Computing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
MATH 112	Calculus II	4
CS 113	Introduction to Computer Science	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
MATH 213	Calculus III B	4
MATH 333	Probability and Statistics	3

CS 114	Introduction to Computer Science II	3
History and Humanities GER 200 (p. 106)		3
Social Sciences GER (p. 114)		3
	Term Credits	**16**
2nd Semester		
MATH 222	Differential Equations	4
MATH 337	Linear Algebra	3
CS 241	Foundations of Computer Science I	3
CS 280	Programming Language Concepts	3
CS 301	Introduction to Data Science	3
	Term Credits	**16**
Third Year		
1st Semester		
MATH 340	Applied Numerical Methods	3
MATH 480	Introductory Mathematical Analysis	3
CS 288	Intensive Programming in Linux	3
CS 332	Principles of Operating Systems	3
CS 356	Introduction to Computer Networks	3
	Term Credits	**15**
2nd Semester		
MATH 331	Introduction to Partial Differential Equations	3
MATH 332	Introduction to Functions of a Complex Variable	3
CS 331	Database System Design & Mgmt	3
CS 341	Foundations of Computer Science II	3
CS 350	Intro to Computer Systems	3
	Term Credits	**15**
Fourth Year		
1st Semester		
MATH 450	Methods Of Applied Math	3
MATH 473	Intermediate Differential Equations	3
CS 435	Advanced Data Structures and Algorithm Design	3
CS 490	Guided Design in Software Engineering	3
History and Humanities GER 300 (p. 108)		3
	Term Credits	**15**
2nd Semester		
MATH 451	Methods Appl Math II	3
MATH 300+ Elective		3
CS 351	Introduction to Cybersecurity	3
CS 491	Senior Project	3
History and Humanities GER 300 (p. 108)		3
	Term Credits	**15**
Fifth Year		
1st Semester		
MATH 300+ Elective		3
MATH 400+ Elective		3
IS 350	Computers, Society and Ethics	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**12**
	Total Credits	**132**

B.S. in Computing and Business

(120 credits minimum)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
Science Literacy with Lab GER (p. 113)		4
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
CS 113	Introduction to Computer Science	3
MATH 112	Calculus II	4
ENGL 102	English Composition: Introduction to Writing for Research	3
Science Literacy with Lab GER (p. 113)		4
	Term Credits	**14**
Second Year		
1st Semester		
CS 114	Introduction to Computer Science II	3
ACCT 117	Principles Of Fin Accountng	3
MATH 333	Probability and Statistics	3
History and Humanities GER 200 level (p. 106)		3
ECON 201	Economics	3
	Term Credits	**15**
2nd Semester		
COM 312 or COM 313	Oral Presentations or Technical Writing	3
CS 280	Programming Language Concepts	3
MGMT 216	Business Data Analytics	3
CS 241	Foundations of Computer Science I	3
YWCC 207	Computing & Effective Com	1
IS 350	Computers, Society and Ethics	3
	Term Credits	**16**
Third Year		
1st Semester		
FIN 315	Fundamentals of Corporate Finance	3
MRKT 330	Principles of Marketing	3
CS 288	Intensive Programming in Linux	3
CS 332	Principles of Operating Systems	3
HRM 301	Organizational Behavior	3
	Term Credits	**15**
2nd Semester		
IS 344	Computing Applications in Business	3
CS 356	Introduction to Computer Networks	3
IT 310	E-Commerce Technology	3
OM 375	Business Operations Management and Analytics	3
CS 331	Database System Design & Mgmt	3
YWCC 307	Professional Dev in Computing	1
	Term Credits	**16**

Fourth Year		
1st Semester		
MGMT 391	International Business	3
History and Humanities GER 300+ level (p. 108)		3
CS 351	Introduction to Cybersecurity	3
Free Elective		3
CS 490	Guided Design in Software Engineering	3
	Term Credits	**15**
2nd Semester		
CS 435	Advanced Data Structures and Algorithm Design	3
CS 491	Senior Project	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
Business Elective-Select one 200 level or higher from the following subjects:		3
ACCT, ENTR, FIN, HRM, MRKT, MGMT (excluding MGMT 390)		
Free Elective		3
	Term Credits	**15**
	Total Credits	**120**

Minimum Grades:
Prerequisite grade requirement for Computing and Business majors:
Students are expected to earn a grade of B or better in CS 100. Students are expected to earn a grade of C or better in all CS courses that serve as prerequisites in a sequence of courses.

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

BS in Computer Science and BS in Mathematical Sciences, Computational Mathematics

(132 credits)

First Year		
1st Semester		**Credits**
MATH 111	Calculus I	4
CS 100	Roadmap to Computing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
MATH 112	Calculus II	4
CS 113	Introduction to Computer Science	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
MATH 213	Calculus III B	4
MATH 333	Probability and Statistics	3
CS 114	Introduction to Computer Science II	3

History and Humanities GER 200 level (p. 106)		3
Social Sciences GER (p. 114)		3
	Term Credits	**16**
2nd Semester		
MATH 222	Differential Equations	4
MATH 337	Linear Algebra	3
CS 241	Foundations of Computer Science I	3
CS 280	Programming Language Concepts	3
CS 301	Introduction to Data Science	3
	Term Credits	**16**
Third Year		
1st Semester		
MATH 340	Applied Numerical Methods	3
MATH 480	Introductory Mathematical Analysis	3
CS 288	Intensive Programming in Linux	3
CS 332	Principles of Operating Systems	3
CS 356	Introduction to Computer Networks	3
	Term Credits	**15**
2nd Semester		
MATH 331	Introduction to Partial Differential Equations	3
MATH 332	Introduction to Functions of a Complex Variable	3
CS 331	Database System Design & Mgmt	3
CS 341	Foundations of Computer Science II	3
CS 350	Intro to Computer Systems	3
	Term Credits	**15**
Fourth Year		
1st Semester		
MATH 391	Numerical Linear Algebra	3
MATH 450	Methods Of Applied Math	3
CS 435	Advanced Data Structures and Algorithm Design	3
CS 490	Guided Design in Software Engineering	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
MATH 451	Methods Appl Math II	3
MATH 453	High-Performance Numerical Computing	3
CS 351	Introduction to Cybersecurity	3
CS 491	Senior Project	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fifth Year		
1st Semester		
MATH 440 or MATH 448	Advanced Applied Numerical Methods or Stochastic Simulation	3
MATH 300+ Elective		3
IS 350	Computers, Society and Ethics	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**12**
	Total Credits	**132**

Computer Science Minor (for Computer Engineering majors)

Code	Title	Credits
CS 280	Programming Language Concepts	3
CS 331	Database System Design & Mgmt	3
CS 357	Fundamentals of Network Security	3
or CS 351	Introduction to Cybersecurity	
or CS 458	Technologies-Network Security	
Two courses approved by the minor coordinator		6
Total Credits		**15**

Computer Science Minor (not for Computer Engineering majors)

Code	Title	Credits
CS 114	Introduction to Computer Science II	3
CS 280	Programming Language Concepts	3
CS 331	Database System Design & Mgmt	3
CS 332	Principles of Operating Systems	3
CS 350	Intro to Computer Systems	3
One course chosen among CS 356, CS 357, CS 388, and CS 485.		3
Total Credits		**18**

Informatics

The Department of Informatics consists of two divisions: Information Systems and Information Technology. All Informatics degree programs are STEM degrees (STEM = Science, Technology, Engineering and Math).

The Division of Information Systems (IS) demonstrates a long history of integrating innovation, research and education at the intersection of people, information and computing technology. Our state-of-the-art curriculum, with a hands-on focus in web, social media, data science, business applications, and user experience, provides students with solid career knowledge, design and implementation skills, and leadership preparation. Students at all levels engage in research alongside distinguished professors, creating, applying and disseminating fundamental knowledge and innovative approaches. Research concentrates in two rigorous tracks -- data-intensive research and human-centered computing -- conducted by faculty who win teaching awards, highly competitive grants, best paper awards, write books, and publish extensively in very selective journals.

Information Technology (IT) is the "practitioner focused" discipline within the field of computing. The BS IT degree program, the applied computing degree at NJIT, provides a balanced approach to software and hardware applications and their conceptual underpinnings. Moreover, the program offers an array of specializations that prepare students to enter various areas of the information economy. IT courses are taught by faculty and industry professionals having years of IT experience. Students benefit from a hands-on approach that provides them with a real grasp of the actual technology, development tools, and paradigms in demand in the IT industry.

NJIT Faculty

B

Bieber, Michael P., Professor Emeritus

D

Deek, Fadi P., Distinguished Professor, Provost and Senior Executive Vice President

Deek, Maura, Senior University Lecturer

E

Egan, Richard W., Senior University Lecturer

H

Halper, Michael, Professor and IT Program Director

Hendela, Arthur, Professor of Practice

Hiltz, S. Roxanne, Distinguished Professor Emeritus

Hoover, Amy, Assistant Professor

J

Jones, Quentin, Associate Professor

K

Kehoe, Donald, University Lecturer

Kettering, Joan, Senior University Lecturer

L

Lee, Michael, Assistant Professor

Lin, Lin, Senior University Lecturer

N

Nersesian, Eric, University Lecturer

P

Phan, Hai, Assistant Professor

S

Scher, Julian M., Associate Professor Emeritus

Senesy, Stanley, Senior University Lecturer

Sequeira, Marc, University Lecturer

Statica, Robert, Senior University Lecturer

T

Tremaine, Marilyn M., Professor Emeritus

Turoff, Murray, Distinguished Professor Emeritus

W

Wang, Shaohua, Assistant Professor

Waltrous-Deversterre, Lori, Senior University Lecturer

Williams, Keith A., University Lecturer

Wong, Donghee Yvette, Assistant Professor

Wu, Yi-Fang, Brook, Associate Professor and Chair

X

Xu, Songhua, Assistant Professor

Programs

Double Majors (p. 102)

- Science, Technology and Society/Business and Information Systems - B.S. (p. 247)

Accelerated Programs (p. 102)

- Information Technology - Accelerated B.S. and J.D. (p. 232) (with Seton Hall School of Law)

- Data Analytics (p. 251)
- Design of the User Experience Minor (p. 252)
- Business and Information Systems Minor (p. 251) (not for Computing Sciences majors)
- Business and Information Systems Minor (p. 251) (for Computing Science majors)
- Mobile and Web Minor (p. 253)
- Information Technology Minor (p. 253) (not for Computing Sciences majors)
- Information Technology Minor (p. 253) (for Computing Sciences majors)

Informatics Courses

IS 117. Introduction to Website Development. 3 credits, 3 contact hours (3;0;0).
This course discusses the concepts and skills required to plan, design and build websites. It will be taught in a lab to ensure hands-on experience with each of these tasks. The course begins with an overview of web technologies. Students learn to plan websites, which includes determining the business and end-user requirements for the site. Design includes learning to develop "mockups" of how the site will look and how people will use it. The major tools for building websites will be industry standard HTML and XHTML to describe webpage content, and Cascading Style Sheets (CSS) for flexibly formatting the content. Using XHTML and CSS makes it relatively simple to change formats across the entire site, as well as "future-proofs" a website, allowing it to be viewed on every major web browser (such as Firefox or Chrome) and easily adapt to changes in future browser technology. The course features substantial hands-on projects comprising websites of several interlinked pages and images, enabling students to thoroughly learn the course's important concepts and skills.

IS 218. Building Web Applications. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (IS 117 or IT 202) and (CS 100, CS 113, or CS 115). This course provides a critical, hands-on introduction to the design of Web-based Information Systems. We will explore and discuss emerging trends, capabilities, and limitations of web technologies used to capture, store, access, and disseminate information for both businesses and online communities. Students, working in groups, will design and develop different types of web applications, which will then be analyzed and critiqued by the students as to their usability in actual public and private settings. An open-source web content management system will be utilized throughout the course.

IS 219. Adv Website Development. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (IS 117 or IT 202) and (CS 100, CS 113, or CS 115). IS 218 is strongly encouraged as additional foundation knowledge. This course discusses the concepts and skills required to plan, design and build advanced websites, with a focus on sophisticated user interaction enabled by programming the web browser (such as Internet Explorer or Chrome). Such programming is known as client-side scripting. These interactive websites utilize forms to gather user inputs, and vary both the content and display of the webpages based on the current user tasks and preferences. This includes designing and dynamically changing tabs and menus, as well as expanding and contracting sections of pages. Students will develop a thorough understanding of website usability (designing effective sites that people like, security and user privacy, browser capability (ensuring websites work on every major web browser), and the tools and skills that web developers use to add interactive features to websites. These skills include Javascript (for programming interactive features), the Document Object Model or DOM (specifying the internal structure of web pages), JQuery (to access information utilizing this internal structure, create animations and generally streamline Javascript), browser variables (providing information about the browser characteristics), HTML input forms, form validation (ensuring correctness of user input), securing user input (to ensure user privacy), cookies (tracking user information), basic communication with the web server (which processes the information users input into forms), and AJAX (which integrates many of these technologies). The course will be taught in a lab to ensure hands-on experience and will include substantial design and development projects.

IS 245. Information Technology Systems: Hardware/Software. 3 credits, 3 contact hours (3;0;0).
This course reviews hardware/software technologies in order to enable system developers to understand tradeoffs in the design of computer architectures for effective computer systems. Also covered are operating systems and systems architecture for networked computing systems. Topics include Hardware (CPU architecture, memory, registers, addressing modes, busses, instruction sets, multi processors versus single processors, and peripheral devices), Operating systems (processes, process management, memory and file system management), and Telecommunications (basic network components, switches, multiplexers and media, installation and configuration of multi-user operating systems).

IS 247. Designing the User Experience. 3 credits, 3 contact hours (3;0;0).
This course covers the design and evaluation of the human-computer interface in interactive computer systems. Among the topics covered are approaches to interface design such as menus, commands, direct manipulation; screen layout strategies; metaphor models; models of human information processes; evaluation approaches such as protocol for analysis, interactive monitoring, use of surveys; and requirements for documentation and help. Students are expected to design interface mockups and evaluate them.

IS 265. Introduction to Information Systems. 3 credits, 3 contact hours (3;0;0).
Information systems is the study of how organizations use information technology. This course is an overview of the information systems discipline, the role of information systems in organizations, and the changing nature of information technology. Computer tools for analysis and presentation are used.

IS 270. Designing the Multimedia Experience. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Completion of 100 level course in the computing sciences: CS 101 or CS 111 or CS 113 or CS 115 or IS 118. Multimedia combines text, graphics, sound, video, and animation in a single application. Preparation for creating multimedia information systems, and understanding the crucial issues involving technology, design and effectiveness of multimedia applications. Programming techniques for integrating video, sound, animation, and graphics, and design strategies for multimedia information systems.

IS 310. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

IS 322. Mobile Applications: Design, Interface, Implementation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IS 218, IS 219, or IT 202. This course is a practical introduction to building applications for mobile devices. The course combines hands on design and development experience, with a conceptual overview and discussion of design and practical development issues. Taken into account will be constraints and requirements of devices with small screen sizes, limited battery power, limited computational power, etc. Tools used for building an application in the context of a specific device such as iPhone or an Android based device will be discussed. Students build a mobile application to demonstrate their understanding of mobile web constraints and tools.

IS 331. Database Design Management and Applications. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IS 218 or IT 202. Businesses use databases extensively for analysis and decision-making because they provide efficient, large-scale information storage and rapid retrieval. Databases support the "back end functionality" of most large web systems. This course gives students extensive, pragmatic experience in designing, building, querying, updating, maintaining and managing relational databases, using the Structured Query Language (SQL). Proper database design principles are emphasized throughout the course, beginning with high level descriptions of relational databases using data modeling tools (such as entity-relationship or ER diagrams)and progressing to relational database design principles based on higher order normalizations. We will examine some poorly designed databases and show how these can be transformed into well designed databases. SQL will be extensively covered, and students will design and implement sophisticated SQL queries invoking self-joins, outer joins, correlated subqueries and related concepts. Students will explore and utilize design methodologies for input data validation and maintaining database integrity, and study issues of database privacy and security. Advanced topics to be discussed include the role of the Database Administrator (DBA), database life cycle activities, database denormalization, read-only databases and data warehouses. Hands-on experience will be gained by working with actual databases using industry-standard database management systems such as Oracle.

IS 333. Social Network Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Completion of computing GUR (CS 100, CS 101, CS 103, CS 104, CS 111, CS 113, CS 115 or BNFO 135) AND statistical GUR (MATH 105, MATH 120, MATH 225, MATH 244, MATH 279, MATH 305, MATH 333, IE 331, ECE 321 or MNET 315). In this intensive hands-on course, students will learn how to design computer programs to “grab” information from social networking systems such as Facebook, and analyze this to reveal useful but hidden information about the users and their interconnections. Since math is the only language that computers understand, the goal of this class is to build connections between the human language one finds in social network postings and profiles, and mathematical formulas. The skills and techniques utilized in the course will prepare students for advanced courses in data mining and business analytics. This course requires basic statistical knowledge and Java programming skills.

IS 344. Computing Applications in Business. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MIS 245 or IS 265 or ACCT 115 or ACCT 117 or MGMT 390. A comprehensive overview of the various types of computing applications used by businesses in order to run effectively and efficiently. All the major functional departments within organizations are examined and evaluated to see how applications are integrated to implement "business processes" that flow across department boundaries, and from suppliers to customers. Students will learn to model business situations and the design of applicable software solutions. A full-semester hands-on student project will provide experience in designing solutions to changes in the business environment.

IS 350. Computers, Society and Ethics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: GER (CS 100, CS 101, CS 103, CS 104, CS 113, CS 115, or BNFO 135), and any History and Humanities GER 200 level course and ENGL 101. Examines the historical evolution of computer and information systems and explores their implications in the home, business, government, medicine and education. Topics include automation and job impact, privacy, and legal and ethical issues.

IS 373. Content Management Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IS 117 or IT 202. This course provides a hands-on introduction to the design and implementation of enterprise-scale web systems built upon web based content management systems (CMS). CMS manage the creation, storage, retrieval, dissemination, and collection of information in order to meet the needs of businesses, organizations and individuals. Students learn to how to create blogs, discussion boards, wiki, intranets, and dynamic websites using popular CMS packages such as Wordpress and Drupal. Throughout the course students learn how to overcome common challenges that impact the design of these systems such as security for multi-user systems, content strategy, marketing and performance.

IS 375. Discovering User Needs for UX. 3 credits, 3 contact hours (3;0;0).
What new digital products or services need to be developed? How do you anticipate someone's needs before they do? How do you understand how people interact with products? These are key questions that both interaction designers and start-up entrepreneurs need to answer. It's all about understanding the user. We need to work with users to investigate or "research" their needs and how they interact with the product or service. In this course, we take a deep dive into qualitative user experience (UX) research. UX research is the process of understanding why and how people use products and services. This course will teach you a set of research tools to discover user needs, investigate the user experience, and enhance the user experience by deriving design recommendations. We will cover techniques like ethnography, focus groups, interviewing, and analyzing qualitative data. We will be talking with user experience researchers at major companies and getting involved with actual user research. This practical, hands-on course will give you an insight into the psychology of user behavior and lay the foundation for students who are pursuing careers designing, evaluating, or marketing products for people.

IS 385. Special Topics in IS. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in an area of information systems and the computing sciences not regularly covered in any other IS course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course.

IS 390. Requirements Analysis and Systems Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CS 103, CS 113, CS 115, IS 218 or IT 202 A study of the information systems development life-cycle, from the initial stages of information requirements analysis and determination to the ultimate activities involving systems design. Theory, methodologies and strategies for information requirements analysis, including the assessment of transactions and decisions, fact-finding methodologies, structured analysis development tools, strategies of prototype development, and an overview of computer-aided software engineering (CASE) tools. Theory, methodologies and strategies for systems design, including design of user-interfaces, particularly menu-driven and keyword dialogue strategies, and issues in the proper design of computer output.

IS 392. Web Mining and Information Retrieval. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IS 218, IT 114, or CS 114. This course introduces the design, implementation and evaluation of search engines and web mining applications. Topics include: automatic indexing, natural language processing, retrieval algorithms, web page classification and clustering, information extraction, summarization, search engine optimization, and web analytics. Students will gain hands-on experience applying theories in case studies.

IS 410. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: IS 310 or its equivalent, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and/or project. Note: Normal grading applies to this COOP Experience.

IS 421. Advanced Web Applications. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IS 219 and (IS 331 or CS 331). This course focuses on the design, development, and management of cloud-based web information systems, within the context of startup companies and established organizations. Within the course, we examine business, organizational and technical challenges faced by developers, project managers, and the business development professionals that create web-based software products. The course consists of readings, discussions, and a final team project that demonstrates modular design, planned scalability, maintainability, and the creation of a set of organizational processes that supports the continued support and development of the application. Some of the topics covered in the course are: continuous deployment, continuous integration, automated unit testing, modular design, software team management, agile development, Kanban, customer focused development, and the technologies used to scale cloud applications.

IS 448. Usability & Measuring UX. 3 credits, 3 contact hours (3;0;0).
Prerequistes: Statistics GUR (MATH 105, MATH 120, MATH 225, MATH 244, MATH 279, MATH 305, MATH 333, IE 331, ECE 321 or MNET 315). User experience research is the process of understanding why and how people use products and services. Usability refers to the ease of use and learnability of such a product or service. The primary function of usability is to be able to measure and assess the optimal use of a product from the perspective of the user. This course will teach students a set of quantitative tools to understand user needs, derive design recommendations, and evaluate the user experience. Students will receive an overview of the different quantitative methods being used in industry and academia, such as eye-tracking, big social media data analysis, and physiological tests. They will then get an in-depth knowledge of how to design, execute, and analyze data from experiments and surveys using both descriptive and inferential statistics. The course will incorporate a hands-on approach and be comprised completely of individual and group project assignments.

IS 455. IS Mgmt & Business Processes. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (IS 265 or MIS 245) and IS 390. Grade of C or better. This course will emphasize how information systems enable core and supportive business processes, as well as those that interface with suppliers, partners and customers. It will discuss basic administrative, management and policy issues associated with the impact of information systems on the user and organization. The second part of the course looks at business processes in organizations: what the business process view is and why it is important, how information systems can improve processes, and how Enterprise Resource Planning systems help with that improvement. Hands-on use of a major ERP system (SAP) is included.

IS 461. Systems Simulation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: completion of a 100-level GUR course in computing; MATH 333. This course introduces computer simulation as an algorithmic problem solving technique. Includes discrete simulation models, elementary theory, stochastic processes, use of simulation languages, random number generators, simulation of probabilistic processes, design of simulation experiments, validation of models, queueing systems, and applications to the design and analysis of operational systems. The GPSS language is covered in detail.

IS 465. Advanced Information Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Statistical GER (MATH 105, MATH 120, MATH 225, MATH 244, MATH 279, MATH 305, MATH 333, IE 331, ECE 321 or MNET 315), and (IS 265 or MIS 245) and IS 344, and (IS 331 or CS 331). This course serves as an introduction to data analysis, probability and statistics from an information systems perspective, including many of the techniques that are most relevant to the profession of Data Scientist for business, data and web analytics, as well as current research areas. The course emphasizes manipulation and analysis of relevant data sets. Course topics include the rudiments of probability and random variables, estimation, hypothesis testing, graphics and visualization, data warehousing and OLAP analysis, dashboard, scorecard, data mining algorithms, optimization techniques, DSS and knowledge systems. Students will get hands-on experience in designing and building a data warehouse. They will get hands-on experience building a dashboard with real-world data, and they will apply various data mining algorithms learned in class to solve real world problems.

IS 485. Special Topics in Information Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: junior standing and/or department approval. The study of new and/or advanced topics in an area of IS not regularly covered in any other IS course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course. A student may register for no more than two semesters of Special Topics.

IS 486. Topics in Information Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Same as for IS 485. A continuation of IS 485.

IS 488. Independent Study in Information Systems. 3 credits, 0 contact hours (0;0;0).
Prerequisites: Open to students in the Albert Dorman Honors College or to any student who intends to apply to the Informatics Undergraduate Thesis program. Students need approval from the Informatics department and the Informatics faculty member who will guide the independent study. Independent studies, investigations, research, and reports on advanced topics in Informatics. Students must prepare, in collaboration with their faculty mentor and in the semester prior to enrolling in this course, a detailed plan of topics and expected accomplishments for their independent study. This must have the approval of both the department and the faculty mentor. A student may register for no more than one semester of Independent Study.

IS 489. INFO Undergrad Thesis Research. 3 credits, 3 contact hours (3;0;0).
Students continue their research in preparation for completing a Research Thesis.

IS 491. Senior Project - IS. 3 credits, 3 contact hours (0;0;3).
Prerequisites: IS 331 or CS 331 and senior standing. Integration of knowledge and skills gained in previous information systems courses into an individual research project. The project entails investigation of current literature and the design, implementation and evaluation of an information system.

IT 101. Introduction to Information Technology. 3 credits, 3 contact hours (3;0;0).
The foundations of information technology (IT), including basic computer architecture, various kinds of computer hardware, and networking technology, are introduced. Various data representation schemes, such as the binary number systems, are covered. Different levels of software are examined, including aspects of the operating systems from the perspective of the IT professional. The software development process is discussed. Database management software and SQL are dealt with, as are applications and languages developed around the internet and Web infrastructure. Overall, fundamental knowledge required of today's IT professional is obtained along with an appreciation of IT's impact on business and society. Hands-on experience with some important elements of the IT field is gained through various laboratory assignments.

IT 114. Advanced Programming for Information Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 113 or CS 115. Problem solving techniques and program design knowledge are expanded with an eye toward IT-related applications. Various kinds of data structures are introduced, including classic containers such as lists, stacks, queues, and trees. Sorting and searching techniques are examined. The fundamentals of client/server programming and the use of sockets are covered. Recursion and its various applications are studied. The built-in class library features of an object-oriented programming language are exploited throughout.

IT 120. Introduction to Network Technology. 3 credits, 3 contact hours (3;0;0).
An introduction to the basics of networking in a modern operating system environment. Emphasis is placed on the application and management of networking technology. Topics to be covered include: the OSI model, network hardware and technologies, network protocols, wired and wireless networks, TCP/IP. Whenever possible, concepts will be explained through the use of hands-on exercises that reinforce the lecture material.

IT 201. Information Design Techniques. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 101. This course presents an introduction to the theory and practice of information design. Topics covered include the theoretical foundations of information design, graphic design, content design, interaction design, usability, multimedia design, sound and video, animation, and an introduction to 3D modeling.

IT 202. Internet Applications. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 100 or CS 113 or CS 115 or a course in a high-level programming language as approved by department. This course presents the concepts and software technologies that underline web-oriented, three-tier software architectures and applications. The enabling software mechanism include the markup languages (HTML5 and CSS3) used by browsers, client-side scripting languages and libraries (Javascript and AJAX), web servers and server-side-scripting languages (Apache, PHP, HTTP protocol), and background databases (SQL, MySQL). The course uses a hands-on, guided development approach with substantial assignments to illustrate the fundamental computing concepts systems, and technologies considered and to provide direct experience in their use.

IT 220. Wireless Networks. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 120 or CS 356. This course introduces the students to the applied topic of Wireless Networks, focusing on applied methods, tools and technologies, as well as practical experience in designing & implementing wireless networks. Topics include hardware, software, data, applications, communication, design & installation of wireless networks, together with the implementation, performance, security and limitations of such systems.

IT 230. Computer and Network Security. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 120 or CS 356. This course introduces the applied topic of Computer Security, presenting the evolution of computer security, the main threats, attacks & mechanisms, applied computer operations & security protocols, main data transmission & storage protection methods via cryptography, ways of identifying, understanding & recovery from attacks against computer systems, various methods of security breach prevention, network systems availability, applications security, recovery & business continuation procedures and counter systems penetrations techniques and the role of the US Government in security of national computer infrastructure.

IT 240. Scripting for System Administration. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 113 or CS 115. This course will introduce task automation using shell scripting in a multi-OS environment using the Shell and the Perl programming languages. Topics covered will include scripting commands, control structures, functions, scalar data and lists, regular expressions, hashing, automating administration functions and debugging. Lessons will be enhanced through the use of hands-on exercises to strengthen comprehension.

IT 265. Game Architecture and Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 201 or equivalent. Course introduces students to the core concepts and design methodologies integral to designing and developing games and other Entertainment Software.

IT 266. Game Modification Development. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 113 or CS 115. This course introduces students to the basic concepts of game programming and development. Students will learn how to reprogram a professional game engine, or Modification (Mod) development as it is referred to in the industry. Students will work with C intensively. Students will work on their own game projects utilizing the professional game engine.

IT 276. Game Development. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 266. This course introduces students to the core concepts and skills necessary for the development of games utilizing 2D graphics. Students will learn how to set up and program their own 2D graphics based game engine. The engine will integrate 2D graphics, audio, input handling and network socket programming. Students will learn how to utilize their own custom 2D graphics and sounds into their projects. Once complete, students will have created two fully functional games.

IT 286. Foundations of Game Production. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 202 and IT 265. This class introduces students to many of the tools and design methodologies needed for electronic game production. This class will focus heavily on scripting, level design and content control as applied to game development. Students will learn a few scripting languages that are used in the games industry such as Unreal Script and Python. Students will work on projects to develop the levels, controls and scripts in order to create a new game experience with a professional game.

IT 287. Advanced Game Production. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 286 or COM 266. This course will build on tools and techniques presented in Foundations of Game Production and guide students through the development cycle of game levels. This will be a hands-on class that will teach students the development styles and revision techniques used in the professional game industry. Upon completion of the course, students will have first hand experience producing professional quality content for electronic games and a portfolio of work.

IT 302. Advanced Internet Applications. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 202 or IS 218. This course covers Internet-related software technologies in a more comprehensive, in-depth manner than IT 202. Topics considered include: client-side technologies like HTML5 and jQuery, JQuery UI (user interface) library, jQuery Mobile, CSS3 (transitions, animations), feature detection and polyfills using jQuery UI and Modernizr, advanced Javascript DOM and JSON (Javascript Object Notation), basic web services applications, JSONP. Advanced PHP topics considered include: sessions, cookies, HTTP exchanges, encryption, graphics library (CAPTCHA?s), and as time permits regular expressions and remote file access. An introduction to the Model-View-Controller (MVC) paradigm is presented using Ruby-on-Rails environment. Programming assignments are required which provide experience with the concepts covered.

IT 303. Model View Controller Software Architecture. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 202 or instructor approval. The Model View Controller(MVC) software architecture or pattern separates the concerns of application or domain logic, interface design, and the view of the system presented to the user, with the objective of more effective design, development and testing. This course covers environments and frameworks for modeling, developing and programming Internet Applications with emphasis on the Model View Controller paradigm. Design and development, applicability of principles, integrated test-driven development applicability of major external libraries like JQuery and Prototype, deployment, scaling and security issues will be examined. Case studies will be used to illustrate the concepts and frameworks considered. A substantial development project will be required.

IT 310. E-Commerce Technology. 3 credits, 3 contact hours (3;0;0).
An overview of the technologies relevant to electronic commerce. Communications and networking, web authoring tools, system security, databases and archiving, EDI, transaction processing, and factory/warehouse data networks. Provides competency to appraise tools such as HTTP servers, secure transaction software and firewalls, low and high-end database systems, heterogeneous networks, NNTP Servers, client software, procurement systems, and intelligent agents. Covers e-commerce models including agent-based and Java-based, electronic contracts and the electronic exchange of technical data, electronic cash systems and user security.

IT 311. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Completion of the sophomore year, approval of the program coordinator, and permission of the Office of Cooperative Education and Internship. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

IT 320. Virtual Instrumentation. 3 credits, 3 contact hours (3;0;0).
Cross-listed with OPSE 310. Prerequisite: CS 113 or CS 115. Covers the basics of virtual instrumentation including use of IEEE GPIB, RS232 interfaces, and data acquisition boards. Interface a computer to various instruments for data acquisition and instrument control using a state-of-the-art software platform such as National Instrument's LABVIEW. Emphasis is on the practical aspects of interfacing a computer to various instruments including timing issues, real-time data acquisition and instrument control, instrument status, and acquisition speed.

IT 330. Computer Forensic. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 120 or CS 356. This course introduces students to the applied topic of Computer Forensic, the study of obtaining and analyzing digital information from computers that have been used to commit illegal actions (computer crime), for use as evidence in civil, criminal, or administrative cases.

IT 331. Privacy and Information Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Computing GUR. This course will introduce the legal, social and technical issues involving information privacy. Topics covered will include the historical development of information privacy law; law enforcement, technology and surveillance; government databases and records; privacy and business records and financial information; privacy and the media; health and genetic privacy and international privacy law.

IT 332. Digital Crime. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Computing GUR. Comprehensive, multidisciplinary overview of the methods and means by which technology is used by the criminal in today's society. An examination of the historical, legal, technological and sociological aspects of cybercrime. The course covers the challenges of a new era of technology has brought to combating crime of all types, including terrorism. Topics covered will include: the sociology of the white collar criminal, the criminal justice system and law enforcement, computer security and deterrence/prevention.

IT 335. Introduction to .NET Framework. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 202 or equivalent. This course introduces students to .NET Framework, a new computational environment that supports more than 25 programming languages and is platform and device independent. Problem solving and system development topics are integrated into the course by using C# languages as a vehicle to illustrate the concepts.

IT 340. Introduction to System Administration. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 120 or CS 356. This course will introduce the tasks and techniques required to perform as a system administrator of Linux systems. Topics to be covered include booting, process control, the file system, managing users and resources, backups, configuration management, networking, the network file system, email servers, security, hardware devices, interoperability, and daemons. Whenever possible, lectures will be augmented with hands-on exercises.

IT 360. Programming for Computer Graphics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 113 or CS 115. Introduction to programming graphics and animation through the use of an appropriate application interface such as openGL. Topics include 2D and 3D graphics with mappings from the real world coordinates to graphics display. Perspective display will be provided by an interface. Basic vector and matrix operations which underlie the concepts of perspective will be covered.

IT 380. Educational Software Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 201. Educational Media Design employs the instructional principles of constructivist pedagogy as the process used to develop a solution to develope courseware for K-12 audience. The course builds on the participatory design model of software engineering in order to develop integrated learning environments that support visual and verbal literacy; enables student to be able to plan, organize, and systematically develop instructional materials. This course implements instructional design theory and pedagogy in order to create an actual application for a computer-based environment. Same as STS 318.

IT 382. User Interfaces for Extended Reality. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 201. The course presents the concepts that address hardware and software technologies and principles of perception for mixed reality (virtual and augmented reality) applications. During the course, the students will have an opportunity to build a virtual or augmented reality application and test it with Oculus, Vive, Magic Leap, or HoloLens. During this course, students will learn to design and develop immersive experiences with VR/AR headsets, stereo displays, and large projection screens. They will incorporate body and eye trackers, follow and discuss the latest AR/VR trends, explore why some games make people feel immersed, and others make people sick. Students will also explore the differences and similarities between computer and human vision. This course is hands-on; It will be utilizing Unity 3D or Unreal Engine. The end of the year project will showcase all the different skills and knowledge acquired throughout the semester.

IT 383. Game Design for Extended Reality. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 201. This course concentrates on game development in cross-reality (XR). Specifically, the course looks at various user interface recommendations for virtual and augmented space including navigation, selection, and manipulation techniques. The course reviews current industry standards, design practices, evaluation approaches, and various types of documentation. By the end of the course, students will design, build, and evaluate a project they can use in their portfolio.

IT 386. 3D Modeling and Animation. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 201. This class introduces students to the concepts of 3D modeling and animation, and putting those concepts into action by working with software. This class will be a hands-on, project focused course, using 3D modeling packages, taking students from design to final render.

IT 400. Information Technology and the Law. 3 credits, 3 contact hours (3;0;0).
This course will provide an introduction to legal concepts, principles and terminology as applied to modern information technology. The historical background and foundations of the various principles of U.S. Statutory and Common Law will be considered and will be used to explore how such principles may be applied to encompass and govern modern legal interactions in the U.S. and internationally. Through assignments and class discussion, which will often involve the Socratic Method, students will be expected to spot potential legal issues and make logical arguments for and against various legal propositions.

IT 411. Co-op Work Experience. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Completion of the sophomore year, approval of the program coordinator, and permission of the Office of Cooperative Education and Internship. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

IT 420. Computer Systems and Networks. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IT 120 or CS 356. This course provides students with an understanding of methods, tools, and technologies required to work with computer systems and networks. It includes a detailed discussion of Internet/intranet issues, including standards, connectivity, performance, protocols, network configurations, network design, wireless technology, management, and simulation through practical cases, covering both hardware and software systems.

IT 430. Ethical Hacking for System Administrators. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 340 or equivalent. This course will explore the various means that an intruder has available to gain access to computer resources. Traditional security analysis often falls short due to the rapidly evolving threats that exist. The course was developed to teach how system and network vulnerabilities are found and exploited and what steps can be taken to mitigate the risk.

IT 485. Special Topics in Information Technology I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: junior standing and/or advisor approval. The study of new and/or advanced topics in an area of information technology and its application not regularly covered in any other IT course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course. A student may register for no more than two semesters of special topics courses.

IT 486. Special Topics in Information Technology II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: same as for IT 485. A continuation of IT 485.

IT 488. Independent Study in Information Technology. 3 credits, 3 contact hours (0;0;3).
Prerequisites: open only to Information Technology majors who have the prior approval of the program director and the IT faculty who will guide the independent study taking the form of investigations, research, and reports on advanced topics in information technology. Students must prepare, in collaboration with their faculty mentor and in the semester prior to enrolling in this course, a detailed plan of topics and expected accomplishments for their independent study. This must have the approval of both the program director and the faculty mentor. A student may register for no more than one semester of independent study.

IT 490. Systems Integration. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 113 or CS 115, IS 331 or CS 331, and IT 340. The course will introduce the major design, implementation & distributed deployment issues regarding system integration, Network Operating Systems (NOS), cross-platform database integration, e-commerce and e-business applications implementation, cross-servers & multiple locations e-sessions migration, and the related communications security.

IT 491. IT Capstone Project. 3 credits, 3 contact hours (3;0;0).
Prerequisites: senior standing. An opportunity for students to integrate the knowledge and skills gained in previous information technology work into a team research project. The project involves investigation of current literature as well as implementation of either a part of a large application or the whole of a small system.

Accelerated B.S. in Information Technology and J.D.

Code	Title	Credits
Core Courses		
IT 230	Computer and Network Security	3
IT 310	E-Commerce Technology	3
IT 330	Computer Forensic	3
IT 400	Information Technology and the Law	3
LAW 6014	Criminal Law	3
LAW 6005	Contracts	3
IE 447	Legal Aspects of Engineering	3
Track 2 Law - Year 1 Seton Hall University Law School		
LAW 6009	Civil Procedures	5
LAW 6015	Constitutional Law	5
LAW 6016	Property	5
LAW 6005	Contracts	2

LAW 6008	Torts	1
Area Electives [1]		
LAW 6003	Legal Research & Writing	1
LAW 6004	Legal Research & Writing II	2
LAW 6008	Torts	3
Total Credits		**45**

[1] **Seton Hall University Law:** 6 cr. from 30 first year credits will count as 2 of the 3 required area electives.

B.A. in Information Systems

(120 credits minimum)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 138	General Calculus I [1]	3
Natural Science GER (p. 113)		3
IS 117	Introduction to Website Development	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
IS 218	Building Web Applications	3
IS 265	Introduction to Information Systems	3
IS 247	Designing the User Experience	3
Natural Science GER with Lab (p. 113)		4
	Term Credits	**16**
Second Year		
1st Semester		
IS 350	Computers, Society and Ethics	3
MATH 105	Elementary Probability and Statistics [1]	3
IT 120	Introduction to Network Technology	3
Select one of the following:		3
History and Humanities GER 200 level (p. 106) [2]		
PSY 210	Introduction to Psychology [3]	
Select one of the following:		3
ECON 201	Economics	
General Elective 1 [3]		
	Term Credits	**15**
2nd Semester		
YWCC 207	Computing & Effective Com	1
IS 344	Computing Applications in Business	3
IS 375	Discovering User Needs for UX	3
IS Career Track Elective 1 [4]		3
General Elective 1 or 2		3
New Media or Business Specialization Elective 1 [5]		3
	Term Credits	**16**
Third Year		
1st Semester		
IS 331	Database Design Management and Applications	3
General Elective 2 or 3 [6]		3

IS 390	Requirements Analysis and Systems Design	3
COM 312 or COM 313	Oral Presentations or Technical Writing	3
New Media or Business Specialization Elective 2 [5]		3
	Term Credits	**15**
2nd Semester		
New Media or Business Specialization Elective 3 [5]		3
IS Career Track Elective 2 [4]		3
History and Humanities GER 200 level (p. 106)		3
General Elective 3 or 4 [6]		3
General Elective 4 or 5 [6]		3
YWCC 307	Professional Dev in Computing	1
	Term Credits	**16**
Fourth Year		
1st Semester		
IS 455	IS Mgmt & Business Processes	3
IE 492 or ENTR 210	Engineering Management or Introduction to Entrepreneurship	3
New Media or Business Specialization Elective 4 [5]		3
IS Career Track Elective 3 [4]		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
2nd Semester		
IS 465	Advanced Information Systems	3
Select one of the following:		3
IT 491	IT Capstone Project	
IS 491	Senior Project - IS	
New Media or Business Elective 5 [5]		3
General Elective 5 [6]		3
	Term Credits	**12**
	Total Credits	**120**

1 Student can also take MATH 111 (Calculus I) or MATH 101 (Foundations of Mathematics for the Liberal Arts) instead of MATH 138.
Math: MATH 111 Calculus I and MATH 333 Probability and Statistics are highly recommended to replace MATH 138 General Calculus I and MATH 105 Elementary Probability and Statistics, particularly for students contemplating advanced or graduate work in computing. These students also are encouraged to take MATH 112 Calculus II and one or more advanced statistics courses as free electives, such as MATH 341 Statistical Methods II or MATH 344 Regression Analysis both of which require MATH 333 Probability and Statistics as a prerequisite.

2 For Business Specialization

3 For New Media Specialization

4 **Career Track Electives.** Students are strongly encouraged (but not required) to take 3-4 courses from one of the following Career Tracks, which focus on a particular specialty within the field of Information Systems. Note: Qualified students should consider the BA/MS or BA/PhD program, which allows undergraduates to start on a graduate degree as part of their undergraduate requirements. See the Office of Graduate Studies for more information. Consult your Academic Advisor for further details.

5 **Business and User Experience Specialization Electives:** You must complete an entire set of either 5 approved business electives or 5 approved user experience electives.

6 **Independent Study (optionally leading to the Undergraduate Thesis Option):** We encourage you to consider an independent study (IS 488) as part of your electives as juniors and seniors. You could then continue with an Undergraduate Thesis (IS 489), which optionally can substitute for IS 491 or IT 491. The thesis option is explained further on the Informatics Department web site. Please consult your advisor as early in your studies as possible to plan appropriately for all of these opportunities.

Recommended Business Specialization Electives

Five courses are needed to fulfill the requirements of this Specialization. Students completing his Specialization interested in minoring in Business should check with the School of Management for any additional requirements.

Code	Title	Credits
ACCT 117	Principles Of Fin Accountng	3
MGMT 190	Introduction to Business	3
FIN 315	Fundamentals of Corporate Finance	3
MRKT 330	Principles of Marketing	3
Select one of the following:		3
MRKT 360	Digital Marketing	
HRM 301	Organizational Behavior	
MGMT 492	Business Policy	
Total Credits		**15**

Recommended New Media Specialization Electives

Choose 5 courses from the following to fulfill the requirements for the Specialization. Students taking the New Media specialization have taken most of the courses for a minor in Professional Communications. Check with the Humanities Department to determine current options for electives to complete this minor, if you are interested.

Code	Title	Credits
COM 200	Communicating in Organizations	3
COM 355	Cybertext	3
COM 353	Composing Documents for Print	3
COM 354	Composing Documents for the Web	3
COM 303	Video Narrative	3
COM 337	Photojournalism	3
COM 390	Electronic Writing Workshop	3
Total Credits		**21**

Recommended Career Track Electives

Students are strongly encouraged (but not required) to take 3-4 courses from one of the following Career Tracks, which focus on a particular specialty within the field of Information Systems. Note: Qualified students should consider the BA/MS or BA/PhD program, which allows undergraduates to start on a graduate degree as part of their undergraduate requirements. See the Office of Graduate Studies for more information. Consult your Academic Advisor for further details.

Database

Code	Title	Credits
IS 392	Web Mining and Information Retrieval	3
IT 310	E-Commerce Technology	3
IS 631	Enterprise Database Management	3
IS 634	Information Retrieval	3
IS 687	Transaction Mining and Fraud Detection	3
CS 434	Advanced Database Systems	3
CS 441	Database Programming	3

Networks

Code	Title	Credits
IS 448	Usability & Measuring UX	3
CS 357	Fundamentals of Network Security	3
CS 408	Cryptography and Internet Security	3
CS 458	Technologies-Network Security	3
IT 202	Internet Applications	3
IT 220	Wireless Networks	3
IT 230	Computer and Network Security	3
IT 420	Computer Systems and Networks	3

Management of Information Systems

Code	Title	Credits
IS 392	Web Mining and Information Retrieval	3
IT 310	E-Commerce Technology	3
IS 461	Systems Simulation	3
IS 677	Information System Principles	3
IS 678	IT Service Management	3
IS 680	Information Systems Auditing	3
IS 681	Computer Security Auditing	3
IS 687	Transaction Mining and Fraud Detection	3
IT 332	Digital Crime	3
IT 430	Ethical Hacking for System Administrators	3

Medical Informatics (Healthcare Information Systems)

Code	Title	Credits
For an IS Career Track in Medical Informatics, the student must complete both:		
CPT 325	Medical Informatics Technology	3
CPT 425	Medical Informatics Technology II	3
Select two of the following:		6
IS 392	Web Mining and Information Retrieval	
IS 448	Usability & Measuring UX	
IS 661	User Experience Design	
IT 220	Wireless Networks	
CS 370	Introduction to Artificial Intelligence	

Systems Analysis & Design

Code	Title	Credits
IS 373	Content Management Systems	3
IS 461	Systems Simulation	3
IS 663	System Analysis and Design	3
IS 685	Enterprise Architecture and Integration	3
CS 280	Programming Language Concepts	3
CS 288	Intensive Programming in Linux	3
CS 433	Introduction to Linux Kernel Programming	3
CS 490	Guided Design in Software Engineering	3
IT 335	Introduction to .NET Framework	3
IT 340	Introduction to System Administration	3
IT 490	Systems Integration	3

Intelligence & Decision Support

Code	Title	Credits
IS 392	Web Mining and Information Retrieval	3
IT 310	E-Commerce Technology	3
IS 461	Systems Simulation	3
CS 370	Introduction to Artificial Intelligence	3
CS 434	Advanced Database Systems	3
IT 380	Educational Software Design	3

Web Systems

Code	Title	Credits
IS 117	Introduction to Website Development	3
IS 218	Building Web Applications	3
IS 322	Mobile Applications: Design, Interface, Implementation	3

IS 373	Content Management Systems	3
IS 392	Web Mining and Information Retrieval	3
IS 421	Advanced Web Applications	3
IT 310	E-Commerce Technology	3
IS 448	Usability & Measuring UX	3
IS 683	Web Systems Development	3
IS 688	Web Mining	3
IS 690	Web Services and Middleware	3
IT 202	Internet Applications	3
IT 302	Advanced Internet Applications	3

Information Systems Security, Auditing and Crisis Response

Code	Title	Credits
IS 681	Computer Security Auditing	3
IS 687	Transaction Mining and Fraud Detection	3
CS 357	Fundamentals of Network Security	3
CS 408	Cryptography and Internet Security	3
CS 458	Technologies-Network Security	3
IT 230	Computer and Network Security	3
IT 330	Computer Forensic	3
IT 331	Privacy and Information Technology	3
IT 332	Digital Crime	3
IT 430	Ethical Hacking for System Administrators	3

Human-Computer Interaction

Code	Title	Credits
IS 448	Usability & Measuring UX	3
IS 661	User Experience Design	3
IS 764	Research Methods for Human-Centered Computing and Design	3
IT 265	Game Architecture and Design	3
IT 201	Information Design Techniques	3
IT 266	Game Modification Development	3
or CS 266	Game Modification Development	

Build Your Own Career Track

Students may construct a career track of 3-4 electives in consultation with their advisor.

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses"

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Business and Information Systems

(120 credits minimum)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
Science Literacy GER (p. 113)		3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 138	General Calculus I *	3
IS 117	Introduction to Website Development	3

FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
ECON 201	Economics	3
IS 265	Introduction to Information Systems	3
ENGL 102	English Composition: Introduction to Writing for Research	3
ACCT 117 or ACCT 115	Principles Of Fin Accountng or Fundamentals of Financial Accounting	3
Science Literacy with Lab GER (p. 113)		4
	Term Credits	**16**
Second Year		
1st Semester		
MATH 105	Elementary Probability and Statistics [1]	3
IS 350	Computers, Society and Ethics	3
IT 310	E-Commerce Technology	3
IS 247	Designing the User Experience	3
General Elective 1		3
	Term Credits	**15**
2nd Semester		
General Elective 2		3
IS 218	Building Web Applications	3
IS 344	Computing Applications in Business	3
History and Humanities GER 200 level (p. 106)		3
YWCC 207	Computing & Effective Com	1
IS 375	Discovering User Needs for UX	3
	Term Credits	**16**
Third Year		
1st Semester		
MGMT 216	Business Data Analytics	3
FIN 218	Financial Markets and Institutions	3
IS 390	Requirements Analysis and Systems Design	3
IS 331	Database Design Management and Applications	3
COM 312 or COM 313	Oral Presentations or Technical Writing	3
	Term Credits	**15**
2nd Semester		
HRM 301	Organizational Behavior	3
FIN 315	Fundamentals of Corporate Finance	3
History and Humanities GER 300+ level (p. 108)		3
IT 120	Introduction to Network Technology	3
General Elective 3 [2]		3
YWCC 307	Professional Dev in Computing	1
	Term Credits	**16**
Fourth Year		
1st Semester		
MRKT 330	Principles of Marketing	3
MGMT 391	International Business	3
IE 492 or ENTR 210	Engineering Management or Introduction to Entrepreneurship	3
IS 455	IS Mgmt & Business Processes	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**

2nd Semester		
IS 465	Advanced Information Systems	3
Select one of the following:		3
IT 491	IT Capstone Project	
IS 491	Senior Project - IS	
General Elective 4 [2]		3
General Elective 5 [2]		3
	Term Credits	**12**
	Total Credits	**120**

* Students can also take MATH 111 (Calculus I) or MATH 101 (Foundations of Mathematics for the Liberal Arts) instead of MATH 138.

1 Math: We highly recommend MATH 111 Calculus I and MATH 333 Probability and Statistics to replace MATH 138 General Calculus I and MATH 105 Elementary Probability and Statistics, particularly for students contemplating advanced or graduate work in computing. We also encourage you to take MATH 112 Calculus II and one or more advanced statistics courses as free electives, such as MATH 341 Statistical Methods II or MATH 344 Regression Analysis, both of which require MATH 333 Probability and Statistics as a prerequisite.

2 Independent Study (optionally leading to the Undergraduate Thesis Option): We encourage you to consider an independent study (IS 488) as part of your electives as juniors and seniors. You could then continue with an Undergraduate Thesis (IS 489), which optionally can substitute for IS 491 or IT 491. The thesis option is explained further on the Informatics Department web site. Please consult your advisor as early in your Moved from Y4S2 Moved to Y4S1 Old GUR studies as possible to plan appropriately for all of these opportunities

Curriculum Overview

Following is an overview of the curriculum.

Code	Title	Credits
Core Information Systems Courses		
IS 265	Introduction to Information Systems	3
IT 310	E-Commerce Technology	3
IS 247	Designing the User Experience	3
IS 350	Computers, Society and Ethics [1]	3
IS 344	Computing Applications in Business	3
IS 390	Requirements Analysis and Systems Design	3
IS 375	Discovering User Needs for UX	3
IS 455	IS Mgmt & Business Processes	3
IS 465	Advanced Information Systems	3
IE 492	Engineering Management	3
or ENTR 210	Introduction to Entrepreneurship	
IS 491	Senior Project - IS	3
Core Business Courses		
ACCT 117	Principles Of Fin Accountng	3
ECON 201	Economics	3
MGMT 216	Business Data Analytics	3
FIN 218	Financial Markets and Institutions	3
HRM 301	Organizational Behavior	3
FIN 315	Fundamentals of Corporate Finance	3
MRKT 330	Principles of Marketing	3
MGMT 391	International Business	3
Technical Foundation Courses		
CS 100	Roadmap to Computing	3
IS 117	Introduction to Website Development	3
IS 218	Building Web Applications	3
IS 331	Database Design Management and Applications	3
IT 120	Introduction to Network Technology	3
Career Building Courses		
YWCC 107	Computing as a Career	1

YWCC 207	Computing & Effective Com	1
YWCC 307	Professional Dev in Computing	1

[1] Students may take IS 350 Computers, Society and Ethics

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Human-Computer Interaction

(120 credits)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
ENGL 101	English Composition: Introduction to Academic Writing	3
Science GER (p. 113)		4
MATH 101 or MATH 138	Foundations of Mathematics for the Liberal Arts or General Calculus I	3
IS 117	Introduction to Website Development	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
IS 218	Building Web Applications	3
PSY 210 or R830 101	Introduction to Psychology or Principles Of Psychology I	3
ENGL 102	English Composition: Introduction to Writing for Research	3
IS 247	Designing the User Experience	3
Science Literacy with Lab GER (p. 113)		4
	Term Credits	**16**
Second Year		
1st Semester		
General Elective 1 [1]		3
Select one of the following:		3
AD 150	Color and Composition	
R085 102	Design Fundamentals	
R085 103	3-D Design Fund	
R080 121	Intro To Drawing	
MATH 105	Elementary Probability and Statistics	3
IS 350	Computers, Society and Ethics	3
R830 102	Prin Of Psychology	3
	Term Credits	**15**
2nd Semester		
HCI Specialization Elective 1		3
IS 375	Discovering User Needs for UX	3
R830 301	Stat Meth Cog & Beh	4
R830 304	Cognitive Processes	3
YWCC 207	Computing & Effective Com	1
	Term Credits	**14**

Third Year		
1st Semester		
IS 331	Database Design Management and Applications	3
IS 448	Usability & Measuring UX	3
IE 355 or AD 201	Human Factors or Human Factors/Ergonomics	3
General Elective 2 [2]		3
IS 390	Requirements Analysis and Systems Design (General Elective 2)	3
	Term Credits	**15**
2nd Semester		
General Elective 3 [2]		3
Select one of the following:		3
History and Humanities GER 300+ level (p. 108) [1]		
General Elective 4 [2]		
R830 302	Exp Meth Cog & Beh	4
COM 312 or COM 313	Oral Presentations or Technical Writing	3
YWCC 307	Professional Dev in Computing	1
	Term Credits	**14**
Fourth Year		
1st Semester		
General Elective 5 [2]		3
General Elective 6 [2]		3
HCI Specialization Elective 2		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
IE 492 or ENTR 210	Engineering Management or Introduction to Entrepreneurship	3
	Term Credits	**15**
2nd Semester		
IS 491 or IT 491	Senior Project - IS or IT Capstone Project	3
General Elective 7 [2]		3
General Elective 8 [2]		3
HCI Specialization Elective 3		3
HCI Specialization Elective 4		3
	Term Credits	**15**
	Total Credits	**120**

1 If already taking a 300-level Humanities & History GER course as part of the HCI Specialization, then you may take a general elective here.

2 Independent Study (optionally leading to the Undergraduate Thesis Option): We encourage you to consider an independent study (IS 488) as part of your electives as juniors and seniors. You could then continue with an Undergraduate Thesis (IS 489), which optionally can substitute for IS 491 or IT 491. The thesis option is explained further on the Informatics Department web site. Please consult your advisor as early

HCI Specializations:

Students choose, with Advisor approval a coherent sequence of 4 courses, chose from one of the HCI specializations given below.

Cognitive Design

Code	Title	Credits
Select four of the following:		12
STS 351	Minds and Machines	
PSY 359	Foundations of Cyberpsychology	
R830 103	Cognitive Science	
R830 104	Cognitive Science II	

R830 324	Psych Of Adolescent
R830 335	Social Psychology
R830 346	Psychology Of Language
R830 354	Adult & Aging
R830 371	Psychology & Personality
R830 405	Psych Of Emotion
R830 410	Perceptual Dev
R830 411	Intro To Cog Neurosc
R830 424	Health Psychology
R830 431	Media Psych

Game Design and Production

Code	Title	Credits
Select two of the following:		12
IT 201	Information Design Techniques	3
IT 265	Game Architecture and Design	3
Choose two remaining electives from among the following. You may take both courses from one grouping or individual courses from two different groupings.		
For students who want to focus on designing games in existing engines/development environments, consider these courses:		
IT 286	Foundations of Game Production	
IT 287	Advanced Game Production	
For students who are more artistic, design or asset creation focused, consider these courses:		
IT 386	3D Modeling and Animation	
For students who want to be challenged with C/C++ programming to develop their own 2D and 3D games, consider these courses:		
IT 266	Game Modification Development	
IT 276	Game Development	
Students may also want to consider these interesting Digital Design courses:		
DD 275	History of Games	
DD 301	Acting Fundamentals for Animators	

Graphical Arts Design

Code	Title	Credits
Select four of the following, which were not taken to fulfill other requirements:		12
AD 112	Communication in Art and Design - Digital Media [1]	
AD 150	Color and Composition	
DD 284	Video and Animation	
DD 321	Interactive and Reactive Environments	
ID 203	Past, Present and Future of Design	
R080 121	Intro To Drawing [1]	
R085 102	Design Fundamentals	
R085 103	3-D Design Fund	

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

B.S. in Information Technology

(120 credits minimum)

First Year		
1st Semester		**Credits**
IT 101	Introduction to Information Technology	3
CS 100	Roadmap to Computing	3
MATH 138	General Calculus I	3
ENGL 101	English Composition: Introduction to Academic Writing	3

Science Literacy GER (p. 113)		3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
CS 113	Introduction to Computer Science	3
IT 120	Introduction to Network Technology	3
MATH 105	Elementary Probability and Statistics	3
Science Literacy with Lab GER (p. 113)		4
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**16**
Second Year		
1st Semester		
IT 114	Advanced Programming for Information Technology	3
IT 201	Information Design Techniques	3
Social Science GER Elective (p. 114)		3
General Elective 1		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**15**
2nd Semester		
IT 202	Internet Applications	3
Specialization Course 1		3
Specialization Course 2		3
General Elective 2		3
YWCC 207	Computing & Effective Com	1
	Term Credits	**13**
Third Year		
1st Semester		
IS 331	Database Design Management and Applications	3
History and Humanities GER 300+ level (p. 108)		3
Specialization Course 3		3
Specialization Course 4		3
IT 340	Introduction to System Administration	3
	Term Credits	**15**
2nd Semester		
IT 420	Computer Systems and Networks	3
COM 313 or COM 312	Technical Writing or Oral Presentations	3
IS 350	Computers, Society and Ethics	3
Specialization Course 5		3
Specialization Course 6		3
YWCC 307	Professional Dev in Computing	1
	Term Credits	**16**
Fourth Year		
1st Semester		
IT 490	Systems Integration	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
General Elective 3		3
Specialization Course 7		3
General Elective 4		3
	Term Credits	**15**
2nd Semester		
IT 491	IT Capstone Project	3

Specialization Course 8	3
General Elective 5	3
General Elective 6	3
General Elective 7	3
Term Credits	**15**
Total Credits	**120**

Information Technology Electives

Code	Title	Credits
Information Technology Core		
Complete information technology/computer and information science courses that provide fundamental knowledge and practice in information technology functions, system development, and software.		36
IT Capstone Project		
Complete a culminating project [1]		3
Specialization Courses		
Select eight courses, focusing on an application area relevant to Information Technology [2]		24
General Electives		
Select seven courses to be chosen in consultation with the advisor		21

1 A culminating project experience that integrates the student's IT and specialization expertise. The IT Program strongly supports and encourages the student to implement this project in collaboration with NJIT industrial partners and/or NJIT's Enterprise Development Centers. In accordance with the need for the IT professional to have highly developed communication skills, the student will present the results of their projects at the completion of the project.

Co-op

In IT, IT 311 (http://catalog.njit.edu/search/?P=IT%20311) Co-op Work Experience I and IT 411 (http://catalog.njit.edu/search/?P=IT%20411) Co-op Work Experience can be taken for degree credit.

Criminal Justice and Law Specialization

(27 credits)

Code	Title	Credits
IT 220	Wireless Networks	3
IT 230	Computer and Network Security	3
IT 310	E-Commerce Technology	3
IT 330	Computer Forensic	3
IT 400	Information Technology and the Law	3
IT 430	Ethical Hacking for System Administrators	3
Select three of the following:		9
R202 203	Police And Community	
R202 301	CJ Research Methods	
R202 102	Criminology	
R202 310	Case Proc Law Courts	
R202 331	Delinquency Juv Justice	
R202 202	Gender Crime & Justice	
Total Credits		**27**

Management Information Systems Specialization

(24 credits)

Code	Title	Credits
Select 8 of the following:		24
ACCT 117	Principles Of Fin Accountng	3

HRM 301	Organizational Behavior	3
IS 265	Introduction to Information Systems	3
or MIS 245	Introduction to Management Information Systems	
IT 220	Wireless Networks	3
IT 302	Advanced Internet Applications	3
IT 310	E-Commerce Technology	3
IS 344	Computing Applications in Business	3
IS 390	Requirements Analysis and Systems Design	3
IS 455	IS Mgmt & Business Processes	3
IS 465	Advanced Information Systems	3
MIS 363	Project Management for Managers	3
or MGMT 480	Managing Technology and Innovation	
MRKT 330	Principles of Marketing	3
OM 375	Business Operations Management and Analytics	3

Game Development Specialization

(27 credits)

Code	Title	Credits
Select 9 of the following:		27
IT 265	Game Architecture and Design	
CS 266	Game Modification Development	
or IT 266	Game Modification Development	
CS 276	2D Game Development	
or IT 276	Game Development	
AD 150	Color and Composition	
STS 318	Educational Media Design	
CS 280	Programming Language Concepts	
IT 386	3D Modeling and Animation	
MATH 337	Linear Algebra	
IT 286	Foundations of Game Production	
IT 4XX	Game Development Workshop	
CS 366	3D Game Development	
IT 287	Advanced Game Production	
Total Credits		**27**

Multimedia Specialization

(27 credits)

Code	Title	Credits
IS 270	Designing the Multimedia Experience	3
IT 386	3D Modeling and Animation	3
COM 350	Digital Video Production	3
STS 347	Introduction to Music	3
Select five of the following:		15
STS 349	Electronic Music in Practice	
IT 286	Foundations of Game Production	
COM 303	Video Narrative	
COM 351	Documentary Studies	
COM 337	Photojournalism	
COM 369	Digital Poetry	
IT 265	Game Architecture and Design	
IT 266	Game Modification Development	

or CS 266	Game Modification Development	
IT 276	Game Development	
or CS 276	2D Game Development	
CS 366	3D Game Development	
AD 150	Color and Composition	
COM 353	Composing Documents for Print	
COM 354	Composing Documents for the Web	
IS 373	Content Management Systems	
STS 318	Educational Media Design	
Total Credits		**27**

Network and Information Security Specialization

(27 credits)

Code	Title	Credits
Select 9 of the following:		27
IT 220	Wireless Networks	
IT 230	Computer and Network Security	
IT 310	E-Commerce Technology	
IT 330	Computer Forensic	
IT 331	Privacy and Information Technology	
IT 332	Digital Crime	
IT 400	Information Technology and the Law	
IT 430	Ethical Hacking for System Administrators	
CS 332	Principles of Operating Systems	
CS 357	Fundamentals of Network Security	
CS 458	Technologies-Network Security	
Total Credits		**27**

Web Applications Specialization

(24 credits)

Code	Title	Credits
Select 8 of the following:		27
IS 117	Introduction to Website Development	3
IS 218	Building Web Applications	3
IS 219	Adv Website Development	3
IS 247	Designing the User Experience	3
IS 322	Mobile Applications: Design, Interface, Implementation	3
IS 373	Content Management Systems	3
IS 375	Discovering User Needs for UX	3
IS 392	Web Mining and Information Retrieval	3
or IS 421	Advanced Web Applications	
IT 302	Advanced Internet Applications	3
IT 310	E-Commerce Technology	3
MGMT 480	Managing Technology and Innovation	3

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses"

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Science, Technology & Society and B.S. in Business and Information Systems

(Minimum 120 credits)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
MATH 101 or MATH 138	Foundations of Mathematics for the Liberal Arts or General Calculus I	3
ENGL 101	English Composition: Introduction to Academic Writing	3
Natural Science GER (p. 113)		3
Natural Science LAB GER (p. 113)		1
STS 201	Understanding Technological Society	3
YWCC 107	Computing as a Career	1
	Term Credits	**17**
2nd Semester		
IS 117	Introduction to Website Development	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics	3
ECON 201	Economics	3
Natural Science GER (p. 113)		3
	Term Credits	**15**
Second Year		
1st Semester		
FIN 218	Financial Markets and Institutions	3
ACCT 117 or ACCT 115	Principles Of Fin Accountng or Fundamentals of Financial Accounting	3
STS 308	Globalization	3
IS 265	Introduction to Information Systems	3
IS 247	Designing the User Experience	3
	Term Credits	**15**
2nd Semester		
IS 218	Building Web Applications	3
MGMT 216	Business Data Analytics	3
IS 375	Discovering User Needs for UX	3
STS 310	Technology and Human Values	3
STS 300-Level Track Course 1		3
YWCC 207	Computing & Effective Com	1
	Term Credits	**16**
Third Year		
1st Semester		
STS 304	Qualitative Research Methods in the Social and Behavioral Sciences	3
IS 350	Computers, Society and Ethics	3
MRKT 330	Principles of Marketing	3
FIN 315	Fundamentals of Corporate Finance	3
IS 344	Computing Applications in Business	3
	Term Credits	**15**
2nd Semester		
STS 307	Quantitative Research Methods in the Social and Behavioral Sciences	3
300 Level STS Specialization		3
IT 120	Introduction to Network Technology	3

HRM 301	Organizational Behavior	3
IS 390	Requirements Analysis and Systems Design	3
YWCC 307	Professional Dev in Computing	1
	Term Credits	**16**
Fourth Year		
1st Semester		
STS 490	Project and Seminar I	3
IE 492 or ENTR 210	Engineering Management or Introduction to Entrepreneurship	3
IS 455	IS Mgmt & Business Processes	3
MGMT 391	International Business	3
STS 300-Level Track Course 2		3
	Term Credits	**15**
2nd Semester		
IS 491 or IT 491	Senior Project - IS or IT Capstone Project	3
IS 465	Advanced Information Systems	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
STS 491	Project & Seminar II	2
	Term Credits	**11**
	Total Credits	**120**

Electives

Code	Title	Credits
Major Option		
Select appropriate electives in consultation with an advisor [1]		18
Free Electives		
Students select appropriate electives in consultation with an advisor.		

1 Usually the Director of the STS Program. Courses may be selected from different disciplines but must comprise a coherent program of study within an option.

Refer to the **General Education Requirements** for further information on electives.

Specializations

- Mind, Behavior, and Society
- Environmental and Sustainability Studies
- Race and Gender in Science in Technology
- Politics, History, and Ethics in Science and Technology
- Music, Literature, and Culture in a Technological Society

Co-op

Co-op courses replace electives with the approval of an advisor. In science, technology and society, STS 311 Co-op Work Experience I and STS 411 Co-op Work Experience II are taken for degree credit.

B.S. in Web & Information Systems

(120 credit minimum)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
FYS SEM	First-Year Student Seminar	0
ENGL 101	English Composition: Introduction to Academic Writing	3

IS 117	Introduction to Website Development	3
MATH 138	General Calculus I *	3
Science Literacy GER (p. 113)		3
	Term Credits	**15**
2nd Semester		
CS 113	Introduction to Computer Science	3
ENGL 102	English Composition: Introduction to Writing for Research	3
IS 265	Introduction to Information Systems	3
IS 247	Designing the User Experience	3
Science Literacy with Lab GER (p. 113)		4
	Term Credits	**16**
Second Year		
1st Semester		
General Elective 1		3
IT 114 or CS 114	Advanced Programming for Information Technology or Introduction to Computer Science II	3
IS 218	Building Web Applications	3
IS 350	Computers, Society and Ethics	3
MATH 105	Elementary Probability and Statistics [1]	3
	Term Credits	**15**
2nd Semester		
YWCC 207	Computing & Effective Com	1
History and Humanities GER 200 level (p. 106)		3
IS 375	Discovering User Needs for UX	3
IS 219	Adv Website Development	3
IS 344	Computing Applications in Business	3
General Elective 2		3
	Term Credits	**16**
Third Year		
1st Semester		
COM 312 or COM 313	Oral Presentations or Technical Writing	3
History and Humanities GER 300+ level (p. 108)		3
IS 331	Database Design Management and Applications	3
IS 390	Requirements Analysis and Systems Design	3
IS 448	Usability & Measuring UX	3
	Term Credits	**15**
2nd Semester		
YWCC 307	Professional Dev in Computing	1
General Elective 3 [2]		3
IS 322	Mobile Applications: Design, Interface, Implementation	3
IS 333	Social Network Analysis	3
IS 373	Content Management Systems	3
IS 392	Web Mining and Information Retrieval	3
	Term Credits	**16**
Fourth Year		
1st Semester		
General Elective 4 [2]		3
IE 492 or ENTR 210	Engineering Management or Introduction to Entrepreneurship	3
IS 421	Advanced Web Applications	3
IT 310	E-Commerce Technology	3

Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
2nd Semester		
General Elective 5 [2]		3
General Elective 6 [2]		3
Select one of the following:		3
IS 491 or IT 491	Senior Project - IS or IT Capstone Project	
IS 465	Advanced Information Systems	3
	Term Credits	**12**
	Total Credits	**120**

1 **Math:** Math: We highly recommend MATH 333 Probability and Statistics to replace MATH 105 Elementary Probability and Statistics, particularly for students contemplating advanced or graduate work in computing. We also encourage you to take one or more advanced statistics courses as free electives, such as MATH 341 Statistical Methods II or MATH 344 Regression Analysis both of which require MATH 333 Probability and Statistics as a prerequisite.

2 Independent Study (optionally leading to the Undergraduate Thesis Option): We encourage you to consider an independent study (IS 488) as part of your electives as juniors and seniors. You could then continue with an Undergraduate Thesis (IS 489), which optionally can substitute for IS 491 or IT 491. The thesis option is explained further on the Informatics Department web site. Please consult your advisor as early in your studies as possible to plan appropriately for all of these opportunities.

* Student can take MATH 111 (Calculus I) instead of MATH 138 (General Calculus I)

Curriculum Overview

Code	Title	Credits
Core Web Courses		
IS 117	Introduction to Website Development	3
IS 218	Building Web Applications	3
IS 219	Adv Website Development	3
IS 373	Content Management Systems	3
IS 322	Mobile Applications: Design, Interface, Implementation	3
IS 392	Web Mining and Information Retrieval	3
IS 421	Advanced Web Applications	3
IS 333	Social Network Analysis	3
Core Information Systems Courses		
IS 265	Introduction to Information Systems	3
IT 310	E-Commerce Technology	3
IS 247	Designing the User Experience	3
IS 344	Computing Applications in Business	3
IS 390	Requirements Analysis and Systems Design	3
IS 375	Discovering User Needs for UX	3
IS 448	Usability & Measuring UX	3
IS 465	Advanced Information Systems	3
IE 492	Engineering Management	3
or ENTR 210	Introduction to Entrepreneurship	
IS 491	Senior Project - IS	3
Technical Foundation Courses		
CS 100	Roadmap to Computing	3
CS 113	Introduction to Computer Science	3
IS 331	Database Design Management and Applications	3
IT 114	Advanced Programming for Information Technology	3
or CS 114	Introduction to Computer Science II	
Career Building Courses		
YWCC 107	Computing as a Career	1

YWCC 207	Computing & Effective Com	1
YWCC 307	Professional Dev in Computing	1

Electives

BS WIS majors are encouraged to take technical electives within the Ying Wu College of Computing, as well as web-related graphics and communications electives offered by Humanities (COM and ENG) and the School of Architecture. Students can also use 5-6 electives to pursue a minor within or outside the Ying Wu College of Computing.

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Business and Information Systems Minor (for Computing Sciences Majors)

Code	Title	Credits
IS 265	Introduction to Information Systems	3
IS 344	Computing Applications in Business	3
IS 390	Requirements Analysis and Systems Design	3
IS 455	IS Mgmt & Business Processes	3
IS 465	Advanced Information Systems	3
Total Credits		**15**

Business and Information Systems Minor (not for Computing Sciences majors)

Code	Title	Credits
Prerequisite	Computing GUR	
IS 265	Introduction to Information Systems	3
IS 331	Database Design Management and Applications	3
IS 344	Computing Applications in Business	3
IS 390	Requirements Analysis and Systems Design	3
IS 455	IS Mgmt & Business Processes	3
Total Credits		**15**

Data Analytics Minor

Note: Students taking a core statistics course that does not require calculus as a prerequisite (such as Math 105) are encouraged to take a calculus-based statistics course instead (such as Math 333).

Code	Title	Credits
Statistics - Any one of the following courses unless one is already a required core course in your major:		3
IE 331	Applied Statistical Methods	
MATH 333	Probability and Statistics	
MATH 341	Statistical Methods II	
MGMT 216	Business Data Analytics	
Mining - Any one of the following courses unless one is already a required core course in your major:		3
CS 482	Data Mining	
IS 392	Web Mining and Information Retrieval	
Core Database and Analytics - Any one of the following courses unless one is already a required core course in your major:		3
CS 331	Database System Design & Mgmt	
IS 331	Database Design Management and Applications	
IS 333	Social Network Analysis	

IS 465	Advanced Information Systems	
Remaining two to five courses from the following are not already required core courses in your major:		6-10
CS 331	Database System Design & Mgmt	
CS 482	Data Mining	
IS 333	Social Network Analysis	
IS 392	Web Mining and Information Retrieval	
IS 465	Advanced Information Systems	
MATH 341	Statistical Methods II	
MGMT 216	Business Data Analytics	
MGMT 316	Business Research Methods	
MIS 445	Dec Supprt Tool & Tech Mngrs	
OM 375	Bus Operations Mgmt & Analytic	
An independent study focus focused specifically on Data Analytics approved by YWCC advisor and the major advisor		
Another course approved by YWCC advisors		
Total Credits		**15-19**

[1] only one course will count for credit toward a major or minor.

Design of the User Experience Minor

(15 credits minimum)

Students must take 5 courses (15 credits) that are not core courses within their existing major.

Required Courses:

Code	Title	Credits
IS 247	Designing the User Experience	3
IS 375	Discovering User Needs for UX	3
IS 448	Usability & Measuring UX	3

Select 2-5 of the following courses:

Code	Title	Credits
AD 112	Communication in Art and Design - Digital Media	3
AD 150	Color and Composition	3
COM 303	Video Narrative	3
DD 284	Video and Animation	3
DD 321	Interactive and Reactive Environments	3
COM 355	Cybertext	3
COM 354	Composing Documents for the Web	3
HIST 387	Computers, Innovators and Hist	3
ID 203	Past, Present and Future of Design	3
IT 201	Information Design Techniques	3
IT 265	Game Architecture and Design	3
STS 310	Technology and Human Values	3
STS 312	Technology and Policy in Contemporary America	3
STS 351	Minds and Machines	3
PSY 359	Foundations of Cyberpsychology	3
You may include one of the following:		
IE 355	Human Factors	
AD 201	Human Factors/Ergonomics	
Total Credits		**15**

Prerequisite: Computing GER

Students must take R830 101 Principles Of Psychology I or PSY 210 Introduction to Psychology as their Social Science GER; Current BA IS, BS BIS and BS WIS majors should substitute two BS HCI specialization courses listed in the catalog for IS 247 Designing the User Experience and IS 375 Discovering User Needs for UX.

Students outside CCS may substitute one course for a IS, CS or IT course approved by the IS Undergraduate Advisor.

Information Technology Minor (for Computing Sciences Majors)

Code	Title	Credits
IT 120	Introduction to Network Technology	3
IT 202	Internet Applications	3
IT 420	Computer Systems and Networks	3
IT 490	Systems Integration	3
Upper division IT course approved by the minor coordinator		3
Total Credits		**15**

Information Technology Minor (not for Computing Sciences majors)

(15 credits)

Code	Title	Credits
IT 114	Advanced Programming for Information Technology	3
IT 120	Introduction to Network Technology	3
IT 201	Information Design Techniques	3
IT 310	E-Commerce Technology	3
Upper division course approved by the minor coordinator		3
Total Credits		**15**

Mobile and Web Minor

Code	Title	Credits
IS 117	Introduction to Website Development [1]	3
IS 219	Adv Website Development	3
IS 322	Mobile Applications: Design, Interface, Implementation	3
Select two - four of the following:		6
IS 218	Building Web Applications [1]	
IS 373	Content Management Systems	
IS 392	Web Mining and Information Retrieval	
IS 421	Advanced Web Applications	
Total Credits		**15**

[1] Not for BA IS, BS BIS and BS HCI majors.

Data Science

The Department of Data Science is the newest addition to the Ying Wu College of Computing. Founded in 2021, it offers a B.S. Degree in Data Science. This is a new degree program that responds to a strong demand from employers for trained Data Scientists. Data is revolutionizing most industries and B.S. graduates in Data Science command high starting salaries.

Data Science combines powerful methods from Computer Science, Statistics, Artificial Intelligence and Machine Learning into a unique new blend of techniques for deriving valuable insights from Big Data. Data Science is an ideal choice for students who are interested in applying data processing methods to ever larger and more varied real-world data sets, including image, video, natural language and speech data that go substantially beyond traditional text and table data to solve real-world problems. The Department of Data Science closely collaborates with the Department of Mathematical Sciences and the Department of Computer Science and students can take advantage of many computer science and mathematical sciences offerings. The Department of Data Science offers its own two-semester capstone projects that are executed with industrial sponsors. Students also can get involved in state-of-the-art research projects at the NJIT Institute for Data Science, where top notch scientists work with users to develop data-driven technologies to innovate the way the world works and lives.

B

Bader, David, Distinguished Professor

D

Dasgupta, Aritra, Assistant Professor

G

Geller, James, Professor

P

Phan, Hai, Assistant Professor

R

Roshan, Usman, Associate Professor

W

Wu, Chase, Professor

Programs

Data Science (Computing Option)- B.S. (p. 254)

B.S. in Data Science

Data science is the study and practice of extracting information and structure from data that can then be used for reasoning and adding value to the solution of a problem. It has growing applications in health and medicine, finance, marketing, economics, genomics, social networks, cyber-security, journalism, and other fields where data is collected. It spans academic fields in computer science and mathematics such as machine learning and statistical inference, probability, linear algebra, computer programming, software engineering, high performance computing, and cloud computing.
The B.S. in Data Science program has two options, Computing (in the Ying Wu College of Computing) and Statistics (in the Department of Mathematical Sciences in the College of Science and Liberal Arts).

B.S. in Data Science (Computing Option)

(120 credits)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
MATH 111	Calculus I	4
PHYS 111	Physics I [1]	3
PHYS 111A	Physics I Lab [1]	1
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
CS 113	Introduction to Computer Science	3
MATH 112	Calculus II	4
PHYS 121	Physics II [1]	3
PHYS 121A	Physics II Lab [1]	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
CS 114	Introduction to Computer Science II	3
MATH 244	Introduction to Probability Theory	3
MATH 337	Linear Algebra	3

History and Humanities GER 200 level (p. 106)		3
Social Sciences GER (p. 114)		3
	Term Credits	**15**
2nd Semester		
CS 241	Foundations of Computer Science I	3
CS 280	Programming Language Concepts	3
IS 350	Computers, Society and Ethics	3
MATH 341	Statistical Methods II	3
YWCC 207	Computing & Effective Com	1
Data Science Elective 1		3
	Term Credits	**16**
Third Year		
1st Semester		
CS 288	Intensive Programming in Linux	3
CS 301	Introduction to Data Science	3
CS 331	Database System Design & Mgmt	3
CS 370	Introduction to Artificial Intelligence	3
COM 312 or COM 313	Oral Presentations or Technical Writing	3
	Term Credits	**15**
2nd Semester		
CS 435	Advanced Data Structures and Algorithm Design	3
Data Science Elective 2		3
CS 482	Data Mining	3
CS 375	Introduction to Machine Learning	3
History and Humanities GER 300+ level (p. 108)		3
YWCC 307	Professional Dev in Computing	1
	Term Credits	**16**
Fourth Year		
1st Semester		
CS 450	Data Visualization	3
CS 444	Big Data Systems	3
CS 492	Data Science Capstone I	3
MATH 478	Stat Methods in Data Sci	3
Data Science Elective 3		3
	Term Credits	**15**
2nd Semester		
Humanities and Social Science Senior Seminar GER (p. 112)		3
Free Elective 1 [2]		3
CS 493	Data Science Capstone II	3
MATH 344	Regression Analysis	3
Data Science Elective 4		3
	Term Credits	**15**
	Total Credits	**120**

Code	Title	Credits
Data Science (Computing Option) Electives		
YWCC 310	Co-op Work Experience I	3
CS 332	Principles of Operating Systems	3
CS 350	Intro to Computer Systems	3
CS 351	Introduction to Cybersecurity	3
CS 356	Introduction to Computer Networks	3

CS 357	Fundamentals of Network Security	3
CS 370	Introduction to Artificial Intelligence	3
CS 375	Introduction to Machine Learning	3
CS 444	Big Data Systems	3
CS 408	Cryptography and Internet Security	3
MGMT 316	Business Research Methods	3
MGMT 416	Artificial Intelligence for Business Decisions	3
MRKT 378	Marketing Analytics	3
MRKT 430	Marketing Research	3
MATH 345	Multivariate Distributions	3
MATH 388	Introduction to Chaos Theory	3
MATH 391	Numerical Linear Algebra	3
MATH 430	Analytical and Computational Neuroscience	3
MATH 447	Applied Time Series Analysis	3
MATH 448	Stochastic Simulation	3
MATH 461	Introduction to Statistical Computing with SAS and R	3
IS 333	Social Network Analysis	3
IS 392	Web Mining and Information Retrieval	3
FIN 218	Financial Markets and Institutions	3
FIN 306	Blockchain Technology for Business	3
FIN 310	Data-Driven Financial Modeling	3
FIN 320	Fin Data Analytics	3
IT 430	Ethical Hacking for System Administrators	3
IT 485	Special Topics in Information Technology I	3

B.S. in Data Science (Statistics Option)

(120 credits)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
MATH 111	Calculus I	4
PHYS 111	Physics I [1]	3
PHYS 111A	Physics I Lab [1]	1
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
CS 113	Introduction to Computer Science	3
MATH 112	Calculus II	4
PHYS 121	Physics II [1]	3
PHYS 121A	Physics II Lab [1]	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
CS 114	Introduction to Computer Science II	3
MATH 244	Introduction to Probability Theory	3
MATH 337	Linear Algebra	3
History and Humanities GER 200 level (p. 106)		3
Social Sciences GER (p. 114)		3
	Term Credits	**15**

2nd Semester		
CS 241	Foundations of Computer Science I	3
CS 280	Programming Language Concepts	3
MATH 213	Calculus III B	4
MATH 341	Statistical Methods II	3
Data Science Elective 1		3
	Term Credits	**16**
Third Year		
1st Semester		
MATH 340	Applied Numerical Methods	3
MATH 344	Regression Analysis	3
MATH 391	Numerical Linear Algebra	3
CS 301	Introduction to Data Science	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
MATH 345	Multivariate Distributions	3
MATH 447	Applied Time Series Analysis	3
MATH 478	Stat Methods in Data Sci	3
Data Science Elective 2		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
MATH 448	Stochastic Simulation	3
MATH 461	Introduction to Statistical Computing with SAS and R	3
MATH 462	Statistics and Statistical Learning (Capstone I)	3
CS 450	Data Visualization	3
Data Science Elective 3		3
	Term Credits	**15**
2nd Semester		
Humanities and Social Science Senior Seminar GER (p. 112)		3
Math Upper Level Elective (300+ level)		3
MATH 463	Statistics and Statistical Learning (Capstone II)	3
Data Science Elective 4		3
Free Elective [2]		4
	Term Credits	**16**
	Total Credits	**120**

Code	Title	Credits
Data Science (Statistics Option) Electives		
YWCC 310	Co-op Work Experience I	3
CS 331	Database System Design & Mgmt	3
CS 332	Principles of Operating Systems	3
CS 350	Intro to Computer Systems	3
CS 351	Introduction to Cybersecurity	3
CS 356	Introduction to Computer Networks	3
CS 357	Fundamentals of Network Security	3
CS 370	Introduction to Artificial Intelligence	3
CS 375	Introduction to Machine Learning	3
CS 444	Big Data Systems	3
CS 408	Cryptography and Internet Security	3

CS 435	Advanced Data Structures and Algorithm Design	3
CS 482	Data Mining	3
MGMT 316	Business Research Methods	3
MGMT 416	Artificial Intelligence for Business Decisions	3
MRKT 378	Marketing Analytics	3
MRKT 430	Marketing Research	3
MATH 222	Differential Equations	4
MATH 388	Introduction to Chaos Theory	3
MATH 430	Analytical and Computational Neuroscience	3
MATH 453	High-Performance Numerical Computing	3
MATH 477	Stochastic Processes	3
IS 333	Social Network Analysis	3
IS 392	Web Mining and Information Retrieval	3
FIN 218	Financial Markets and Institutions	3
FIN 306	Blockchain Technology for Business	3
FIN 310	Data-Driven Financial Modeling	3
FIN 320	Fin Data Analytics	3
IT 430	Ethical Hacking for System Administrators	3
IT 485	Special Topics in Information Technology I	3

[1] Students considering switching to Computer Science or Mathematical Sciences should take PHYS 111/111A and 121/121A. Do not take PHYS 102/102A

[2] Free electives should be chosen in consultation with the advisor. Some restrictions apply.

College of Science and Liberal Arts

The mission of the College of Science and Liberal Arts (CSLA) is to address the complexities of modern life at the intersection of science, technology and human values, and to provide the intellectual foundations necessary to understand and analyze them. CSLA is dedicated to instruction that develops fundamental principles, informed and enriched by research that encourages innovation, enabling students to formulate significant questions, think analytically, offer creative solutions, and communicate them effectively.

CSLA faculty and students are at the forefront of many national research activities, from solar astronomy to mathematical modeling. CSLA provides students with skill sets for professional success that include literacy in the mathematical, physical and biological sciences as well as traditional liberal arts disciplines. CSLA partners with departments throughout the university to explore emerging frontiers and expand interdisciplinary initiatives in such areas as genomics, robotics, mathematical biology, nanotechnology and environmental science.

Programs

- Applied Physics - B.S. (p. 474)
- Biochemistry - B.S. (p. 347)
- Biology - B.A. (p. 313)
- Biology - B.S. (p. 316)
- Chemistry - B.S. (p. 351)
- Communication and Media - B.A. (p. 428)
- Communication and Media - B.S. (p. 431)
- Cyberpsychology - B.S. (p. 433)
- Data Science - B.S. (p. 453)
- Environmental Science - B.S. (p. 352)
- Forensic Science - B.S. (p. 354)
- History - B.A. (p. 384)
- Law, Technology and Culture - B.A. (p. 386)
    - Law, Technology and Culture (Patent Law Concentration) - B.A. (p. 381)
- Mathematical Sciences - B.S.
    - with Applied Mathematics Concentration (p. 448)
    - with Applied Statistics Concentration (p. 450)

Accelerated Programs (p. 102)

Double Majors (p. 102)

- Applied Mathematics Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/mathematical-sciences/applied-mathematics-minor/)
- Applied Physics Minor (http://physics.njit.edu/Minor.php)
- Applied Statistics Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/mathematical-sciences/applied-statistics-minor/)
- Biological Sciences Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/biology/biological-sciences-minor/)
- Chemistry Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/chemistry-environmental-science/chemistry-minor/) (not for Chemical Engineering majors)
- Chemistry Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/chemical-materials-engineering/chemistry-minor-chemical-engineering-majors/) (for Chemical Engineering majors)
- Communication Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/communication-minor/)
- Computational Mathematics Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/mathematical-sciences/computational-mathematics-minor/)
- Electronic Creative Writing Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/electronic-creative-writing-minor/)
- Environmental Science and Policy Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/chemistry-environmental-science/environmental-science-policy-minor/)
- Environmental Studies and Sustainability Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/interdisciplinary-programs/environmental-studies-sustainability-minor/)
- Forensic Science Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/chemistry-environmental-science/forensic-science-minor/)

- Global Studies Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/global-studies-minor/)
- History Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/history/minor/)
- Journalism Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/journalism-minor/)
- Leadership and Aerospace Studies Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/aerospace-studies/leadership-aerospace-studies-minor/)
- Legal Studies Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/history/legal-studies-minor/)
- Literature Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/literature-minor/)
- Mathematical Biology Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/mathematical-sciences/mathematical-biology-minor/)
- Mathematics of Finance and Actuarial Science Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/mathematical-sciences/mathematics-finance-actuarial-science-minor/)
- Philosophy and Applied Ethics Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/philosophy-applied-ethics-minor/)
- Psychology Minor (not for STS majors) (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/psychology-minor/)
- Science, Technology and Society Minor (http://humanities.njit.edu/academics/undergraduate/)
- Technology, Gender and Diversity Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/technology-gender-diversity-minor/)
- Theatre Arts and Technology Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/science-liberal-arts/humanities-and-social-sciences/theatre-arts-technology-minor/)

Programs

- Applied Mathematics - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/mathematical-sciences/applied-mathematics-ms/)
- Applied Physics - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/physics/applied-physics-ms/)
- Applied Statistics - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/mathematical-sciences/applied-statistics-ms/)
- Applied Science - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/humanities-and-social-sciences/applied-sciences-ms/)
- Biology - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/biology/ms/)
- Biology of Health - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/biology/biology-of-health-ms/)
- BioStatistics - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/mathematical-sciences/biostatistics-ms/)
- Chemistry - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/chemistry-environmental-science/chemistry-ms/)
- Data Science - M.S - Statistics Track (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/mathematical-sciences/data-science-ms/)
- Environmental Science - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/chemistry-environmental-science/environmental-science-ms/)
- History - M.A. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/history/ms/)
- Materials Science and Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/physics/materials-science-engineering-ms/)
- Pharmaceutical Chemistry - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/chemistry-environmental-science/pharmaceutical-chemistry-ms/)

Programs

- Applied Physics - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/physics/applied-physics-phd/)
- Biology - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/biology/phd/)
- Chemistry - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/chemistry-environmental-science/chemistry-phd/)
- Environmental Science - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/chemistry-environmental-science/environmental-science-phd/)
- Materials Science & Engineering - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/physics/materials-science-engineering-phd/)
- Mathematical Sciences - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/science-liberal-arts/mathematical-sciences/phd/)

College of Science and Liberal Arts Courses

AS 111. Heritage and Values of the United States Air Force I. 1 credit, 1 contact hour (1;0;0).
A survey course designed to introduce students to the United States Air Force and provide an overview of the basic characteristics, missions, and organization of the Air Force. Air Force communications skills and leadership abilities are developed through group leadership problems and Leadership Laboratory (LLAB).

AS 112. Heritage and Values of the United States Air Force II. 1 credit, 1 contact hour (1;0;0).
Prerequisite: AS 111 or approval of the Professor of Aerospace Studies. A survey course that continues introducing students to the United States Air Force and providing an overview of the basic characteristics, missions, and organization of the Air Force. Air Force communications skills and leadership abilities are developed through group leadership problems and Leadership Laboratory (LLAB).

AS 221. Team & Leadership Fundamentals. 1 credit, 1 contact hour (1;0;0).
Prerequisite: AS 112 or approval of the Professor of Aerospace Studies. This course focuses on laying the foundation for teams and leadership. The topics include skills that will allow cadets to improve their leadership on a personal level and within a team. The courses will prepare cadets for their field training experience where they will be able to put the concepts learned into practice. The purpose is to instill a leadership mindset and motivate students to transition from AFROTC cadet to AFROTC officer candidate.

AS 222. Team and Leadership Fundamentals II. 1 credit, 1 contact hour (1;0;0).
Prerequisite: AS 221 or approval of the Professor of Aerospace Studies. This course continues to focus on laying the foundation for teams and leadership. The topics include skills that will allow cadets to improve their leadership on a personal level and in a team. The course will prepare cadets for their field training experience where they will be able to put the concepts into practice. The purpose is to instill a leadership mindset and motivate students to transition from AFROTC cadet to AFROTC officer candidate.

AS 301. Aerospace Independent Study. 3 credits, 3 contact hours (0;0;3).

AS 333. Leading People & Effective Com. 3 credits, 3 contact hours (3;0;0).
Prerequisite: AS 222 or approval of the Professor of Aerospace Studies. This course teaches cadets advanced skills and knowledge in management and leadership. Special emphasis is placed on enhancing leadership skills and communication. Cadets have an opportunity to try out these leadership and management techniques in a supervised environment as juniors and seniors.

AS 334. Leading Peo & Effective Com II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: AS 333 or approval of the Professor of Aerospace Studies. This course continues to teach cadets advanced skills and knowledge in management and leadership. Special emphasis is placed on enhancing leadership skills and communication. Cadets have an opportunity to try out these leadership and management techniques in a supervised environment as juniors and seniors.

AS 335. Leadership Lab. 0 credits, 0 contact hours (0;0;0).

AS 336. POC Leadership Lab. 0 credits, 0 contact hours (0;0;0).

AS 401. Aeropsace Independent Study. 3 credits, 0 contact hours (0;0;0).

AS 443. National Security Affairs/Prep Act. 3 credits, 3 contact hours (3;0;0).
Prerequisite: AS 334 or approval of the Professor of Aerospace Studies. This course is designed for college seniors and gives them the foundation to understand their role as military officers in American society. It is an overview of the complex social and political issues facing the military profession and requires a measure of sophistication commensurate with the senior college level.

AS 444. Preparation for Active Duty. 3 credits, 3 contact hours (0;0;3).
Prerequisite: AS 443 or approval of the Professor of Aerospace Studies. This course is designed for college seniors and continues to give them the foundation to understand their role as military officers in American society. It is an overview of the complex social and political issues facing the military profession and requires a measure of sophistication commensurate with the senior college level.

BIOL 115. Evolution and Biology of Sex. 3 credits, 3 contact hours (3;0;0).
This course will examine the biological basis of sex determination and resultant gendered behavior in all animals, including humans. We will discuss how and why sex evolved, how different organisms express (& often change) their gender, and what selection pressures shape mating systems and mate selection. In addition, we will examine how gender-specific selection influences offspring care and attachment, aggression and friendship. Throughout the course, we will evaluate which principals can and cannot be extrapolated to human behavior as well as how we as humans project our ideas of gender onto our study of the natural world. We will critically discuss contemporary articles concerning gender in the popular media.

BIOL 150. Living in a Variable Universe. 4 credits, 6 contact hours (3;3;0).
This laboratory course uses real-world case studies and dramatic experimental examples from across the natural sciences to explore the origin, structure, perception and regulation of variability in the world. Why do we so often misunderstand the nature and consequences of variability? Why do our efforts to manage environment variability often fail? What are the benefits of variability? How can we plan more effectively for an uncertain future? Students will leave the course with a better understanding of how variability affects both themselves as individuals, and society at large. They will also be exposed to a broad sampling of different disciplines within the natural sciences, including physics, statistics, neuroscience, psychology, ecology, and geography.

BIOL 200. Concepts in Biology. 4 credits, 4 contact hours (4;0;0).
Prerequisites: MATH 107 or MATH 108 or Co-requisites: MATH 110, or MATH 111 or MATH 138. This course will introduce student to the study of biology at the beginning of their course of study. Central ideas in the biological sciences will be highlighted, with an emphasis on the process of scientific discovery and investigation. The course will provide the basis for more advanced coursework and learning experiences in the biological sciences as students delve into the curriculum of study.

BIOL 201. Found of Biol: Cell & Molecula. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 200 or R120 200 and CHEM 121 or CHEM 125. This course will expose students to an in-depth examination of the structure and function of cells; methods of study; thermodynamics and metabolism; membrane biology, energy utilization and transfer; protein and nucleic acid structure and function; transcription, translation, and genetic regulation. The laboratory course BIOL 202 must be taken concurrently, although they are separate courses.

BIOL 202. Found of Biol: Cell & Molecula. 1 credit, 3 contact hours (0;3;0).
Prerequisites: BIOL 200 or R120 200 and CHEM 121 or CHEM 125. Corequisite: BIOL 201. This course is a complement to the corresponding lecture course BIOL 201. The laboratory course will give students the opportunity to apply, in an experimental setting, the concepts that they are exploring in the accompanying lecture course and will offer them a hands-on experience that will enhance their learning of the Cellular and Molecular Biology content. Both courses (BIOL 201 and BIOL 202) must be taken concurrently.

BIOL 205. Foundations of Biology: Ecology and Evolution Lecture. 3 credits, 3 contact hours (3;0;0).
Prerequisite: BIOL 200 with a C or better, co-requisite BIOL 206. This introductory course considers the population level of biological organizations. Topics include Mendelian and population genetics, evolution, and ecology of populations and communities.

BIOL 206. Foundations of Biology: Ecology and Evolution Lab. 1 credit, 3 contact hours (0;3;0).
Prerequisite: BIOL 200 with a C or better, Co-requisite BIOL 205. The laboratory reinforces the topics covered in Foundations of Ecology and Evolution Lecture (Biol 205) lecture with hands-on activities and exposes students to current methods of research and analysis in these areas.

BIOL 222. Evolution. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This course will provide a comprehensive introduction to the field of evolutionary biology. Topics will include: the development of evolutionary theory, the history of the evolution of life on Earth, the genetic basis of variation and heredity, natural selection, evolution and development, and speciation.

BIOL 250. Biology of Neotropical Habitats: Ecuador and Galapagos Islands. 3 credits, 4 contact hours (2;2;0).
This course is an introduction to tropical biology and evolution held in Ecuador's Highlands, Rain Forest, and in the Galapagos islands. The course uses a hands-on approach to study the flora and fauna of these unique habitats. The course also addresses the history, politics, and culture of Ecuador, with emphasis on how these issues influence the management and sustainability of Ecuadorian natural resources.

BIOL 280. Ecology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 205 and BIOL 201. Overview of the science of ecology, which aims to understand interactions among biological species and among species and the abiotic environment. Topics include population ecology, species interactions, communities, and ecosystems. Topics will be addressed in light of global change including climate change, biodiversity loss, and impacts on human health and wellbeing.

BIOL 310. Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Departmental approval and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report.Note: Normal grading applies to this COOP Experience.

BIOL 315. Principles of Neurobiology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This course will review neuroscience concepts at a basic level. It will cover basics of cellular physiology, molecular biology and developmental biology of nerve cells, network physiology, behavior, cognition and memory and learning. This course will prepare students who are interested in a neuroscience sequence for their major.

BIOL 320. Discovering Biological Research. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102, (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. Success in the constantly evolving field of biology necessitates staying current in scientific literature. This requires competency in skills such as analysis of primary sources, synthesis of information from multiple sources, and oral and written communication skills. This course focuses on these competencies. Students will develop skills need to read and analyze scientific literature, and to communicate science. Each semester the content theme of the course will change depending on the expertise of the faculty member teaching the course.

BIOL 321. Comp Vertebrate Anatomy. 4 credits, 6 contact hours (3;3;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) and (PHYS 102 and PHYS 102A or PHYS 111 and PHYS 111A) with grade of C or better. This course introduces students to the groups of vertebrates and explores the anatomical evolution of vertebrates within the context of the functional interrelationships of organs and the changing environments to which vertebrates have adapted. An ideal entry point into the ways living creatures interact with their immediate physical world, we examine how the forms and activities of animals reflect the materials available to nature and consider rules for structural design under environmental forces.

BIOL 328. Ornithology - The Life of Birds. 3 credits, 5 contact hours (1;4;0).
Prerequisites: BIOL 205, BIOL 201. Ornithology is the study of birds and bird biology. Topics include bird observation and identification, evolutionary origins and biodiversity, form and function, behavior, reproduction, ecology, and conservation. This field/lab course will include numerous field trips to natural areas in New Jersey.

BIOL 337. Collective Intel in Biol Syst. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This course will provide an overview of the fundamental principles underlying the organization of animal and human societies. It will include detailed consideration of behavioral, social, and physical processes that are responsible for the coordination of activities in large animal and human groups and social.

BIOL 338. Ecology of the Dining Hall. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This course will use the examination of an on-campus ecosystem, the dining hall, as a framework for learning about a number of applied ecological concepts. We will investigate topics such as food webs, nutrient cycling, microbial ecology, and agroecology as they apply to the organisms and biological processes, present in our dining hall. Course work will involve extensive reading and discussion of scientific and popular literature, supplemented by regular class trips to the dining hall and related on-campus facilities.

BIOL 340. Mammalian Physiology. 4 credits, 6 contact hours (3;3;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This course will review general principles of the function of the human body as a mammal, with emphasis on the function and regulation of neuromuscular, cardiovascular, respiratory, endocrine, digestive, and excretory systems. The goal is to provide students with the basic knowledge to understand how their own bodies operate.

BIOL 342. Developmental Biology (Embryology). 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. Descriptive and experimental approaches to molecular, cellular and organismal changes during embryonic development; mechanisms of cell differentiation, organogenesis, morphogenesis, and pattern formation.

BIOL 347. Lab Approaches in Neuroscience. 4 credits, 6 contact hours (3;3;0).
Prerequisite: BIOL 315 Students will perform neurophysiological experiments, including assembling neurophysiological equipment, preparing neural tissues, selecting and presenting stimuli, recording, analyzing, and interpreting data. Students will perform experiments of increasing technical complexity. Each will reinforce theoretical and practical concepts related to the amplification and sampling of biopotentials. A lecture part will prepare the students for the concepts relevant to the lab day, and a data discussion meeting will aid the students in analyzing and presenting the data.

BIOL 350. Immunology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. The objective of this course is to facilitate an understanding of preliminary knowledge of the immune system in humans and other mammals. Students will be able to translate a basic understanding of the immune system and how that knowledge translates to further understanding medicine, research topics in cell biology, and broad topics in public health policy.

BIOL 352. Genetics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better.

BIOL 375. Conservation Biology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This course will provide a comprehensive introduction to the field of conservation biology, as well as philosophical and economic concerns.

BIOL 376. Biological Applications of Geographic Information Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 205, BIOL 201. This course offers an introduction to concepts underlying geographic information systems (GIS) and methods of managing and processing geographic information. The course is designed for students who have little background but want to learn the fundamentals and applications of GIS. The nature of geographic information, data models and structures for geographic information, geographic data input, data manipulation and data storage, spatial analytic and modeling techniques will be discussed. Students will be exposed to both theoretical knowledge and technical skills in this course. Assignments and a course project will promote students' application of concepts and skills in solving real-world problems.

BIOL 382. Animal Behavior. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 205 and BIOL 206 or R120 205 and R120 206) and (BIOL 201 and BIOL 202 or R120 201 and R120 202). The objective of this course is to expose students to the broad field of animal behavior. The course will include the historical underpinnings of the field as well as the contemporary theories for a wide variety of behaviors. Behavioral ecology and the evolution of animal behaviors as adaptations will be intertwined throughout the course, as well potential applications of knowledge about animal behavior. Students will be able to analyze existing evidence and investigate modern practices in order to evaluate existing theories and consider potential future directions of animal behavior. Using current scientific literature, as well as case-studies, students will be able to come up with their own hypotheses and determine how different hypotheses related to animal behavior can be tested experimentally. Students will also gain hands-on experience in trying out some of the fundamental techniques.

BIOL 383. Neural Basis of Behavior. 3 credits, 3 contact hours (3;0;0).
Prerequisite (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This lecture course explores the neural mechanisms underlying animal behavior. This course is intended for upper-level undergraduate students who have some background in biology, hence the prerequisite for Foundation of Biology. This courses would also be of interest to graduate students interested in neuroscience, such as, students in the Quantitative Neuroscience (QNS) program, students in the Integrative Neuroscience (INS) program, and students at the Center for Molecular and Behavioral Neuroscience (CMB). It is unnecessary for the students to have taken animal behavior or neurobiology; however, these courses would be helpful.

BIOL 400. Biology in Science Fiction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (R120 340 or BIOL 340) and (R120 355 or R120 356 or BIOL 352 or R120 352). Popular science fiction media will be utilized to initiate thinking critically and creatively about the biological sciences; from the molecular level to whole organism physiology. Students will explore the potential biology of fictitious organisms, and determine real-life analogues. These topics will be used as a vehicle to improve scientific writing and to apply biological knowledge in a new and unique way.

BIOL 410. Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: BIOL 310. Restriction: departmental approval and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic progam. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report.Note: Normal grading applies to this COOP Experience.

BIOL 423. Physiological Mechanisms. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 340 or R120 340 with a grade of C or better. This course will utilize clinical (pathological) case studies to reinforce physiologic knowledge and provide students a strong basis for future studies in biomedical and health related fields.

BIOL 424. Comparative Physiology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 340 or R120 340 or (R120 141 and R120 142) with grades of C or better. We will use a comparative approach to examine the physiology of animals including major physiological systems, with an emphasis on vertebrates. Topics to be covered include metabolic, temperature, osmotic and ionic regulation; respiration and circulatory transport, digestive, muscle, nervous, and locomotor systems; endocrine regulation and biological rhythms. We will further examine how physiological systems are integrated and thus allow animals to respond, physiologically, in different environment.

BIOL 432. Intro to Comp Neuroscience. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222; BIOL 315; BNFO 135 or CS 101 or CS 100 or CS 115 (grade C or better in all prerequisites), or permission by instructor. Introduction to the modeling, computational and analysis techniques for single neurons and small neuronal networks. This course will approach cellular and small network neuroscience beginning with a review and understanding of outstanding problems in neuroscience. The course work will then focus on students developing an independent modeling/computational project around which neuroscience concepts will be discussed. The required knowledge of electric circuits and numerical tools for the solution of differential equations will be introduced as needed.

BIOL 436. Advanced Neuroscience Modeling. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 432 or MATH 430 or permission by instructor. Modeling and computational analysis of biological neuronal networks. The course consists of lectures, and scientific paper presentations aimed at acquiring a clear understanding of the biological issues in systems neuroscience. Students will work on developing an independent modeling/computational project during the duration of the semester around which biological topics will be discussed.

BIOL 440. Cell Biology of Disease: Cells gone Bad!. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 340 or R120 340) and (R120 355 or R120 356) with a grade of C or better. This course will briefly review the normal physiology of mammals and humans and will then extensively explore the basis of many human diseases at the cellular level. The goal is to understand how alterations in normal functions of cells affect the function of the whole system by reviewing current research in the field of cell biology abnormalities.

BIOL 441. Neurophysiology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: R120 201 and R120 202 with a grade of C or better. This course will examine the physiology of neurons such as excitability, impulse conduction, synaptic communication and neural and synaptic plasticity. The objective is to provide students with a basic understanding of neural signaling and communication.

BIOL 443. Biology of Addiction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 201 and BIOL 202 (or R120 201 and R120 202), and BIOL 205 and BIOL 206 (or R120 205 and R120 206) with grade of C or better, or Permission of Instructor. This course will explore Substance Use Disorder from a biological viewpoint. The psychological, epidemiological, social and economical aspects of addiction will be touched upon as needed. The course will consist of several Modules that would be taught in parallel. The Modules include: ‘Psychopharmacology’, ‘The Structure and Function of the Nervous System’, ‘Neurotransmitters and Neuromodulators’, ‘Substances of Abuse’, and ‘What is Addiction?’ The goal is to provide students with a comprehensive understanding of biological mechanisms, both in the body and in the brain, that lead to and underlie Substance Use Disorder.

BIOL 445. Endocrinology. 3 credits, 3 contact hours (3;0;0).
Prerequisites:(BIOL 340 or R120 340)and (R120 355 or R120 356) with a grade of C or better. This course will discuss endocrinology from both an enatomical and physicologic view. We will discuss synthesis, distribution and regulation of the entire human endocrine system. The goal is to provide students with a basic knowledge of the complex endocrine system.

BIOL 447. Systems Neurobiology. 3 credits, 3 contact hours (3;0;0).
Prerequisite: BIOL 315 with a grade of C or better. This course will examine, from a systems perspective, phenomena that relate to neuronal network activity and behavior. Neuronal systems will be studied in detail. The overall goal of the course is to provide students with the basic knowledge of the neurobiological basis of behavior.

BIOL 448. Neuropathophysiology: Nervous System Gone Bad!. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 315 or BIOL 340 or R120 340 or BIOL 341 or R120 444 or BIOL 447 with a grade of C or better. This course will briefly examine the normal physiology of the nervous system and then would extensively explore the basis of many neuronal diseases. The goal is to understand how any alteration in normal functions of the nervous system affects the function of the whole system by reviewing current research in the field of nervous system abnormalities.

BIOL 451. Cell Physiology and Imaging. 4 credits, 4 contact hours (1;3;0).
Prerequisites: PHYS 111, PHYS 121 and R120 455. This course will examine celluar phenomena, such as subcellular structure, secretion, intracellular calcium regulation, etc., from a physiological perspective and using imaging techniques as a tool to understand them. Cell biology, and optics and the user of microscopes, will be discussed in detail.

BIOL 453. Applied Genetics & Genomics. 3 credits, 4 contact hours (3;1;0).
Prerequisites: BIOL 352 or R120 352. This is an advanced course in modern genetics and genomics. It offers students a class that presents a modern understanding of Genetic and genomic applications, given the ongoing explosion of technological developments in this field. An understanding of state-of-the-art genetics and genomics is indispensable for continuing education in fields that include but are not limited to: cell and molecular biology, clinical lab science, bio-mechanical engineering, biotechnology, agriculture, and medicine.

BIOL 462. Comparative Biomechanics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: R120 201, R120 202, BIOL 205 and BIOL 206 all with a C or better. This course takes a comprehensive look at the mechanical aspects of life. We will examine how the forms and activities of animals and plants reflect the materials available to nature, consider rules for fluid flow and structural design, and explore how organisms contend with environmental forces. Drawing on physics, we look at how animals swim and fly, modes of terrestrial locomotion, organism responses to winds and water currents, circulatory and suspension-feeding systems, the relationship between size and mechanical design, and the links between the properties of biological materials (eg spider silk, jellyfish jelly, and muscle) and their structural and functional roles.

BIOL 468. Disease Ecology & Evolution. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) and (MATH 111 or MATH 238) with grade of C or better. This course addresses those aspects of ecology and evolutionary biology most relevant to understanding the origin, dynamics and treatment of disease (both infectious and hereditary/genetic). The class will be a mixture of lecture and discussion of case studies. Material covered will include biology, mathematical models, and some aspects of human behavior.

BIOL 470. Dynamic Princ in Systems BIOL. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222, and BNFO 135 or CS 100 or CS 115 grade C or better, or permission by instructor. Introduction to the dynamic and computational modeling of biological systems, including chemical, biochemical, metabolic and genetic networks. The course includes the description of basic principles and case studies and provides the necessary mathematical and computational tools to understand the mechanisms underlying the dynamics of this type of networks. The necessary knowledge on the biology will be introduced during the course.

BIOL 475. Ecological Field Methods and Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisites: R120 280 or R120 370 with a C or better and permission of instructor. This field-orientated class will study animal and plant communities using a combination of field, laboratory and theory work. The goal of this course is to understand ecological principles and to introduce students to modern methodology for field work, the techniques and instruments used, as well as the theoretical basis for their application. Students will collect data, analyze them and report the results in written and oral format.

BIOL 484. Evolution of Animal Behavior Laboratory. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. A lab course focusing on research in Animal Behavior. This course will cover foraging, predator avoidance, territoriality, and mate choice. Labs will be inquiry based with students designing experiments to test hypotheses concerning aspects of animal behavior.

BIOL 491. Research and Independent Study. 3 credits, 3 contact hours (0;0;3).
Restriction: Departmental approval required. Research in Biology. Each student works under the supervision of a Biology or associated faculty member. A research paper and poster are required.

BIOL 492. Research and Independent Study. 3 credits, 3 contact hours (0;0;3).
Restriction: Departmental approval required. Research in Biology. Each student works under the supervision of a Biology or associated faculty member.

BIOL 495. Honors Seminar in Biology. 3 credits, 3 contact hours (3;0;0).
Prerequisite: BIOL 320 with a grade of C or better. The honors seminar allows students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students will be required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. This course satisfies NJIT's Honors Capstone requirement.

BIOL 498. Special Topics in Biology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Permission by instructor. This course explores a special topic in biology.

CHEM 105. Applied Chemical Principles. 4 credits, 5 contact hours (3;2;0).
Prerequisite: high school algebra or equivalent. The fundamentals and relation of chemistry to living in today's society. Suitable laboratory experiments illustrate the course material. Not open to engineering or science students, or students who have completed a college level chemistry course.

CHEM 108. College Chemistry I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: a one-year college prep high school chemistry course, high school math including algebra and trigonometry. Delivered as a telecourse, the course provides the first of a two-semester sequence of college chemistry for high school students and other distance learners seeking college credit and/or preparation for the AP Examination. Matriculated undergraduates may not receive credit for this course.

CHEM 109. College Chemistry II. 3 credits, 4 contact hours (3;1;0).
Prerequisite: CHEM 108. A continuation of CHEM 108.

CHEM 121. Fundamentals of Chemical Principles I. 3 credits, 3 contact hours (3;0;0).
Introduces the basic concepts of chemistry, including chemical reactions, and bonding, electronic and molecular structure, gases and thermochemistry. Students requiring lab should also register for lab CHEM 125A.

CHEM 122. Fundamentals of Chemical Principles II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHEM 121 with a grade C or better. Continuation of the CHEM 121 sequence. Introduces the basic concepts of chemistry, including equilibrium, chemical kinetics, thermodynamics, electrochemistry, and nuclear chemistry.

CHEM 125. General Chemistry I. 3 credits, 3 contact hours (3;0;0).
Co-requisite: MATH 110 or higher. The first semester of a two-semester sequence in chemistry. Introduces the basic concepts of chemistry, including chemical reactions and bonding, electronic and molecular structure, gases, and thermochemistry. Students requiring lab should also register for lab CHEM 125A.

CHEM 125A. General Chemistry Lab I. 1 credit, 3 contact hours (0;3;0).
Corequisites: CHEM 125 or CHEM 121. General Chemistry Lab I is a laboratory course; it is designed to be taken currently with CHEM 125 or CHEM 121. Instructions are in the lab manual and concepts are from the text and lecture of the CHEM 125/CHEM 121 courses. The experiments are designed to provide undergraduate students with practical experience and train students with laboratory techniques/equipment common to chemistry laboratories.

CHEM 126. General Chemistry II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 110 or higher and CHEM 125 or CHEM 121 with a C or better. The second semester of a two-semester sequence in chemistry. Introduces the basic concepts of chemistry, including equilibrium, chemical kinetics, thermodynamics, and electrochemistry. Students requiring 2 semesters of Chemistry lab should also register for lab CHEM 126A.

CHEM 126A. Gen Chemistry Lab II. 1 credit, 3 contact hours (0;3;0).
Prerequisites: CHEM 125A with a grade of C or better. Corequisites: CHEM 126 or CHEM 122. This new course is designed to be taken concurrently with CHEM 126. Instructions are in the lab manual and concepts are from the text and lecture of the CHEM 126. The experiments are designed to provide undergraduate students with practical experience and techniques in the chemistry laboratory. Also they will help students understand the underlying concepts covered in the lecture course.

CHEM 210. Frontiers in Chemistry. 1 credit, 1 contact hour (1;0;0).
Prerequisites: CHEM 125 or CHEM 121. Restrictions: Sophomore standing. Offers CES students to come together and learn about the different subdisciplines within the department. This course will give them an opportunity to learn about the research projects of various CES faculty. The course will provide students with opportunities to enhance their understanding of classroom knowledge through research presentation from internal and external invited speakers. Through exposure to research methods, the course will also introduce them to pathways for students to engage in undergraduate research.

CHEM 221. Analytical Chemical Methods. 2 credits, 4 contact hours (0;4;0).
Corequisite: CHEM 222. Laboratory introducing quantitative chemical analyses by gravimetry, titration, spectroscopy, chromatography, and potentiometry.

CHEM 222. Analytical Chemistry. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (CHEM 122 or CHEM 126), CHEM 124 or (CHEM 125A and CHEM 126A) with grade of C or better. Lecture course introducing concepts of chemical analyses by gravimetry, titration, spectroscopy, chromatography, and potentiometry.

CHEM 231. Physical Chemistry I. 3 credits, 4 contact hours (3;0;1).
Prerequisites: CHEM 122 or CHEM 126 , PHYS 111 and MATH 211 or MATH 213 or MATH 309 with a grade of C or better. The topics covered include the properties of ideal and non-ideal gases and liquids, solutions, thermochemistry, thermodynamics, the phase rule, and phase equilibria.

CHEM 235. Physical Chemistry II. 3 credits, 4 contact hours (3;0;1).
Prerequisite: CHEM 231 with a grade of C or better. A continuation of CHEM 231. The topics include homogeneous and heterogeneous chemical equilibria, ionic equilibria, electrochemistry, kinetic theory of gases, transport phenomena, kinetics, and irreversible processes.

CHEM 235A. Physical Chemistry II Laboratory. 2 credits, 4 contact hours (0;4;0).
Prerequisites: CHEM 221, CHEM 235 with a grade of C or better. Corequisite: MATH 225 (special section for chemical engineering and chemistry majors). Laboratory experiments apply and extend the basic knowledge of physical chemistry acquired in the lecture. Reports and presentations are an essential part of the course.

CHEM 236. Physical Chemistry for Chemical Engineers. 4 credits, 5 contact hours (4;0;1).
Prerequisites: (CHEM 122 or CHEM 126) and CHEM 125A and (CHE 230 or CHE 232) with a grade C or better. This course will introduce the chemical engineering students to the concepts of order, disorder, chemical equilibrium and phase equilibrium. Credit for this course will not be given if credit for CHEM 235 has been given.

CHEM 238. Analytical/Organic Chem Lab for Chemical Engineers. 2 credits, 4 contact hours (0;4;0).
Prerequisites: CHEM 124 and CHEM 245 with a grade of C or better. This course will offer the CHE students experience in organic and analytical laboratory experiments. These experiments will reinforce concepts learned in the organic chemistry lecture classes. This laboratory course will also provide exposure to analytical and other techniques useful in the chemistry and chemical engineering laboratories.

CHEM 243. Organic Chemistry I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 122 or CHEM 126 with a grade of C or better. Systematic study of the theories, principles and applications of Organic Chemistry. This course covers topics such as bonding theories and structure, conformations and stereochemistry, and functional groups like alkanes, alkenes, and alkynes. This course will also cover topics such as spectroscopy and mass spectrometry.

CHEM 244. Organic Chemistry II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHEM 243 with a grade of C or better. The second semester in the two-semester Organic Chemistry sequence. Systematic study of the theories, principles, applications and techniques of Organic Chemistry. The course will cover topics such as alcohols, conjugated and aromatic compounds, carbonyl derivatives and amines.

CHEM 244A. Organic Chemistry I Laboratory. 2 credits, 4 contact hours (0;4;0).
Prerequisites: CHEM 125A or CHEM 124 with a grade C or better. Corequisites: CHEM 245 or CHEM 243. Synthesis, purification and characterization of organic compounds are performed. Students will learn techniques such as multi-step synthesis, distillation, crystallization, separation and chromatography. Techniques such as UV, IR, NMR and mass spectrometry will be used for compound characterization.

CHEM 245. Organic Chemistry for Chemical Engineers. 4 credits, 5 contact hours (4;0;1).
Prerequisites: CHEM 126 or CHEM 122 with a grade of C or better. This course is a one-semester course(opposed to classic two-semester sequence) to provide chemical engineering students with a basic understanding of organic compounds and their reactions.

CHEM 246A. Organic Chemistry Laboratory. 4 credits, 4 contact hours (0;4;0).
Prerequisite: CHEM 244A with a grade of C or better. This course will cover some common reaction types that are not included in CHEM 244A. The experiments will be carried out in microscale. Students will learn new concepts in organic synthesis, including multi-step synthesis, organometallic reagents, and green chemistry for chemical synthesis, catalytic reactions, protecting groups, and peptide couplings. NMR and IR will be used for compound characterization.

CHEM 301. Chemical Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisites: high school algebra and trigonometry or equivalent with a grade of C or better. Designed for engineering technology majors. Not open to students who have completed a college level chemistry course. Covers principles of chemistry, with a focus on chemical energetics and chemistry of materials. Suitable laboratory experiments illus-trate the course material.

CHEM 310. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Restriction: completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report. Cannot be used for degree credit.Note: Normal grading applies to this COOP Experience.

CHEM 311. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: CHEM 310 with a grade C or better.

CHEM 336. Quantum Chemistry. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222 and CHEM 126 with a grade of C or better. An introduction to quantum mechanics, statistical mechanics, spectroscopy, and solid state.

CHEM 339. Analytical/Physical Chem Lab for Chemical Engineers. 2 credits, 4 contact hours (0;4;0).
Prerequisites: CHEM 236 with grade C or better. Co-requisite: MATH 225 This course will offer students an introduction to physical and analytical chemistry laboratory techniques. The application of principles learned in lecture will be reinforced by the experiments done in this lab. They will also provide exposure to analytical and other techniques used in chemistry and chemical engineering.

CHEM 340. Chemistry of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 244 or CHEM 245 with a grade of C or better. Covers chemistry of materials and introduces relevant concepts of bonding and structure. Topics covered include the crystalline solid state, bonding and thermodynamics, semiconductors/electronic materials, nanoscale materials, biomaterials, chemistry at interfaces, characterization techniques, and application of materials in devices.

CHEM 360. Environmental Chemistry of Air Pollution and Climate Change. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126 or CHEM 122 with a grade of C or better. Chemistry of the environment with emphasis on the atmosphere. Included are an introduction to the composition and chemistry of the natural and polluted atmosphere, thermodynamics and kinetics of atmospheric reactions, indoor and outdoor air pollution, air quality and its impact on human health, air quality regulations, and climate change. Examples of specific environmental issues covered in this course are the stratospheric ozone depletion, classical and photochemical smog, acid rain, and climate change.

CHEM 361. Environmental Chemistry of Water and Soil Pollution. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 360 or one of the following courses (CHEM 222, CHEM 231, CHEM 236, CHEM 243, CHEM 245) with a grade of C or better. Chemistry of the environment, including the hydrosphere and geosphere. Principles of physical, inorganic, and organic chemistry are applied to understand the origins of environmental pollutants, their transport, distribution, and decomposition pathways in water and soil environments.

CHEM 391. Research and Independent Study. 3 credits, 3 contact hours (0;0;3).
Restriction: Junior standing in Chemistry. Provides an opportunity to work on a reserch project under the individual guidance of a member of the department.

CHEM 412. Inorganic Chemistry. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHEM 244 with a grade of C or better. The course covers structure, bonding, properties, and reactivity in inorganic chemistry. Topics covered will include inorganic structure/bonding, molecular orbitals, coordination chemistry, organometallic chemistry, catalysis, symmetry, and group theory.

CHEM 437. Applications of Computational Chemistry and Molecular Modeling. 3 credits, 3 contact hours (3;0;0).
This class introduces students to applications and fundamental aspects of computational chemistry and molecular modeling for application and understanding in organic, bio- or physical chemistry. It is an introductory course involving hands-on applications of computational chemistry and molecular modeling. The course provides training application and computer programs for students to use in determining fundamental thermochemical parameters, elementary reaction paths, and design of molecular structures to try and optimize and/or improve biochemical / pharmaceutical products or industrial chemical processes. Students will use chemical software packages to perform calculations in order to identify optimum interaction structures for pharmaceutical or industrial chemical systems. The course teaches the student to evaluate relative energy of different structures plus chemical species stability, reactivity and equilibrium rations in chemical environments. The course is relevant to organic, inorganic, physical bio- and pharmaceutical chemistry. It is also relevant to optimization of chemical engineering processes.

CHEM 473. Biochemistry. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHEM 244 or CHEM 245 with a grade of C or better. Covers the fundamentals of biochemistry including buffers, blood, proteins, enzymes, carbohydrates, fats, and nucleic acids. Emphasis on the relationship of biochemistry to biotechnology and medicine.

CHEM 474. Biochemistry II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHEM 473 with grade of C or better. This course focuses on transducing and storing energy, synthesizing the molecules of life, and responding to environmental changes. Topics include concepts of metabolism, glycolysis, gluconeogenesis, citric acid cycle, oxidative phosphorylation, photosynthesis, fatty acid metabolism, protein turnover, amino acid catabolism, biosynthesis of amino acids, DNA replication and recombination, RNA synthesis and processing, protein synthesis, gene expression control, immune system, and drug development.

CHEM 475. Biochemistry Lab I. 2 credits, 4 contact hours (0;4;0).
Prerequisites: CHEM 244 or CHEM 473 with a grade of C or better. This course will offer the chemistry and related (chemical engineering, biology, bioinformatics, bioengineering)students fundamental laboratory approaches for biochemistry and biotechnology. These experiments will reinforce concepts learned in biochemistry lecture classes.

CHEM 480. Instrumental Analysis. 2 credits, 4 contact hours (0;4;0).
Prerequisites: CHEM 221, CHEM 222 or equivalent with a grade of C or better. Laboratory exploring the principles of operation of modern instruments for chemical analysis. Ultra-violet and infrared spectroscopy, mass spectrometry, gas chromatography, high performance liquid chromatography, voltametry, and potentiometry are among the instruments utilized. Apply calibration methods, statistical data treatment, and sample preparation techniques are applied.

CHEM 490. Special Topics in Chemistry. 3 credits, 3 contact hours (3;0;0).
Prerequisite: depends upon the nature of the course given. Course is offered in specific areas as interest develops.

CHEM 491. Research and Independent Study I. 3 credits, 3 contact hours (0;0;3).
Prerequisite: senior standing in chemistry or chemical engineering. Provides an opportunity to work on a research project under the individual guidance of a member of the department.

CHEM 492. Research and Independent Study II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: CHEM 491 with a grade of C or better. A continuation of CHEM 491.

COM 200. Communicating in Organizations. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a co-requisite. Allows students to understand the need for writing in an information-based corporate culture. Students write intensively in a variety of forms for a variety of audiences. Attention is given to editing, graphic design, communications ethics, and desktop publishing. At the conclusion of the course, students prepare a portfolio of their work. This course satisfies the three credit 200 GER in History and Humanities.

COM 303. Video Narrative. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Introduces various multimedia resources and environments in order to develop new strategies for both reading and writing within a visually-based, screen-oriented culture. Students will study different historical and theoretical lineages in videography, and learn hands-on techniques and technologies to produce independent media works of their own. This course satisfies the three credit 300 GER in History and Humanities.

COM 310. Interpersonal Communication. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course surveys theory and research related to interpersonal communication. The course focuses on effectively managing personal and professional relationships. The course's format consists of lectures, group discussions, experiential activities, and written assignments that require students' active involvement. This course satisfies the three credit 300 GER in History and Humanities.

COM 312. Oral Presentations. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Instruction and practice in effective oral presentations. Students deliver a wide range of presentations adapted to the needs of a variety of audiences. Topics include voice and diction, presentation skills, the effective use of visual aids, reporting technical material and audience analysis. This course satisfies the three credit 300 GER in History and Humanities.

COM 313. Technical Writing. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An advanced writing course. Combines current theory with actual practice to prepare students as technical writers. Analyze complex communication situations and design appropriate responses through tasks that involve problem solving, rhetorical theory, document design, oral presentations, writing teams, audience awareness, ethical considerations, and gender equity issues. This course satisfies the three credit 300 GER in History and Humanities.

COM 314. Theory of Rhetoric. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines theories of rhetoric from ancient to contemporary times. Special attention is paid to Aristotle, Peter Ramus, James Kinneavy, Walter Ong, and Jurgen Habermas. Focuses on the ways in which theories inform the practice of communication. In the course project, students design and conduct field research based on rhetorical theory. This course satisfies the three credit 300 GER in History and Humanities.

COM 315. Environmental Communication. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. COM 315 (Environmental Communication) concentrates on effective communication through a close study of contemporary writing and film about the environment. To refine and strengthen students' abilities as sharp observers and effective communicators, the course will examine rhetorical decisions made across a variety of genres—including recent journalism, personal essays, documentaries, and digital works—centered on issues surrounding the environmental crisis. This course satisfies the three credit 300 GER in History and Humanities.

COM 316. Creative Writing. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Focuses on the complexities of creating literary texts. Analyzes student writing in genres such as fiction, creative non-fiction, poetry, and drama. Considers these genres from theoretical perspectives. Topics include character development, plot, dialogue; meter, rhyme, figurative language; audience analysis, ethos, and narrative theory. Students write, edit and critique their own work with the aim of publication. This course satisfies the three credit 300 GER in History and Humanities.

COM 317. Advanced Composition. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Involves composing in-depth, persuasive research essays designed to address the aims of discourse (expressive, referential, literary, and persuasive), using current media tools (text, graphics, audio, animation and video) and venues (print and electronic), in several iterations. This course satisfies the three credit 300 GER in History and Humanities.

COM 318. Communication Theory. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course will introduce students to communication theory and practice. The course begins with a review of contemporary communication theory. After covering five selected theories - semiotic, visual, cultural, social, and reception, students will be required to apply a selected theory to a computer-mediated case study. Students will also be required to perform a collaborative field study. Through the course, students will be expected to read critically, to research peer-reviewed sources thoroughly, to present effective oral briefings, and to write analytic reports. This course satisfies the three credit 300 GER in History and Humanities.

COM 319. Technical, Professional and Scientific Writing for Publication. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The purpose of this course is to acquaint students with samples from significant technical, professional and scientific writing, sharpen skills in identifying theses and the major supporting elements in these works, while making judgments on their contributions. In addition, students will be required to demonstrate their ability to do the necessary research to integrate related sources other than the assigned texts. This course satisfies the three credit 300 GER in History and Humanities.

COM 321. Technology & Tactics of Sound. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The course offers students an effective primer in the science of how sound has been measured and understood historically as a media format. This course satisfies the three credit 300 GER in History and Humanities.

COM 323. Mobile Media Making. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Through hands-on writing, interviewing, videography, and photography supervised by the instructor, students develop competencies in discovering, developing and using a variety of skills using their cell phone for information gathering, archiving, and presentation to present publishable narratives. Special focus on using cell phone based technologies to document, record, create and produce narratives in a variety of media. Particular emphasis is placed on the creative process, planning, revision and editing to a completed product. This course satisfies the three credit 300 GER in History and Humanities.

COM 324. Podcast Practicum. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with a grade of C or better. In recent years, the digital media/network communications practice known as podcasting has gained much attention and popularity. This primary objective of this course is to guide students through the practice of preparing, organizing, and producing a series of thematically orchestrated podcasts, specifically focusing on teaching students to use the hardware and software that enables them to compose, edit, and publish online podcasts on subjects corresponding to their own interests and research. As a practicum, the bulk of the course emphasizes, and is dedicated to, applying the multiple compositional processes and audio engineering necessary to complete the tasks involved with creating works in this particular media format.

COM 325. Special Topics in Communication. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course. This course satisfies the three credit 300 GER in History and Humanities.

COM 337. Photojournalism. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Through hands-on writing and photography supervised by the instructor, students develop competencies in discovering and creating an interdisciplinary viewpoint using a variety of writing methods and photographic viewpoints. Special focus on interpreting architecture and architectural detail, nature's conflict and place in urban and suburban environs, and the human interface with nature and man-made spaces. Particular emphasis is placed on the creative process and critical revision. This course satisfies the three credit 300 GER in History and Humanities.

COM 338. The Newsroom. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This is an advanced journalism course. Students will work closely with the instructor in order to write news and feature stories, commentaries and critiques, and will be encouraged to publish their work in The Vector and other publications. This course satisfies the three credit 300 GER in History and Humanities.

COM 339. Practical Journalism. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A descriptive and analytic survey of news systems. Assignments include practice in writing straight news items, sports writing, feature writing, science writing, interviewing, and editing with emphasis on understanding methods. The survey of printed and broadcast news systems includes the influence of technological, economic, legal, ethical, and historical factors. This course satisfies the three credit 300 GER in History and Humanities.

COM 341. Documentary Film and Media. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or better, and one 200-level Cultural History GER course with a grade of C or higher. This course investigates a broad genre of media we've come to call 'documentary.' It looks at the origins of documentary filmmaking, investigates a range of mostly contemporary works, and looks critically at the truth-promises and reality-expectations that surround documentary. The course engages with complex questions of aesthetics, ethics, propaganda, and performance while simultaneously interrogating our own responses.

COM 342. Media and the Body. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or better, and one 200-level Cultural Literacy GER course with a grade of C or higher. This course is grounded in forms of audio-visual media — especially moving images — that represent and impact human bodies, those of both its subjects and its spectators. But at the same time, our field of inquiry will be broadened by thinking through the ways that the body is itself a mediating force. Medium, by definition, refers to something that's "in a middle position" or "facilitates transmission" — a reminder that the study of media is, at heart, the study of states of between-ness, and can help us think through embodiment and representation in essential ways. The course probes the creative and theoretical possibilities that emerge when we move our bodies — as thinkers, readers, writers, media-makers and spectators — into the foreground.

COM 350. Digital Video Production. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Instruction in the creation and editing of non-linear digital video; emphasis on team production of a short film; individual editing skills with Final Cut Pro editing software; development and editing of a variety of graphic formats and digital images; formulation of a script treatment; and development of a storyboard. Topics covered include: digital multi-media production; web-casting; interactive television; data-casting; CD and DVD production. This course satisfies the three credit 300 GER in History and Humanities.

COM 351. Documentary Studies. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course will allow students to study the methods by which documentary work is conducted and to complete a documentary project of their own. The course will connect the qualitative methods of the social sciences and the humanistic concerns of the arts by allowing students to study documentary subjects as captured by non-fiction, photography, film, tape recorder, and the World Wide Web. Special emphasis will be placed on narrative and metaphor. This course satisfies the three credit 300 GER in History and Humanities.

COM 353. Composing Documents for Print. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Explores information structuring via print and digital media; how computer technology has influenced the ways in which information is presented in modern culture. Focuses on the optimal ways to prepare and present information for technical and commercial use. Important concepts such as visual literacy and effective design are discussed and addressed. This course satisfies the three credit 300 GER in History and Humanities.

COM 354. Composing Documents for the Web. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Seminar and laboratory-based course designed for BA/BS majors; open to others with appropriate backgrounds and interests and permission of instructor. Follow up of COM 353, explores information structuring via digital media, and how computer technology has influenced the ways in which information is presented in contemporary culture. Through guided interactive research, presents information for technical, commercial, and artistic use. Projects involve use of HTML editors, NJIT networks, and graphical and animation software. This course satisfies the three credit 300 GER in History and Humanities.

COM 355. Cybertext. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Through theoretical readings and electronic research, students explore and compare information structuring in print and digital media, particularly how digital technology influences the dynamics of text. Interactivity, visual communication and developments in the realm of cybernetics are addressed in the course. Materials presented in creative, technical and commercial areas were studied. This course satisfies the three credit 300 GER in History and Humanities.

COM 369. Digital Poetry. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An investigation of activities taken up by poets who integrate computer technology in their works. Students discuss and evaluate virtues of the dynamics presented in an array of titles that include algorithmic programming, graphical artistry, videography, holography, hypermedia, and sonic design in order to build an understanding of the combined values of these disparate forms of expression. This course satisfies the three credit 300 GER in History and Humanities.

COM 390. Electronic Writing Workshop. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A practice-oriented workshop for creative expression in a variety of electronic formats with the specific goal of facilitating individual writing projects for screen and performance. Topics in literary theory will be combined with current criticism in electronic writing, media and screen studies to produce new cultural works in a variety of digital sub-genres, including soundscapes, hypertext poetry, animation, code poems, interactive games, digital video and wiki poems. This course satisfies the three credit 300 GER in History and Humanities.

COM 490. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments are facilitated and approved by the co-op office. Requires mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

COM 491. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments are facilitated and approved by the co-op office. Requires mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

COM 496. Senior Project-Communication and Media. 2 credits, 4 contact hours (0;0;4).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Intended for Communication and Media majors only. For professional and technical communication majors only. Provides students with a capstone experience. Offers PTC students the opportunity to enhance their understanding of communication through their integration of skills and knowledge gained in prior courses. The resultant research thesis or field project, of substantial length and originality, represents the culmination of the undergraduate disciplinary experience. Utilizing both a seminar and workshop approach, entails intense and sustained collaboration between student and instructor, and cooperation among students.

ENGL 090. General Skills in the English Language. 5 credits, 5 contact hours (5;0;0).
Prerequisites: None. Intended for students whose native language is not English and who need practice in speaking, listening, reading, and writing in English prior to enrolling in ENGL 096. Extensive activities to develop grammar and expand vocabulary. Frequent speaking practice in small groups and oral presentations. Practice in understanding and taking notes on academic lectures. Small class size and weekly individual tutoring sessions ensure students receive individualized attention.

ENGL 096. Reading, Writing, Critical Thinking. 6 credits, 6 contact hours (6;0;0).
Prerequisites: None, unless placement test result requires ENGL 090. The first course of the two-semester composition sequence ENGL 096 - ENGL 100. Intended for students for whom English is a second language. Emphasizes reading strategies, building vocabulary, grammar, developing a thesis, organizing an essay, editing and writing different kinds of expository essays. Frequent oral presentations. Weekly writing labs are held in conjunction with the course work.

ENGL 099. Reading, Writing, Language. 3 credits, 3 contact hours (3;0;0).
Prerequisites: None. Focuses on developing the reading and writing skills necessary for success in a college curriculum, including structuring and organizing effective sentences and paragraphs; preparing summaries; expanding vocabulary; developing grammatical fluency; formulating a thesis, and other steps toward writing expository essays. Students develop skills in evaluating, editing, and proofreading their writing. Intensive work in developing college-level reading skills. Gives attention to specific needs of students whose native language is not English as well as of native speakers of English. Small class size ensures students receive individualized attention.

ENGL 100. English Composition: Introduction to Academic Reading and Writing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Entrance is determined by placement test or completion of ENGL 096 with a grade of C or higher. Intended for students whose first language is not English but who have advanced level English language skills. Emphasizes writing college-level text-based essays, reading strategies, and advanced critical thinking. Special attention to strengthening skills in analysis and argumentation. Advanced vocabulary and grammar. Extensive practice in editing (proofreading) and revision skills. Frequent oral presentations. Some attention to rhetorical analysis and basic documentation. Small class size and weekly individual tutoring sessions ensure students receive individualized attention. Passing this course with a grade of C or higher satisfies the ENGL 101 General Education Requirement (GER).

ENGL 101. English Composition: Introduction to Academic Writing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Entrance is determined by placement-test score or completion of ENGL 099 with a grade of C or higher. This course provides an introduction to college-level writing, particularly the rhetorical dimensions of composition, including purpose, audience, occasion, and genre. The course also focuses on the writing process, asking students to brainstorm topics, to write drafts, and to revise their writing based on reflection and peer feedback. Activities in the course involve reading challenging articles, essays, and prose and considering paintings, films, and other visual compositions. Additionally, students work to analyze claims, to formulate independent arguments, and to communicate ideas through clear, well-organized writing.

ENGL 102. English Composition: Introduction to Writing for Research. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 100 with a grade of C or higher or ENGL 101 with a grade of C or higher. This course builds on the skills students learned and practiced in ENGL 101 and provides an introduction to writing using both primary and secondary sources. Emphasis is on developing research questions, finding and citing sources, conducting primary research, and synthesizing elements of research into persuasive arguments. Students also complete this course knowing how to correctly document and attribute sources.

EPS 202. Society, Technology, and the Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENGL 101. Uses case studies to examine the relationships between the creation and use of technologies, the human and natural environment, and the development of social and cultural institutions. Its central theme is the manner in which human society structures the environment in which it lives: nature and culture, city and country, civilization and development. This course satisfies 3 credits of the Basic Social Sciences GUR. Honors Note: See HSS 101.

EPS 312. Technology and Policy in Contemporary America. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101, HSS 202 or their equivalents; two from HSS 211, HSS 212, HIST 213 or their equivalents. A study of technology and politics in recent America. Focuses on the role of the federal government in shaping technology, especially through funding technological innovations and applications. Topics will include the origins of technology policy in World War II, the influence of the Cold War, the science and technology policy advisory system, and political and cultural influences on technology policy. Honors Note: See HSS 101.

EPS 313. Environmental History and Policy. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101, HSS 202 or their equivalents; two from HSS 211, HSS 212, HIST 213 or their equivalents. Covers the rise of the modern environmental debate, and examines its current priorities and values, politics and economics, and impacts on industry and society. Students review the role of regulatory agencies, private industry, public interest groups, and the media. Current major issues in New Jersey are considered, as well as environmental debate on a national and global level. Honors Note: See HSS 101.

EPS 362. Environmental Economics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101, HSS 202, SS 201 or their equivalents. Presents a detailed overview of the relationship between political economy and the environment. Draws on diverse case studies including global warming, harvesting of minerals on the ocean's floor, destruction of old growth forests, and contamination of the -nation's water, air, and soils. Explores the economic remedies to the fast-changing relationship between society and nature. Honors Note: See HSS 101.

EPS 380. Policy Issues in the Coastal Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101, HSS 202 or their equivalents; two from HSS 211, HSS 212, HIST 213 or their equivalents. An examination of coastal environments from the standpoint of the scientist, the engineer, and the resource manager. Topics include beach and shoreline characteristics, technological innovations to address coastal erosion problems, and current debates in coastal policy and resource management. Case studies are used to illustrate coastal management practices and the scientific, technical, and social constraint to policy formulation.

EPS 381. Field Techniques and Research. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101, HSS 202 or their equivalents; two from HSS 211, HSS 212, Hist 213 or their equivalents.; STS 307. An introduction to research methods. The objectives of the course are to provide opportunity to pursue specialized, in-depth research in a subfield of science, technology and society of the student's choice; to develop skills in problem identification, research design and problem solving; to increase familiarity with methods of data analysis; to strengthen library research skills; to provide an opportunity to gather original field data in a team-oriented environment; and to improve oral and written communication skills.

EVSC 125. Fundamentals of Environmental Sciences. 3 credits, 3 contact hours (3;0;0).
An introductory course that will present freshman EVSC students with general concepts and topics on Environment, including chemistry, ecosystems, geological and soil resources, water quality, agricultural and Environment, atmosphere, noise and ionizing radiation.

EVSC 325. Energy and Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 125 with a grade C or better and PHYS 111 with grade C or better. An advanced course to instruct EVSC students, topics on energy and environmental issues such as introduction to energy, natural energy conservation, environmental issues of energy production and consumption, regulation and legislation related to energy, public policy development in energy and environment.

EVSC 335. Environmental Law. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENGL 102 with a grade of C or better. The prerequisite is a college ability to communicate competently in the English language including the ability to research and prepare essay compositions and to articulate the major points in a presentation format. The introduction to Environmental Law will cover the regulatory system developed over time that has forged a complex system of environmental rules influencing industrial and other private and public actions that impact the environment. The course will review these rules from the vantage point of the practicing technical environmental engineer and scientist. Students will become familiar with the background and derivation of these laws as well as the major operational features such as environmental permits and enforcement. Several major environmental cases will be analyzed that give definition to the key features of these laws. Each class module will direct itself to the practical application of these laws.

EVSC 340. Environmental Health and Safety. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126. This course includes an interdisciplinary review of fundamental scientific principles necessary to understand basic environmental health science. Basic science and engineering knowledge is applied to the recognition, evaluation and control of physical, chemical and biological processes that influence human health and welfare. The impact of contaminants ranging from industrial pollutants to biological agents and environmental disease vectors will be analyzed. This course is based on the premise that exposures to the environmental stressors that cause harm can be recognized through the observation of environmental quality parameters and mitigated by source controls and pollution prevention.

EVSC 375. Environmental Biology. 3 credits, 3 contact hours (3;0;0).
An introductory ecological approach to understanding man's impact and dependence on the natural environment. Broad topics include ecosystems, nutrient cycles, pollution, pest management, conservation of natural resources, energy, and human population.

EVSC 381. Geomorphology. 3 credits, 3 contact hours (3;0;0).
This is a course in geomorphology, the study of landforms and the contemporary processes that create and modify them. The course will emphasize earth surface processes and quantitative analysis of landform change. Lectures will stress geomorphic principles and two field-based problems will enable students to apply these principles to contemporary geomorphic problems in engineering and management with a focus on the natural environment.

EVSC 385. Environmental Microbiology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: R120 101 and R120 102, or BIOL 205 and BIOL 206, with grade of C or better. The main goals of this course are to present an overview of the important microbes involved in environmental microbiology, to discuss the environments where they are found, to learn how they are detected and monitored, and to describe their effects on humans. Lectures and exams will be supplemented with discussions of experimental design and data interpretation by reading current research articles.

EVSC 391. Research and Independent Study. 3 credits, 3 contact hours (0;0;3).
Provides an opportunity to work on a research project under the individual guidance of a member of the department.

EVSC 416. Environmental Toxicology. 3 credits, 3 contact hours (3;0;0).
The course is intended to explore the general principles of toxicology and apply them to the assessment of acute, subacute and chronic effects of hazardous and toxic chemicals. Qualitative and quantitative measures of toxicity and testing protocols are addressed. The role of toxicology in risk assessment and risk management is discussed.

EVSC 484. Environmental Analysis. 3 credits, 4 contact hours (2;2;0).
The analysis of environmental samples is studied from the acquisition of representative samples, through sample handling, chain of custody, sample storage, analytical method selection, analysis, and data treatment.

EVSC 490. Special Topics in Environmental Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: This will depend upon the course given. The course will be offered in specific areas as interest develops.

FRSC 201. Intro to Forensic Science. 3 credits, 3 contact hours (3;0;0).
This course explores the scientific and legal praxis of forensic science. Forensic science is an integral and important part of the legal system by providing investigators credible science to corroborate or refute statements, and offering factual reports of scientific-based findings to a trial judge and jury. Students will be introduced to the science behind examination techniques used in forensic science labs. Guest lecturers and practitioners will offer insights into their day-to-day investigative and technological challenges and success.

FRSC 307. Crime Scene Investigation &Lab. 4 credits, 5 contact hours (3;2;0).
Prerequisite: FRSC 201. Overview and analysis of the cardinal principles and techniques of crime scene investigation, with an emphasis on a rigorous scientific approach. Students will be introduced to: documentation with notes, sketches, and photography; specialized techniques for the recognition and enhancement of physical evidence; preparation and maintenance of case folders; communication of results and preparation of formal reports; management of resources, including equipment and personnel; and ethics and bias in criminalistics.

FRSC 359. Physical Methods of Forensic Analysis & Lab. 4 credits, 6 contact hours (2;4;0).
Prerequisites: FRSC 201; FRSC 307 (FRSC 307 may be taken as a co-requisite). This course is designed to prepare undergraduate students in the forensic science program for impression, pattern, and trace evidence analysis. Students will learn the principles of criminalistics, proper evaluation and comparison of impression evidence, and the theory and practical application of forensic microscopy to the analysis of unknown materials. There will be an emphasis on the necessity of an objective and rigorous scientific approach to forensic investigations.

FRSC 475. Forensic Chemistry & Lab. 4 credits, 6 contact hours (2;4;0).
Prerequisite: CHEM 221. Forensic Chemistry is the application of modern analytical chemistry to matters of law. This course will describe methods of analysis commonly performed in forensic laboratories for the analysis of controlled substances, forensic toxicology, fire debris analysis, trace evidence, and other types of evidence. The laboratory component of the course will prepare students for forensic science careers with practical examples of commonly performed tests and examinations.

FRSC 479. Forensic Biology & Lab. 4 credits, 6 contact hours (2;4;0).
Prerequisite: BIOL 352. Forensic Biology will expose students to Forensic Serology and Forensic DNA. It covers the different types of analyses that are performed in forensic biology sections of crime laboratories. The course will introduce students to human identity testing, focusing on the theory, methods, procedures and statistics associated with this forensic science. The course also contains a weekly laboratory component.

FRSC 480. Forensic Microscopy & Lab. 4 credits, 6 contact hours (2;4;0).
Prerequisite: CHEM 221. This course provides students with the basic knowledge and skills necessary to explore the application of microscopy to the forensic sciences. This course incorporates lectures and laboratory exercises organized in a format to engage each registrant in the analytical and investigative roles of the light microscope in the forensic professions. The general topics and techniques covered in this course include microscope nomenclature, alignment and focus, microscopic sample handling, and photographic documentation of samples.

FRSC 490. Co-op Work Experience. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Senior standing and departmental approval. Students gain major-related work experience and reinforcement of their academic program. Work assignments are facilitated and approved by the co-op office. Requires mandatory participation in seminars and completion of a report. Note: Normal grading applies to this co-op experience.

FRSC 491. Research & Indep Study I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Senior standing and departmental approval. Research in forensic science. Each student works under the supervision of a forensic science or associated faculty member. A research paper or poster are required.

FRSC 495. Senior Seminar. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Senior standing and departmental approval. Offers forensic science students the opportunity to enhance their understanding of professional practice through their integration of skills and knowledge gained in prior courses. The resultant research paper and presentation represents the culmination of the undergraduate disciplinary experience. Guest speakers will be invited to present on topics relevant to their area of expertise within the field of forensic science.

FRSC 498. Special Topics in Forensic Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Permission of instructor. Special topics course in the field of forensic science.

HIST 2. History Elective. 3 credits, 3 contact hours (3;0;0).**
This designation is used primarily to designate a course transferred from another school, judged to be acceptable, but without a specific NJIT or Rutgers-Newark equivalent. This course satisfies the three credit 200 GER in History and Humanities.

HIST 213. The Twentieth-Century World. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENGL 101 with a grade C or better, and pre- or co-requisite ENGL 102 with a grade C or better. Uses case studies to provide an interdisciplinary view of the 20th-century world. Selected literary, philosophical, and artistic movements are discussed in the context of the major historical developments of the century. This course satisfies the three credit 200 GER in History and Humanities.

HIST 214. Tech & Cult in Amer History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 with a grade of C or better, ENGL 102 pre- or co-requisite with a grade of C or better. This course examines the relationship between technology and society throughout the history of the United States. We analyze the roles and impacts of major technological innovations within their cultural and historical contexts, seeking to understand how these contexts shaped and were shaped by these technologies. This course satisfies the three credit 200 GER in History and Humanities.

HIST 310. Co-op in Law, Technology, Culture and History I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENGL 102 and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Students gain work experience related to their major in Law, Technology and Culture. Work assignments are facilitated and approved by the co-op office. Requires mandatory participation in seminars and completion of a report. This course may not be used to satisfy either of the three credit 300 level GER in History and Humanities.

HIST 311. Co-op in Law, Technology, Culture and History II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENGL 102 and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Students gain work experience related to their major in Law, Technology and Culture. Work assignments are facilitated and approved by the co-op office. Requires mandatory participation in seminars and completion of a report. This course may not be used to satisfy either of the three credit 300 level GER in History and Humanities.

HIST 312. Prof Development in Law. 1 credit, 1 contact hour (1;0;0).
Prerequisite: Sophomore standing. This course is designed to enhance professional development for students who hope to attend law school or another graduate program. It will provide students with the skills necessary to apply to, be accepted into, and succeed in law school or other graduate program. It will meet workshop-style for three hours for five weeks. This course may not be used to satisfy either of the three credit 300 level GER in History and Humanities.

HIST 320. Law and Evidence. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade C or higher and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. This course considers the philosophical and technical question of what constitutes evidence in the US legal system. This course satisfies the three credit 300 GER in History and Humanities.

HIST 329. Dante: Hell, Heaven, and Medieval Florence. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines the work of Dante Alighieri in the cultural context (intellectual, religious, literary, social, political, and artistic) of his contemporary Florence. Students will read a range of primary source materials, including the "Divine Comedy." This is a digital history course and students will construct and analyze a geographic database. This course satisfies the three credit 300 GER in History and Humanities.

HIST 334. Environmental History of North America. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade C or higher and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. The history of interactions between humans and their natural environment on the North American Continent. Considers perceptions of, use of, and alteration of the environment. Traces the cultural, intellectual, economic, political and technological transformations from early colonial times to the late 20th century. Addresses the diverse environmentalisms that have emerged the last several decades. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 338. Environmental Justice and Climate Change in America. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade C or higher and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. The history of interactions between humans and their natural environment on the North American Continent. Considers perceptions of, use of, and alteration of the environment. Traces the cultural, intellectual, economic, political and technological transformations from early colonial times to the late 20th century. Addresses the diverse environmentalisms that have emerged the last several decades. Examines the history of environmental inequality within the United States, especially in poor and minority communities, as well as the rise of the environmental justice movement during the post-World War II period. Considers the numerous historical causes of environmental discrimination along with the strategies undertaken by local communities to alleviate such inequality. Topics include analysis of grassroots organizing, legal strategies, and policy implementation focused on fostering a more environmentally just society. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 341. The American Experience. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade C or higher and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. American history from the colonies to the 20th century, with concentration on several selected themes basic to an understanding of the changing cultural patterns and social values of American civilization. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 342. Civil Rights Revolution and Law. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. This course will examine what historians have been identifying as the civil rights revolution—the moment in the twentieth century when a host of interest groups began pursuing rights through the court system. We will begin by examining African Americans’ campaign to gain civil rights through the courts and how political action supported and sometimes even exceeded this process. We will then examine how African Americans’ success inspired or shored up the claims of other groups—including women, Chicanos, Asian Americans, Native Americans, LGBTQ people, disabled people, and others—to pursue their rights in courts as well. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 343. African-American History I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Introduction to African-American history from pre-colonial West Africa to emancipation in the mid-19th century. Topics include the African slave trade, the economics and politics of slavery, gender and culture in the slave community, and the free black experience in both the north and south. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 344. African-American History II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Introduction to African-American history from the mid-19th century to the present. Covers race relations and the civil rights movement, as well as migration, black social and political thought, gender roles, and class formation. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 345. Communication through the Ages. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Modes of communication, ancient and modern, in their social and cultural context, from cave paintings to computers. Topics include literacy and economic development in the West; the technological revolution in media beginning with Daguerre, Samuel Morse, and Alexander Graham Bell; the institutional development of mass media and popular culture; and contemporary trends in world communication and interaction. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 351. Ancient Greece and the Persian Empire. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. The political, institutional, and cultural developments of Ancient Greece and the Persian Empire from the Mycenaean period to the King's Peace (386 B.C.). This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 352. The Hellenistic States and the Roman Republic. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. The political and cultural developments of the Hellenistic states and their influence on the Republic of Rome to 30 B.C. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 361. The Founding of the American Nation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. North America in the colonial and revolutionary periods, with emphasis on patterns of cultural and institutional development from early settlement through the ratification of the Constitution. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 362. Sex, Gender, and the Law in American History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines how the US legal system has dealt with the problems of sex and gender. Surveys laws that dictated different roles for men and women as well as seemingly gender-neutral laws that affected men and women differently. Tracks the designation of sexual acts as legal or illegal and the ways that race, class, and nationality complicated these relationships. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 363. The United States as a World Power. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. American domestic and foreign policy in the 20th century. Topics include imperialism, the Progressive Era, the Depression, the New Deal, World Wars I and II, the Cold War, America and the world today. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 364. American Law in the World. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Concerns the history of American law as a product and catalyst of world politics by considering in global context the transformation of central doctrines of regulation, property rights, and civil liberties from the Declaration of Independence through the War on Terror. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 365. Science and Technology in the Global South. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. A comparative analysis of the relationship between expanding Western nations and selected regions of Africa, Asia, and South America, from 1500 to 1970. A case study approach illuminates key historical processes, with a special emphasis on economic development and cultural change in colonial settings. Topics include European perceptions of culturally different peoples, race relations in colonial societies, forms of rebellion and resistance to European rule, nationalist movements. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 366. Gender, Race and Identity in American History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Surveys the social construction of gender in America from the s17th century to the present. Examines the changing gender roles and relations that have characterized and structured the historical experiences of different racial and ethnic groups. In a multicultural framework, covers the impact that colonization, industrialization, slavery, immigration and migration, urbanization, war, and social movements have had on the ways that women and men think of themselves in terms of gender as well as their respective roles in families and larger social networks. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 367. International Law and Diplomacy in History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines the origins, evolution, and application of diplomacy and international law from the 15th century to the present. Topics include the rise of modern diplomacy in Renaissance Italy; the emergence of international law and professionalization of diplomacy in early modern Europe; the development of international law and diplomatic theory in the 18th and 19th centuries; the codification of international law; and adaptation of international law to transnationalism and globalism in the 20th century. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 369. Law and Society in History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Uses historical case studies to illustrate and evaluate various approaches to the study of law and society. Topics include criminality and the rise of incarceration as a legal penalty in the 19th century; the comparative law of slavery; and the evolution of American Indian law. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 370. Legal issues in the History of Media. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Investigates the development and impact of media law and policy in the United States. Examines how media law and policy affect media content, industry behavior, and consumer rights. Analyzes the values and ideas, as well as political and cultural contexts that have guided continuities and transformations in media law and policy. Topics include indecency and obscenity, copyright and intellectual property, legal protections for children, and media ownership regulation. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 372. Contemporary Europe. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. European society in the 20th century, Nationalism, imperialism, totalitarianism, movements toward European unity, and prominent cultural developments. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 373. The Rise of Modern Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines the development of modern science in the western world from the origins of the Scientific Revolution to 1900. Explores how science challenged the revealed universe of Christianity, changed the curriculum in schools and universities, and altered the world view of philosophers. This course covers the achievements of Copernicus, Galileo, Newton, Darwin, Einstein, and other leading scientific innovators, but it also weaves the expansion of scientific knowledge into the larger fabric of European intellectual history. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 374. Modern Russian Civilization. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Russia under the last tsars, the 1917 upheavals, the rise of the Soviet state to world power under Lenin, Stalin, and others, until the collapse of the communist dictatorship. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 375. Legal Issues in Environmental History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines the role of law in the formation of human relationships with the natural world. The course will focus on the management and regulation of the human use of natural resources in a variety of historical contexts, but particularly in the United States from colonial times to the present. Through readings and class discussion, students will explore a number of recurring themes, including the transformation from customary rules governing access to local resources to state enforced laws. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 377. Cities in History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines social, cultural and economic changes in urban areas. Regions and themes vary and may include urbanization in Europe, the rise of cities in Latin America, and urban change in contemporary America. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 378. Medicine and Health Law in Modern America. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines the legal and ethical aspects of medical and public health practice in the United States from 1900 to the present. Topics include the rights and responsibilities of physicians and patients, the roles of government in promoting health, the rise of health law and bioethics, the tensions between civil liberties and public health, as well as evolving notions of harm, liability, uncertainty, and proof as they relate to the history of medical and public health practice. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 379. History of Medicine. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Focuses on the evolving institutions, values, concepts, and techniques through which doctors attempted to control the impact of disease and preserve the health of Americans, beginning with the shaman and colonial physician through post-World War II changes in the system of medical care. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 380. History of Public Health. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Attempts to protect the health of human populations from the Black Death in medieval Europe to recent threats from epidemics and chemical and biological terrorism. Shifting patterns of disease and the emergence and growth of public health as a domain of expert knowledge and policy. Topics include epidemiology and statistical modes of inquiry; the tension between civil liberties and public health; the economics of health and disease; and the relationship between medicine and public health. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 381. Sci & Tech In Modern Medicine. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines how science and technology came to play critical roles in the rise of modern medicine. Readings, lectures, and discussions focus on the specific innovations in ideas, practices, and technologies that helped transform Western medicine in the 19th and 20th centuries. The course also considers how medicine and the biomedical sciences both inform and reflect attitudes about the human body in Western society. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 382. War and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. The evolution of warfare and the impact of war on political, economic, cultural, and social institutions, including the two World Wars and post-1945 conflicts. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 383. The Making of Modern Thought. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. The formation of contemporary images of human nature since the mid-19th century. Emphasis on Marx, Darwin, and Freud and their legacy to 20th century thought. Theories of the family, sexuality and the changing role of women in society are explored. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 384. Invention and Regulation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. This course examines how the law has affected technological development in the United States from its founding to today. We cover four broad technical categories: industrialization, transportation, communication, information technology. We analyze the invention of technology within issues of patent and copyright, funding and regulation of technology through legislation, and legal challenges to technology. Our goal is to understand change in law and technology in historical and cultural context. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 385. Technology and Society in European and World History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. An introduction to the social history of European and global tech-nology from the Middle Ages to the second Industrial Revolution of the late 19th century. Emphasis on such themes as the process of tech-nological innovation, the nature of technological systems, the diffusion of technology, the interaction of Western and non-Western technology, the changing relations of science and technology, and the role of technology in broader historical movements. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 386. Technology in American History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Survey of the history of American technology emphasizing the social and economic environments of technological change. Topics include the transfer of technology in building canals and cities, the rise of the factory system, the emergence of the American system of manufacture, and the development of major technological systems such as the railroad, telegraph, electric light and power, and automobile production and use. Focus on the professionalization of engineering practice, the industrialization of invention, and the growing links between engineers and corporate capitalism in the 20th century. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 387. Computers, Innovators and Hist. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. This course traces the development of computer technology from its theoretical origins in the 19th century, through the transformation from analog to digital computers and the emergence of personal computing in the 20th century, up to the present. Topics include the place of computer technology in society, how computers & people shape each other, who & what was involved in innovating computers, the cultural context of such innovation, as well as how the uses and users of computers have evolved. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 388. Britain in the 20th Century. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Survey of British history from the death of Queen Victoria (1901) to that of Diana, Princess of Wales (1997); emphasis on Britain’s social, cultural and political transformation. Topics include causes and impact of the World Wars, the turn from Empire to Europe, rise and critique of the welfare state, and foreign relations. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 390. Historical Problems of the 20th Century through Film. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. A study of selected problems in the 20th century using film as a window into history. Such topics as the rise of Nazi Germany, America in the thirties, World War II and American society, the development of cities, and the emergence of the Third World will be considered. In any one semester only two topics will be selected for study. The material for the course will include documentary films, newsreels, TV news films, and theatrical feature films as well as selected readings. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 391. Industrial Revolution in World. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. This course covers the Industrial Revolution from its emergence in Britain in the 18th century to its expansion to America, Western Europe, and Japan. Topics include the practical need for new forms of power, links between invention, empire, the impact of technical advance on the labor force, colonialism and slavery, and 19th century socio-cultural change. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 395. Research Methods in Law and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Law threads through every aspect of society: it permits and prohibits human behaviors, it enables and invalidates official actions, and it protects and prosecutes citizens. This course explore the social complexity of law through original research. Students will learn how to trace the connections between law and society using interdisciplinary humanities and social science approaches. Readings span several theoretical, disciplinary, and interdisciplinary perspectives that include history, sociology, anthropology, political science, economics, psychology, and cultural studies. The readings will guide the student's original research on what law is and how it operates in relation to society. The course facilitates student understanding of the relationships between social, cultural, political, and economic forces on the one hand, and legal rules, practices, and outcomes, on the other. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 401. Independent Study. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher in addition to junior or senior standing; and before registering, permission from one of the following: NJIT history department chairperson or history major or minor advisor. Pursuit of special interests in history not covered in a regular elective course. A history faculty member provides guidance and assigns readings and papers. Note: Normal grading applies.

HIST 402. Independent Study. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher in addition to junior or senior standing; and before registering, permission from one of the following: NJIT history department chairperson, or history major or minor advisor. Pursuit of special interests in history not covered in a regular elective course. A history faculty member provides guidance and assigns readings and papers.

HIST 489. Seminar - Readings. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher, an upper level History course (3 credits) and senior standing. Intended to combine study of specific topics, which vary each year, with attention to the methods for researching and writing history, these small classes for history majors in their senior year prepare students for the following semester's research project and culminate in a brief paper describing a proposed topic and the historical documents and sources to be used.

HIST 490. Seminar - Research. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher, an upper level history course, R510 315 or R510 316 Perspectives in History, and HSS 404 History Senior Seminar. This one-semester-long seminar allows students to apply the skills they learn in the History major to specific topics that vary semester by semester. In these small classes, students conduct research with attention to historical methods. With close guidance from instructors, students explore local archives, design a paper topic of their individual interest in conjunction with the professor, and write a research paper.

HSS 404. Humanities, History and Social Sciences Senior Seminar. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. Restrictions: Registration requires senior standing. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students are required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HSS 405. Humanities Senior Seminar - Philosophy. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. Restrictions: Registration requires senior standing. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students will be required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HSS 406. Humanities Senior Seminar - English. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. Restrictions: Registration requires senior standing. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students will be required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HSS 407. Humanities Senior Seminar - Theater. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. Restrictions: Registration requires senior standing. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students will be required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HSS 408. Humanities Senior Seminar - Science, Technology, and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. Restrictions: Registration requires senior standing. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students will be required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HSS 409. Humanities Senior Seminar - Social Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students will be required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HSS 410. Humanities and Social Sciences Senior Seminar. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. Restrictions: Registration requires senior standing. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students are required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HUM 2. Humanities Elective. 3 credits, 3 contact hours (3;0;0).**

HUM 211. The Pre-Modern World. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101 and HUM 102 with a grade of C or higher; HUM 102 may be taken concurrently as a co-requisite. Case studies focus on differing forms of material culture, belief systems, aesthetic norms, and artistic productions to develop an understanding of ancient and medieval world views. This course satisfies the three credit 200 GER in History and Humanities.

HUM 212. The Modern World. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101 and HUM 102 with a grade of C or higher; HUM 102 may be taken concurrently as a co-requisite. Uses case studies to examine such key processes as the expansion of global trade and the formation of a global economy, European perceptions of non-Western cultures, and the roots and legacy of imperialism. This course satisfies the three credit 200 GER in History and Humanities.

HUM 232. Introduction to Film. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 with a C or higher. Corequisites: ENGL 102 with a C or higher, ENGL 102 may be taken concurrently as a co-requisite. An introduction to film studies, this course focuses on close verbal and visual analysis, and on critical writing. Students will consider a number of culturally and aesthetically significant films; make claims about how a film’s content and form connect; and find and present evidence for such claims, becoming familiar with essential cinematographic techniques. Students will carefully consider their own writing at a slow pace, thereby refining their ability to communicate persuasively in a variety of settings.

LIT 230. Introduction to Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with a C or higher; ENGL 102 may be taken concurrently as a co-requisite. An introduction to literary studies, this course focuses on close reading and critical writing. Students will investigate and reflect on standard literary genres; make claims about how the content and form of each connect; find and present evidence for such claims. Students will carefully consider their own writing at a slow pace to understand, ultimately, how a literary text operates as a work of art, as well as to learn how to communicate powerfully and persuasively in a variety of settings. This course satisfies the three credit 200 GER in History and Humanities.

LIT 320. American Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A survey of major works of American literature. Provides a foundation for understanding the currents of American thought and experiences. Special emphasis is paid to American literature within a global context. This course satisfies the three credit 300 GER in History and Humanities.

LIT 321. British Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A survey of the major works of British literature. Provides a foundation for understanding the currents of British thought and experience. Special emphasis is paid to British literature within a global context. This course satisfies the three credit 300 GER in History and Humanities.

LIT 330. World Literature I: North America, Latin America and the Caribbean, Australia and Oceania. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Enhances understanding of other cultures and of past and contemporary global interactions. This course satisfies the three credit 300 GER in History and Humanities.

LIT 331. World Literature II: Africa and the Middle East, Asia, and Europe. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Enhances the under-standing of other cultures and of past and contemporary global interactions. This course satisfies the three credit 300 GER in History and Humanities.

LIT 340. Contemporary Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Focuses on the study of literary works published within the last ten years. Considers how contemporary issues and problems are addressed in a variety of literary works. This course satisfies the three credit 300 GER in History and Humanities.

LIT 350. Fiction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Explores the short story and the novel from varied countries and eras. Emphasis is given to narrative methods, representative themes, and global perspectives. This course satisfies the three credit 300 GER in History and Humanities.

LIT 352. 20th Century European Fiction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines themes ranging from war and occupation, revolution, Fascism, and Communism to individual liberation and self-discovery, existentialism, absurdism, and feminism. This course satisfies the three credit 300 GER in History and Humanities.

LIT 355. Poetry. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Explores the problems, devices, and techniques of poetry's sound, rhythm, meter; diction and tone; connotation, metaphor, and symbol? as a means of demystifying the reading of poems. Emphasis is given to the place and purpose of poetry in a technological society. This course satisfies the three credit 300 GER in History and Humanities.

LIT 361. 20th Century American Drama. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines the development of 20th century American drama with emphasis on the ways, often experimental, in which the playwrights reflect the spirit of the times. This course satisfies the three credit 300 GER in History and Humanities.

LIT 364. Modern Continental and British Drama. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An examination of some of the dramas from the late nineteenth and twentieth centuries with the purpose of gaining some understanding of how dramatists, in both subject matter and technique, reflect the spirit of the times. Representative playwrights include Ibsen, Shaw, Wilde, Strindberg, Synge, Chekhov, O'Casey, Pirandello, Anouilh, Brecht, Ionesco, and Pinter. This course satisfies the three credit 300 GER in History and Humanities.

LIT 365. Non-Fiction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines the ways that writers examine cultural issues through the use of literary non-fiction. Emphasis is placed on autobiographical, persuasive, and narrative techniques. This course satisfies the three credit 300 GER in History and Humanities.

LIT 370. Literature and Diversity. 3 credits, 3 contact hours (3;0;0).

LIT 372. African-American Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Allows students to explore themes and styles particular to literary works by and about African-Americans. This course satisfies the three credit 300 GER in History and Humanities.

LIT 374. Women and Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Allows students to explore literature by and about women from around the world. Special attention is paid to autobiographical narratives. This course satisfies the three credit 300 GER in History and Humanities.

LIT 376. Latin America through Art and Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course explores Latin American cultures through literature, film, music, and other art forms. It examines how twentieth and twenty-first century writers and artists responded to major social and political changes. Special attention is given to involvement of the United States in Latin America, immigration narratives, and issues involving individual and group identity. Knowledge of Spanish is not required; the course is taught in English. This course satisfies the three credit 300 GER in History and Humanities.

LIT 378. Literature and Nature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Literature as it reveals and interprets the natural world. Examines the ways that nature has been used in fiction, drama, poetry, and non-fiction. Students learn to describe the natural world in their writing. Co-listed as STS 378. This course satisfies the three credit 300 GER in History and Humanities.

LIT 380. Historical Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Sources of fiction and drama are often based on historical personalities and actual incidents. Examines a number of such works. Original historical material is compared with the literary work it inspired, thus providing insights into the nature of the creative process and the purposes of the historian and the creative writer. This course satisfies the three credit 300 GER in History and Humanities.

LIT 382. The Comic Tradition in English and American Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Presents great comic works from the 14th century to the present. Students study verse narratives, plays, novels, and essays. Emphasis is given to the classical roots and international connections of the comic tradition in English, the relationship between form and function in comedy, and elucidation of comedy's social and philosophical ends. This course satisfies the three credit 300 GER in History and Humanities.

LIT 386. Science Fiction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Explores the distinctive characteristics of science fiction as a literary genre and its function as a social criticism. Special attention is given to the ways in which cultural gender coding surfaces in the text. Films and videos are used. This course satisfies the three credit 300 GER in History and Humanities.

LIT 388. The Russian Novel and Short Story. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Focuses on Russian fiction of the 19th and 20th centuries. Approaches material both as evidence of artistic vision and as social documents of Russian history. This course satisfies the three credit 300 GER in History and Humanities.

MATH 101. Foundations of Mathematics for the Liberal Arts. 3 credits, 3 contact hours (3;0;0).
Intended for students in degree programs offered by HSS and History. This course reviews principles of algebra and the foundations of mathematics. Degree credit awarded for degrees offered by HUM and HIST.

MATH 102. Modern Pre-calculus. 6 credits, 6 contact hours (6;0;0).
This course is an intensive non-traditional approach to pre-calculus employing curriculum innovations for the preparation of students for college calculus. The course infuses calculus techniques into the pre-calculus curriculum. The format includes both regular class and workshop environments with a focus on student problem solving. Course meets on Saturdays in the fall and spring terms and M, T, W, R in the summer, second session. This course is only available to high school students.

MATH 105. Elementary Probability and Statistics. 3 credits, 3 contact hours (3;0;0).
Consider notions of probability. Topics include the binomial and normal distributions, expected value, and variance. The notions of sampling, hypothesis testing, and confidence intervals are applied to elementary situations.

MATH 107. University Mathematics A. 3 credits, 3 contact hours (3;0;0).
Linear functions, equations, inequalities, systems of linear equations, quadratic equations elementary functions, graphing functions.

MATH 108. University Mathematics B. 4 credits, 5 contact hours (4;0;1).
Intended for students whose major requires MATH 111. Linear functions, equations, inequalities, systems of linear equations, quadratic equations, polynomials, rational expressions, expressions involving radicals, partial fraction decomposition, conic sections, graphing functions.

MATH 110. University Mathematics B II - Trigonometry. 4 credits, 5 contact hours (4;0;1).
Intended for students whose major requires MATH 111. Prerequisite: MATH 108 or placement by performance on standardized entrance examinations. Trigonometric functions and identities, laws of sines and cosines, logarithmic equations, systems of nonlinear equations, polar coordinates.

MATH 111. Calculus I. 4 credits, 5 contact hours (4;0;1).
Prerequisites: MATH 110 with a grade of C or better or placement by performance on standardized entrance examinations. Topics include limits, differentiation, applications of differentiation, and integration.

MATH 112. Calculus II. 4 credits, 5 contact hours (4;0;1).
Prerequisite: MATH 111 with a grade of C or better. Topics include integration, applications of integration, series, exponential and logarithmic functions, transcendental functions, polar coordinates, and conic sections.

MATH 113. Finite Mathematics and Calculus I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: (Intended for Architecture students.) MATH 107 with a grade of C or better, or MATH 110 with a grade of C or better, or NJIT placement. An introduction to differential and integral calculus. Applications include area, volumes, curve lengths, surface area, centroids, and moments. Focus is on application throughout the course.

MATH 120. Basic Concepts in Statistics. 1 credit, 1 contact hour (1;0;0).
The course offers an introduction to the basic concepts in statistics. Topics include the role of statistics, data summary, normal distribution, elements of probability, and computation of mean and variance. This course will also include an introduction to statistical estimation and inference.

MATH 135. Calculus for Business. 3 credits, 3 contact hours (3;0;0).
Intended for students with major offered by SOM. Prerequisite: MATH 107 with a grade of C or better or MATH 110 with a grade of C or better or NJIT placement. An introduction to mathematics of business, principles of differential and integral calculus, and optimization.

MATH 138. General Calculus I. 3 credits, 3 contact hours (3;0;0).
Intended for students who are not in Science or in Engineering. Prerequisite: MATH 107 with a grade of C or better, or MATH 110 with a grade of C or better or NJIT placement. An introduction to differential and integral calculus of a single variable.

MATH 161. Calculus I for Computing. 4 credits, 5 contact hours (4;0;1).
Prerequisites: MATH 110 with a grade of C or placement by performance on standardized entrance examinations. Corequisite: CS 100. A calculus course with the same core content as MATH 111 but with an emphasis on building foundations for computing rather than differential equations.
The course is characterized by an emphasis on symbolic computing over numerical computing. Topics include limits, differentiation, applications of differentiation, and integration. Student can not receive credit for both MATH 161 and MATH 111.

MATH 211. Calculus III A. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. Topics include vectors, curvature, partial derivatives, multiple integrals, line integrals, and Green's theorem. Students who are considering a major in Mathematical Sciences or who are undecided about their major should take MATH 213.

MATH 213. Calculus III B. 4 credits, 4 contact hours (4;0;0).
Prerequisite: MATH 112 with a grade of C or better. Topics include vectors, curvature, partial derivatives, multiple integrals, line integrals, and Green's, divergence, and Stokes' theorems.

MATH 222. Differential Equations. 4 credits, 4 contact hours (4;0;0).
Prerequisite: MATH 112 with a grade of C or better. Methods for solving ordinary differential equations are studied together with physical applications, Laplace transforms, numerical solutions, and series solutions.

MATH 225. Survey of Probability and Statistics. 1 credit, 1 contact hour (1;0;0).
Prerequisite: MATH 112 with a grade of C or better. Topics include descriptive statistics, elements of probability, random variables and distributions; mean and variance; introduction to estimation and inference. This course satisfies the Mathematics GUR in probability and statistics. However, degree credit will not be granted for both MATH 225 and any other upper level course in probability and/or statistics.

MATH 225A. Survey of Probability and Statistics. 1 credit, 1 contact hour (1;0;0).
Prerequisite: MATH 112 with a grade of C or better. Restriction: For Chemical Engineering students only. Topics include descriptive statistics, elements of probability, random variables and distributions; mean and variance; introduction to estimation and inference. This course satisfies the Mathematics GUR in probability and statistics. However, degree credit will not be granted for both MATH 225 and any other upper level course in probability and/or statistics.

MATH 226. Discrete Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. An introduction to discrete mathematics. An introduction to discrete mathematics. Topics include elementary set theory, logic, combinatorics, relations, and selections from graphs and trees and algebraic systems.

MATH 227. Mathematical Modeling. 3 credits, 4 contact hours (3;1;0).
Prerequisites: MATH 112 with a grade of C or better and CS 115 with a grade of C or better or CS 113 with a grade of C or better or CS 100 with a grade of C or better or CS 101 with a grade of C or better. An introduction to the theory and practice of mathematical modeling. Techniques include scaling and dimension, fitting of data, linear and exponential models, elementary dynamical systems, probability, optimization, Markov chain modeling. Models are drawn from applications including biology, physics, economics, finance, and chemistry.

MATH 238. General Calculus II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 138 with a grade of C or better or MATH 111 with a grade of C or better. A continuation of MATH 138. Topics include applications of integral calculus and an introduction to ordinary differential equations.

MATH 244. Introduction to Probability Theory. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. Topics include basic probability theory in discrete and continuous sample space, conditional probability and independence, Bayes' theorem and event trees, random variables and their distributions, joint distribution and notion of dependence, expected values and variance, moment generating functions, useful parametric families of distributions including binomial, geometric, hypergeometric, negative binomial, exponential, gamma, normal and their applications, simple case of central limit theorem and its uses.

MATH 279. Statistics and Probability for Engineers. 2 credits, 2 contact hours (2;0;0).
Prerequisite: MATH 112 with a grade of C or better. This course introduces methods of summarizing and analyzing engineering data and the importance of observing processes over time such as control charts. Descriptive statistics, plots and diagrams are then used to summarize the data. Elements of probability and random variables with their distributions along with mean and variance are taught. All this knowledge is then used as a platform towards covering how to do basic estimation and inference, including confidence intervals and hypothesis testing based on a single sample. Students taking this course cannot receive degree credit for MATH 225, MATH 244, or MATH 333.

MATH 305. Statistics for Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 111 with a grade of C or better or MATH 138 with a grade of C or better. (Intended for students in Engineering Technology) An introduction to the modern concepts of statistics needed by engineering technologists. Topics include organization of data, descriptive statistics, discrete and continuous probability distributions, sampling distribution and designs, estimation -- one and two populations, tests of hypotheses.

MATH 309. Mathematical Analysis for Technology. 4 credits, 4 contact hours (4;0;0).
Prerequisite: MATH 112 with a grade of C or better or MATH 238 with a grade of C or better. Emphasis on partial derivatives; vector calculus, and multiple integrals.

MATH 310. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Completion of the sophomore year, departmental approval, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

MATH 322. Differential Equations for Applications. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better or MATH 238 with a grade C or better. An applied science study using differential equations as the vehicle for comprehension of the unknown. Introduction to first-order differential equations and their applications to motion, cooling and electromechanical systems followed by higher order differential equations and their solutions. Study of methods of undetermined coefficients, variation of parameters, and many series and numerical methods. Includes Laplace transforms, matrix methods, and eigenvalue problems.

MATH 326. Discrete Analysis for Computer Engineers. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. An introduction to mathematical logic, Boolean algebra, and Karnaugh maps. Other topics include functions, equivalence relations and partially ordered sets, counting, graph theory and finite state machines. The emphasis is on computation but proofs will be addressed. Students cannot receive credit for both MATH 226 and MATH 326.

MATH 328. Mathematical Methods for Scientists and Engineers. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 with a grade of C or better, or MATH 213 with a grade of C or better. Corequisite: MATH 222. The course exposes students to concepts of mathematics encountered throughout the physical science and engineering disciplines. Topics include matrix algebra, vector analysis, complex numbers, and boundary value problems in partial differential equations.

MATH 331. Introduction to Partial Differential Equations. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 or MATH 213 and MATH 222 all with a grade of C or better. Partial differential equations in science and engineering. Topics include initial- and boundary-value problems for parabolic, hyperbolic, and elliptic second-order equations. Emphasis is placed on separation of variables, special functions, transform methods, and numerical techniques.

MATH 332. Introduction to Functions of a Complex Variable. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 or MATH 213 and MATH 222 all with a grade of C or better. Functions of a complex variable: Cauchy-Riemann equations, Cauchy-Goursat theorem, integration, series, residues, poles, geometrical aspects. Emphasis on techniques.

MATH 333. Probability and Statistics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. Descriptive statistics and statistical inference. Topics include discrete and continuous distributions of random variables, statistical inference for the mean and variance of populations, and graphical analysis of data.

MATH 334. Operations Research. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 244 with a grade of C or better or MATH 333 with a grade of C or better. Considers mathematical methods found especially in contemporary fields such as operations research and reliability engineering. Topics include linear programming, graph theory, finite mathematics, differential equations, matrices, and determinants.

MATH 335. Vector Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better. Algebra and calculus of vectors. Topics include the theorems of Gauss, Green, and Stokes, and curvilinear coordinates.

MATH 336. Applied Abstract Algebra. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. Classical algebra from a modern and constructive viewpoint. Emphasis is on the development of algorithmic and computational skills. Topics include rings, fields, and groups and their applications to science and engineering.

MATH 337. Linear Algebra. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. Matrices, determinants, systems of linear equations, vector spaces, linear transformations, eigenvalues, eigenvectors, and related topics.

MATH 340. Applied Numerical Methods. 3 credits, 4 contact hours (3;1;0).
Prerequisites: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better, and CS 100 with a grade of C or better or CS 101 with a grade of C or better or CS 113 with a grade of C or better or CS 115 with a grade of C or better. Introduction to numerical methods with emphasis on mathematical models. Implements and investigates numerical techniques for the solution of linear and nonlinear systems of equations, eigenvalue problems, interpolation and approximation, techniques of optimization, Monte Carlo methods, and applications to ordinary differential equations and integration.

MATH 341. Statistical Methods II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 244 with a grade of C or better or MATH 333 with a grade of C or better. Covers applications of classical statistical inference. Topics include transformation of variables, moment generating technique for distribution of variables, introduction to sampling distributions, point and interval estimation, maximum likelihood estimators, basic statistical hypotheses and tests of parametric hypotheses about means of normal populations, chi-square tests of homogeneity, independence, goodness-of-fit.

MATH 344. Regression Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 333 with a grade of C or better or MATH 341 with a grade of C or better. An introduction to statistical data analysis using regression techniques. Topics include least squares estimation, hypothesis testing, prediction, regression diagnostics, residual analysis, variance stabilizing transformations, regression using indicator variables, variable selection, and model building.

MATH 345. Multivariate Distributions. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 244 with a grade of C or better or MATH 333 with a grade of C or better. Topics include discrete and continuous multivariate distributions and their moments, multivariate distributions including multivariate normal and multinominal distributions, order statistics, conditional probability and the use of conditioning, discrete time Markov chains and their examples, discrete time branching processes, homogeneous and nonhomogeneous Poisson processes.

MATH 346. Mathematics of Finance I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. The main topics include basic problems in interest, annuities, certain amortization and sinking funds, bonds and related securities.

MATH 347. Mathematics of Finance II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 346 and MATH 244 or MATH 333 all with a grade of C or better. This course introduces mathematical models of bond and stock prices, which lead to arbitrage pricing of options and other derivative securities, and portfolio management. These areas of mathematical finance have a great impact on the way financial markets function. Topics include risk-free, and risky assets, portfolio management, futures, and options.

MATH 356. Loss Models. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 341 with a grade of C or better. This course will introduce a variety of frequency, severity, and aggregate models that are useful for actuarial applications. This will include analyzing data from applications, determining a suitable model, providing measures of confidence for decisions based on the model, and estimating losses.

MATH 371. Physiology And Medicine. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 222 with a grade of C or better. Mathematical models of organs and organ systems: the heart and circulation, gas exchange in the lungs, electrical properties of excitable membranes, neuro-biological clocks, the renal countercurrent mechanism, muscle mechanics. The biology is introduced with each topic. Emphasis is on quantitative problem solving, model building, and numerical simulation.

MATH 372. Population Biology. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 222 with a grade of C or better. Introduction to the mathematics of populations: Malthus' model of geometric population growth, Euler's renewal equations, age structure in human populations, predator satiation, chaos, mathematical models of inheritance, and the theory of epidemics. The ability to weave back and forth between physical concepts and mathematical notation is emphasized as well as the relationships between random and non-random models of similar phenomena.

MATH 373. Introduction to Mathematical Biology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better and MATH 222 with a grade of C or better. This course provides an introduction to the use of mathematical techniques applied to problems in biology. Discrete and continuous models of biological phenomena will be discussed. Biological topics discussed range from the subcellular molecular systems and cellular behavior to physiological problems, population biology and developmental biology. Techniques of phase plane analysis for differential equations are introduced in the course. No prior background in biology is necessary.

MATH 388. Introduction to Chaos Theory. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better. An elementary treatment of chaos theory and its applications concentrating on discrete dynamical systems. Uses theory and applications illustrated by computer experiments to develop such topics as bifurcation, attractors, the logistic map, period-doubling routes to chaos, symbolic dynamics, Sarkovskii's theorem, fractals, and Julia and Mandelbrot sets for complex dynamics.

MATH 391. Numerical Linear Algebra. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 337 with a grade of C or better and CS 113 with a grade of C or better or CS 115 with a grade of C or better or CS 101 with a grade of C or better or CS 100 with a grade of C or better. This course provides an introduction to computational linear algebra. Topics include direct solution of linear systems, iterative methods for linear systems, fast Fourier transforms, least squares problems, singular value decomposition and eigenvalue/eigenvector problems.

MATH 401. Undergraduate Research Seminar. 1 credit, 1 contact hour (0;0;1).
Research seminar intended for students who participate in year-long research projects. Methodologies and techniques needed for summer research projects are discussed. Presentations of current research topics are made by various faculty.

MATH 410. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: MATH 310 with a grade of C or better, departmental approval, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience. Mandatory participation in seminars and completion of requirements that include a report and/or project. Note: Normal grading applies to this COOP Experience.

MATH 430. Analytical and Computational Neuroscience. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better, and MATH 222 with a grade of C or better, and CS 100 with a grade of C or better or CS 113 with a grade of C or better or CS 115 with a grade of C or better or MATH 340 with a grade of C or better. A mathematical and computational introduction to the biophysical mechanisms that underlie physiological functions of single neurons and synapses. Topics include voltage-dependent channel gating mechanisms, the Hodgkin-Huxley model for membrane excitability, repetitive and burst firing, nerve impulse propagation in axons and dendrites, single- and multi-compartmental modeling, synaptic transmission, calcium handling dynamics and calcium dependent currents and processes.

MATH 431. Systems Computational Neuroscience. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 430 with a grade of C or better or departmental approval. This course provides a mathematical and computational introduction to operations of neuronal systems and networks. Topics covered include central pattern generators, neuroethology of sensory systems, sensory-motor transformations, models of various brain regions, models of visual processes, large networks modeling, models of learning and memory, neural coding and mathematics of neural networks.

MATH 432. Mathematics of Financial Derivatives I (Capstone I). 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222 with a grade of C or better and MATH 346 with a grade of C or better. Mathematical analysis of models encountered in the area of financial derivatives. Topics include modeling and analysis of futures markets, determination of future prices, hedging strategies, swaps, option markets, stock options and their trading strategies.

MATH 433. Mathematics of Financial Derivatives II (Capstone II). 3 credits, 3 contact hours (3;0;0).
Corequisite: MATH 340 with a grade of C or better. MATH 432 with a grade of C or better. Mathematical analysis of models encountered in the area of financial derivatives with emphasis on numerical methods. Topics include: Binomial Trees, Black Scholes Models, Finite Difference Methods.

MATH 440. Advanced Applied Numerical Methods. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 331 with a grade of C or better and MATH 340 with a grade of C or better. A survey of numerical methods for solving ordinary and partial differential equations. Includes initial-value and boundary-value problems for ordinary differential equations and for elliptic, hyperbolic, and parabolic partial differential equations.

MATH 441. Actuarial Mathematics I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 346 with a grade of C or better. Topics include the economics of insurance, individual risk models for a short term, survival distributions and life tables, life insurance per year, life annuities, and net premiums.

MATH 442. Actuarial Mathematics II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 441 with a grade of C or better. Topics include net premium reserves, insurance models including expenses, nonforfeiture benefits, and dividends.

MATH 444. Applied Sampling Methods and Quality Control. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 333 with a grade of C or better, or MATH 244 with a grade of C or better and MATH 341 with a grade of C or better. An introduction to sample survey and statistical quality control. Topics include sampling from a finite population and different sampling techniques, more detailed study of random sampling and stratification, control charts and acceptance sampling plans in statistical quality control.

MATH 445. Introduction to Experimental Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 333 with a grade of C or better, or MATH 244 with a grade of C or better and MATH 341 with a grade of C or better. Basic concepts and principles of designs are covered. Topics include randomized blocks, Latin squares, factorial designs.

MATH 446. Topics in Applied Statistics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 341 with a grade of C or better or MATH 333 with a grade of C or better. Topics may include biostatistics, environmental statistics, statistical consulting.

MATH 447. Applied Time Series Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 341 with a grade of C or better or MATH 333 with a grade of C or better. An introduction to applied univariate time series analysis. Topics include regression techniques for modeling trends, smoothing techniques (moving average smoothing, exponential smoothing), autocorrelation, partial auto-correlation, moving average, and autoregressive representation of series, Box-Jenkins models, forecasting, model selection, estimation, and diagnostic checking, Fourier analysis, and spectral theory for stationary processes.

MATH 448. Stochastic Simulation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 340 and either MATH 244 or MATH 333 with a grade of C or better. An introduction in the use of computer simulation to study stochastic models. Topics include the generation of samples of continuous and discrete random variables and processes with applications to stochastic models, statistical analysis of the results, and variance reduction techniques.

MATH 450. Methods Of Applied Math. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 331 with a grade of C or better, MATH 337 with a grade of C or better, and MATH 340 with a grade of C or better. Combines mathematical modeling with physical and computational experiments conducted in the Undergraduate Mathematics Computing Laboratory.

MATH 451. Methods Appl Math II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 450 with a grade of C or better. Small teams of students conduct research projects under the guidance of faculty members who perform applied research.

MATH 453. High-Performance Numerical Computing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 340 with a grade of C or better and MATH 391 with a grade of C or better. The course covers state-of-the-art numerical algorithms for solving large-scale problems accurately and efficiently. Topics include iterative methods for linear systems and eigenvalue computations, introduction to parallel program and parallel numerical algorithms and spectral methods. An instructor-selected advanced topic will be included in the course.

MATH 461. Introduction to Statistical Computing with SAS and R. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 341 with a grade of C or better or MATH 344 with a grade of C or better or MATH 447 with a grade of C or better. In this course, SAS and R statistical software will be studied from a programming language perspective. It will emphasize SAS and R data steps including getting data into SAS and R environments, working and combining data using control flows, merge and subsets. SAS and R mathematical, statistical, and data functions are discussed, as well as learning to write SAS Macro and generate high resolution graphics using SAS/Graph. The concentration is on SAS and R programming issues rather than on statistical procedures or functions; however, several SAS and R statistical procedures or functions are discussed and illustrated. Finally, interactive statistical software JMP and Minitab are briefly introduced.

MATH 462. Statistics and Statistical Learning (Capstone I). 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 461, MATH 478 with a grade of C or better. This is the first semester of a two-semester undergraduate-level statistical learning capstone course. The course provides an opportunity for students to synthesize knowledge gained during their undergraduate study by applying modern statistical tools to solve real-world projects. In this first semester course, the following basic statistical learning objects will be reviewed: statistical decision theory, linear/logistic regression, discriminant analysis, principle component analysis, high-dimensional data analysis, nearest neighbor methods, multiclass classification. The course will also select important papers on the above topics for students to read and present. Capstone research topics will be selected approaching the end of the semester.

MATH 463. Statistics and Statistical Learning (Capstone II). 3 credits, 3 contact hours (1;2;0).
Prerequisites: MATH 462 with a grade of C or better. This course is the continuation of MATH 462. In this course, the following basic statistical learning objects will be reviewed: variable/model selection, support vector machine, tree-based methods, cluster analysis. Students will work in teams on real-world projects which will require extensive use of statistical software. Each group will produce a written report and give an oral presentation of their findings. present their work in a research talk. Successful completion of this course will equip students with the modern statistical learning, teamwork, and presentation skills necessary to conduct advanced research or enter the professional world.

MATH 473. Intermediate Differential Equations. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222 with a grade of C or better and MATH 337 with a grade of C or better. Topics in the qualitative behavior of solutions of ordinary differential equations with applications to engineering problems. Includes phase plane analysis, stability, dynamical systems, and chaos.

MATH 477. Stochastic Processes. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 244 with a grade of C or better or MATH 333 with a grade of C or better and MATH 337 with a grade of C or better. This course introduces the theory and applications of random processes needed in various disciplines such as mathematical biology, finance, and engineering. Topics include discrete and continuous Markov chains, Poisson processes, as well as topics selected from Brownian motion, renewal theory, and simulation.

MATH 478. Stat Methods in Data Sci. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 333 with a grade of C or better or MATH 341 with a grade of C or better. This course introduces to students concepts in statistical methods used in data science, including data collection, data visualization and data analysis. Emphasis is on model building and statistical concepts related to data analysis methods. The course provides the basic foundational tools on which to pursue statistics, data analysis and data science in greater depth. Topics include sampling and experimental design, understanding the aims of a study, principles of data analysis, linear and logistic regression, resampling methods, and statistical learning methods. Students will use the R statistical software.

MATH 480. Introductory Mathematical Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better. Builds on principles taught in basic calculus courses. Topics discussed include continuity, differentiation, integration, and the limit process of sequences and series.

MATH 481. Advanced Calculus. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 480 with a grade of C or better. Systematic development of partial differentiation, multiple and improper integrals, transformations, inverse and implicit function theorems, and integrals over curves and surfaces.

MATH 491. Independent Study in Mathematics. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Senior standing and departmental approval. Each student works under the direct supervision of a member of the Department of Mathematical Sciences. The work consists primarily of a project applying the student's mathematical skills to an engineering- or science-oriented project.

MATH 492. Independent Study II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Senior standing and departmental approval. Each student works under the direct supervision of a member of the Department of Mathematical Sciences. The work consists primarily of a project applying the student's mathematical skills to an engineering- or science-oriented project.

MATH 495. Topics in Applied Mathematics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 331 with a grade of C or better, MATH 332 with a grade of C or better, and MATH 340 with a grade of C or better, or departmental approval. A survey of selected areas of applied mathematics. Case histories of problems in applied mathematics from an industrial background.

MATH E. Math Stack Engineers. 3 credits, 3 contact hours (3;0;0).

MATH NE. Math Stack For Non-Engineers. 3 credits, 3 contact hours (3;0;0).

MTSE 301. Principles of Material Science and Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 111 and PHYS 121, CHEM 125 and CHEM 126, MATH 111 and MATH 112 or equivalent. Examines the interrelationships among structure, properties, and performance of engineering materials. Topics to be covered include atomic structure, crystallography, solid state imperfections and diffusion. The properties of metals, semiconductors, polymers, ceramics, and composites as well as their behavioral response to mechanical, chemical, optical, electrical, and magnetic stimuli are examined in light of their performance in service.

MTSE 311. Properties of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisite: two semesters of college physics or equivalent. Intended for engineering technology students and is an introduction to the principal metallic and nonmetallic engineering materials, including their physical properties, response to heat treatment, and corrosion -resistance.

MTSE 318. Engineering Materials. 4 credits, 5 contact hours (3;2;0).
Prerequisites: PHYS 111; CHEM 126. Introduces the student to such engineering materials as metals, viscoelastic materials, ceramics, polymers, and semiconductors. The approach is interdisciplinary with stress upon the structure of materials. Various mechanical and thermal treatments are discussed and related to the stability of the resultant properties. The laboratory sessions implement and emphasize the effects of these mechanical and thermal treatments on the materials.

MTSE 319. Engineering Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 111; CHEM 126. This course is identical to MTSE 318, with the laboratory omitted.

MTSE 451. X-Ray Diffraction. 3 credits, 4 contact hours (2;2;0).
Prerequisites: PHYS 234; CHEM 126; MATH 112; CS 100, CS 101, CS 115 or BNFO 135. Course combines lecture and laboratory work in introducing methods of X-ray diffraction. Simple sample synthesis will be conducted to initiate experiments. Topics include fundamentals of x-ray scattering, powder and single crystal diffraction techniques and data modeling methods. Local and national laboratory facilities will be utilized for experiments.

MTSE 452. Materials Science I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 111; CHEM 126; ME 435 or PHYS 335. Emphasizes the structure and properties of materials and the relationships between them. The primary topics include the thermodynamics of solids, fracture mechanisms, diffusion, elasticity, plasticity, fatigue strength, viscosity, and creep.

MTSE 453. Materials Science II. 5 credits, 7 contact hours (3;4;0).
Prerequisite: MTSE 452. Emphasizes the electronic properties of materials in conjunction with an introduction to ceramics. Topics include semiconductors, thermoelectricity, magnetism, conductivity, dielectric, optical properties, and an introduction to the properties and behavior of ceramics.

OPSE 301. Introduction to Optical Science and Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 121. Laboratory and lecture introduces optics and photonics principles with their elementary applications for applied physics, engineering, computer science, or biology majors. Topics include speed at light, reflection, refraction, geometric optics, interference and interferometry, polarization, dispersion, birefringence, fiber-optics, diffraction, introduction to spectroscopy and ray tracing.

OPSE 310. Virtual Instrumentation. 3 credits, 5 contact hours (2;3;0).
Prerequisites: CS 113 or CS 115. Intended for all engineering, computer science, and science majors. Covers the basics of virtual instrumentation including use of IEEE GPIB, RS232 interfaces, and data acquisition boards. Interface a computer to various instruments for data acquisition and instrument control using a state-of-the-art software platform such as National Instrument's LABVIEW. Emphasis is on the practical aspects of interfacing a computer to various instruments including timing issues, real-time data acquisition and instrument control, instrument status, and acquisition speed.

OPSE 402. High Power Laser and Photonics Applications. 3 credits, 4 contact hours (1;3;0).
Prerequisite: PHYS 121. Open to all engineering, computer science, and science majors with junior or senior standing. Advanced combined laboratory and lecture course emphasizing photonics and high power laser applications. Topics include Maxwell's equations, principles of lasers, electro-optics, non-linear optics, absorption and transmission of light, bio-optics, fiber-optic communications, chemiluminescence, scattering from periodic surfaces and colloids, sensors. Topics and experiments change on a semester basis depending on interests of enrolled students.

OPSE 410. Biophotonics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 103 or PHYS 121. An introduction to the interaction of light with biological tissues. Biophotonics for diagnostic and therapeutic applications will be discussed. Topics include a series of studio-style, hands-on experiments measuring the optical properties of real or simulated tissues using reflection, polarization, absorption and scattering, with discussions of related subjects including laser surgery and mutations by radiation exposure. The course is designed for Biophysics majors, but is also geared to Biomedical Engineers, Biologists and Chemists.

PE 103. Swim Instruction. 1 credit, 1 contact hour (0;1;0).
Students develop aquatic skills, including various swimming strokes and rescue techniques, according to skill level. Limited to 10 students.

PE 104. Survival Swimming. 1 credit, 1 contact hour (0;1;0).
Designed for the average, weak or non-swimmer and will emphasize survival swimming, basic rescue and water safety techniques, and swimming instruction.

PE 105. Life Saving/Lifeguard Training. 1 credit, 1 contact hour (0;1;0).
An American Red Cross certification course. The purchase of textbooks is required. Laboratory hours are established at first lecture.

PE 106. Water Safety Instructor. 1 credit, 1 contact hour (0;1;0).
Prerequisite: Valid Advanced Lifesaving certificate. An American Red Cross certification course. The purchase of textbooks is required. Laboratory hours are established at first lecture. Upon successful completion of this course, an individual will be able to teach swimming at all levels as well as emergency water safety.

PE 115. Strength Training and Conditioning. 1 credit, 1 contact hour (0;1;0).
Covers strength and conditioning techniques and programs, goal setting, and record keeping.

PE 117. Jogging. 1 credit, 1 contact hour (0;1;0).
The purpose of this course is to help students improve personal fitness and health through active participation in a safe and effective jogging and conditioning program. Students will learn the lifetime benefits of walking & jogging and the health related components of fitness. Correct biomechanical movements will be emphasized along with fitness and health improvements for all students. Upon completion of the course the students will understand the importance of proper safety techniques and the cardiovascular benefits of activities associated with jogging and conditioning.

PE 118. Walking. 1 credit, 1 contact hour (0;1;0).
An approach to cardiovascular fitness and weight reduction. Walking tours may be offered.

PE 128. Hydrofitness. 1 credit, 1 contact hour (0;1;0).
Water fitness designed to tone major muscle groups, and strengthen the cardiovascular system. Includes exercises for all parts of the body, recipes for staying in shape, and the aerobic way to a strong heart.

PE 129. Individualized Fitness. 1 credit, 1 contact hour (0;1;0).
Specific training to meet the individual student's interest. Areas include techniques of strength training, goal setting and record keeping.

PE 131. Step Aerobics. 1 credit, 1 contact hour (0;1;0).
A high-intensity aerobic workout designed for the moderate to advanced participant using the "Reebok Step" to increase cardiovascular strength and endurance with emphasis on target heart rates, safety, fat reduction, and achieving overall fitness and good health.

PE 132. Aerobics. 1 credit, 1 contact hour (0;1;0).
Designed for cardiovascular conditioning, weight loss, and muscle toning.

PE 133. Swim for Health. 1 credit, 1 contact hour (0;1;0).
Prerequisite: must be able to swim. Designed for those who want to use swimming to improve their health and fitness. Swim for Health is a concentrated program which teaches the techniques and methods used in the development of individualized ?training programs.?.

PE 135. Beginning Swimming. 1 credit, 1 contact hour (1;0;0).
Designed for the non-swimmer. Includes survival techniques and basic rescue.

PE 136. Beginning Karate. 1 credit, 1 contact hour (0;1;0).
An introduction to shotokan karate. Includes basic self-defense. Gi (martial arts uniform) optional.

PE 137. Intermediate Karate. 1 credit, 1 contact hour (0;1;0).
Prerequisite: PE 136 or permission of the instructor. A continuation of PE 136. Includes an introduction to katas, Japanese terms and complex self-defense. Gi (martial arts uniform) required.

PE 139. Individualized Fitness II. 1 credit, 1 contact hour (0;1;0).
Prerequisite: PE 129 or permission of the instructor. Designed to increase cardiovascular efficiency, muscular strength, and endurance through specific training that meets a student's continuing goals.

PE 140. Circuit Training. 1 credit, 1 contact hour (0;1;0).
Designed as a low-impact aerobic program utilizing weights to increase flexibility, coordination, muscle tone, and cardiovascular endurance.

PE 141. Introduction to Dance. 1 credit, 1 contact hour (0;1;0).
An introduction to several styles of dance, including ballet, modern, jazz, tap, folk, ethnic, and social.

PE 145. Aerobic Instructor Certification. 1 credit, 1 contact hour (1;0;0).
This Air Force-sponsored physical training course is open to NJIT AFROTC enrolled students only. Course activities include conditioning exercises, calisthenics, a 1.5 mile run, Air Force Sports, Warrior Runs, a Physical Fitness Diagnotic, and a Physical Fitness Assessment.

PE 150. Beginning Yoga. 1 credit, 1 contact hour (0;1;0).
Course introduces the ancient discipline of personal development that balances body, mind, and spirit. Students learn a series of physical postures as well as practical methods for relaxation, proper breathing, meditation, and concentration that promote health, alleviate stress, improve skelatal alignment, and increase muscular strength and flexibility.

PE 151. Intermediate Yoga. 1 credit, 1 contact hour (0;1;0).
In this course students will deepen their study and practice of yoga. Students will master the basic knowledge learned in the Beginning Yoga, while studying advanced poses and breathing techniques. By the end of the course, students will demonstrate and advanced kinesthetic awareness of the body, the ability to perform advanced poses, and a deeper understanding of the philosophy and science of yoga.

PE 170. Modern Dance. 1 credit, 1 contact hour (0;1;0).
This course provides a basis for students to understand and develop an appreciation of dance as an art form. Through active participation students explore fundamental movement principles and modern dance techniques. Incorporated into this course is the study of all the major dance genres and dance history, as well as the study of anatomy. Structured improvisation and choreography allow students to manipulate abstract ideas, and develop their creativity.

PE 171. Latin Dance. 1 credit, 1 contact hour (0;1;0).
This course will focus on training students to understand and perform basic ballroom and Latin steps, turns, and partnering. Students will also learn the rhythms, history, and culture of each style. Students will demonstrate mastery of these styles through choreographed and non-choreographed class performances.

PE 180. Zumba Fitness. 1 credit, 1 contact hour (0;1;0).
This course combines high energy and motivating music with unique moves and combinations that allow participants to exercise with no worries. Zumba combines traditional Latin dance styles including salsa, mambo, cha-cha, cumbia and merengue, as well as hip hop and belly dancing moves. The routines feature aerobic fitness interval training with a combination of fast and slow rhythms that tone and sculpt the body. By focusing on interval training, classes seek to burn calories without exhausting participants with a high impact pace. Zumba is based on the theory that a work out should be fun and easy to do. This allows participants to stick to a fitness program and achieve long-term benefits that are good for both the body and mind.

PE 1XX. PE Exemption. 0 credits, 0 contact hours (0;0;0).

PE 201. Introduction to Lifetime Sports I. 1 credit, 1 contact hour (0;1;0).
Offered only in the fall semester, introduces a variety of the individual, dual, and team sports available at NJIT.

PE 202. Lifetime Sports II. 1 credit, 1 contact hour (0;1;0).
A continuation of PE 101. Participate in a variety of activities or develop an area(s) of concentration.

PE 208. Sports for Women. 1 credit, 1 contact hour (0;1;0).
Designed specifically for women interested in learning and competing in individual, dual and team sports.

PE 210. Skiing. 1 credit, 1 contact hour (0;1;0).
Instruction and practical experience in recreational skiing designed for the novice and intermediate skier. Includes lectures on safety, equipment and clothing, first aid and injuries, tuning and repair; six sessions at Hidden Valley, and possibly one weekend trip to Vermont. Students are responsible for costs of lift tickets and any equipment rentals. Transportation may be provided.

PE 211. Introduction to Bowling and Archery. 1 credit, 1 contact hour (0;1;0).
The rules, techniques and scoring of each sport. Archery equipment is provided. For bowling, students must pay a $1 per class alley fee.

PE 213. Volleyball. 1 credit, 1 contact hour (0;1;0).
Learn current techniques and skills while playing triples (3 on 3) and leading up to competitive team (6 on 6) volleyball.

PE 214. Advanced Volleyball. 1 credit, 1 contact hour (0;1;0).
Prerequisite: PE 113 or approval of the instructor. Advanced methods and techniques of spikes, serves, blocks, sets, team transition, strategy, tournament play, statistics, and videotape analysis.

PE 220. Introduction to Racquet Sports. 1 credit, 1 contact hour (0;1;0).
An introduction to the racquet sports of badminton, paddleball, tennis, and racquetball. Includes rules of play, service, strokes, and playing strategy for singles and doubles.

PE 221. Badminton. 1 credit, 1 contact hour (0;1;0).
Includes the rules, skills, strokes, and strategies of badminton, and provides an opportunity for competition.

PE 223. Tennis for Beginners. 1 credit, 1 contact hour (0;1;0).
Introduces students to the rules and basic techniques and strategies of tennis.

PE 224. Intermediate Tennis. 1 credit, 1 contact hour (0;1;0).
Prerequisite: PE 223 or permission of the instructor. Emphasizes correcting problem strokes, strategies, drills, and tournament play.

PE 225. Golf. 1 credit, 1 contact hour (0;1;0).
Designed for the beginner. Areas covered are grip, stance, swing, strokes, and use of clubs, progressing towards actual course play. Students pay green and range fees.

PE 226. Intermediate Golf. 1 credit, 1 contact hour (0;1;0).
Prerequisite:PE 225 or permission of the instructor. Designed to strengthen and advance the skills and theory learned in PE 125.

PE 234. Beginning Fencing. 1 credit, 1 contact hour (0;1;0).
Introduces fencing as both a lifetime and intercollegiate sport. Basic equipment is provided.

PE 242. Introduction to Racquetball. 1 credit, 1 contact hour (0;1;0).
An introduction to rules, skill development, strategies and tournament play.

PE 243. Introduction to Volleyball. 1 credit, 1 contact hour (0;1;0).
An introduction to rules, skill development, strategies, and tournament play.

PE 244. Advanced Racquetball. 1 credit, 1 contact hour (0;1;0).
Prerequisite: PE 242 or permission of the instructor. Advanced methods and techniques of various serves; passing, and kill shots; advanced strategy; tournament play focusing on singles and doubles play.

PE 245. Air Force Physical Training II. 1 credit, 1 contact hour (1;0;0).
This Air Force-sponsored physical training course is open to NJIT AFROTC enrolled students only. Course activities include conditioning exercises, calisthenics, a 1.5 mile run, Air Force Sports, Warrior Runs, a Physical Fitness Diagnotic, and a Physical Fitness Assessment.

PE 2XX. PE Exemption. 0 credits, 0 contact hours (0;0;0).

PHIL 310. Logic. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Logic. Teaches students how to reason critically, identify issues, construct and evaluate arguments. Improves students' ability to communicate effectively, both orally and in writing. Examines topics such as meaning and definition; explanations and arguments; informal logic and fallacies; and formal logic, including modern symbolic logic, truth tables, formal fallacies, proofs, and quantification. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 331. Problems in Philosophy. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An examination of problems of a social, ethical, esthetic, religious, and scientific nature, and a study of the related principles and methods of philosophy. Readings are chosen from a wide range of periods and schools from the Greeks to the present, with some application of philosophical analysis to individual and societal problems. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 333. Moral Philosophy. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A critical discussion of the history and fundamental elements of ethical thought. Examines topics such as the basic ethical theories, the nature of right and wrong, the significance of moral choice, the structure of the moral life, and the place of reason in ethics. Readings from both classical and modern philosophers. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 334. Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A philosophical examination of the nature of engineering practice and applied technology. Considers such questions as: How do the societal functions of engineers and the practical application of technologies relate to basic moral and intellectual values? What moral obligations are implied by the uses of technology? What are the ethical duties of engineers in the practice of their careers? How are technological practice and engineering related to questions about knowledge and reality? This course satisfies the three credit 300 GER in History and Humanities.

PHIL 335. Ethical Issues in Business. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with a grade of C or higher; ENGL 102 may be taken concurrently as a corequisite. An examination of the ethical problems and moral foundations of business from the perspective of moral philosophy. Among the questions explored are: What are the rights of employees and employers in the workplace? Do corporations and managers have an obligation to society at large? What is the relationship between personal and business morality? Is there a moral justification for the free market?.

PHIL 337. World Religions. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An introduction to five world religions which make strong claims to be in some sense universal: Hinduism, Judaism, Buddhism, Christianity, and Islam, with special attention to their impact on contemporary politics, gender, economics, and culture. Study of selected scriptures, major customs, representative figures, and one or two works of art from each religious tradition. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 350. Representative Philosophies. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The ideas of a few great thinkers, from a variety of historical periods. Shows at first-hand how these philosophers accelerated intellectual progress and how their work may contribute to the solution of modern problems. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 351. Biomedical Ethics. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An examination of the ethical problems and moral foundations of medicine. Among the issues explored are the changing nature of the doctor/patient relationship, increased patient autonomy, advance directives, the rationing of care, doctor-assisted suicide, and "the right to die." This course satisfies the three credit 300 GER in History and Humanities.

PHIL 355. The Philosophy Of Science. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An investigation into the foundations and implications of modern science, with special emphasis on the influence of philosophy on scientific thought, and on philosophic questions. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 380. Philosophy of Language. 3 credits, 3 contact hours (3;0;0).

Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines tradition, formation and change in the ways that language shapes thought. Special attention is paid to the relationships between language and religion, as well as language and science. This course satisfies the three credit 300 GER in History and Humanities.

PHYS 102. General Physics. 3 credits, 3 contact hours (3;0;0).

Corequisite: PHYS 102A. Intended for students in architecture, computer science (B.A. only), STS and other disciplines requiring laboratory science electives. Elementary statics and dynamics. Subjects discussed are kinematics, Newton's laws of motion, energy, momentum, conservation principles, and mechanical properties of matter. Lab must be taken concurrently.

PHYS 102A. General Physics Lab. 1 credit, 2 contact hours (0;2;0).

Corequisite: PHYS 102. This course is the laboratory component of PHYS 102 and must be taken concurrently.

PHYS 103. General Physics. 3 credits, 3 contact hours (3;0;0).

Prerequisites: PHYS 102/PHYS 102A or PHYS 111/PHYS 111A all with grade of C or better. Corequisite: PHYS 103A. A continuation of PHYS 102 for students in architecture, computer science (B.A. only), STS and other disciplines requiring laboratory science electives. Topics discussed are heat, thermodynamics, sound, wave motion, illumination, geometric and physical optics, and color. Lab must be taken concurrently.

PHYS 103A. General Physics Lab. 1 credit, 2 contact hours (0;2;0).

Prerequisites: PHYS 102/PHYS 102A or PHYS 111/PHYS 111A all with grade of C or better. Corequisite: PHYS 103. This course is the laboratory component of PHYS 103 and must be taken concurrently.

PHYS 111. Physics I. 3 credits, 3 contact hours (3;0;0).

Corequisites: PHYS 111A and MATH 111. Elementary mechanics with an emphasis on the fundamental concepts and laws of mechanics, especially the conservation laws. Topics are scalar and vector quantities of mechanics; rectilinear and circular motion; equilibrium and Newton's laws of motion; work, energy, momentum; the conservation laws. Lab must be taken concurrently. See PHYS 111A.

PHYS 111A. Physics I Lab. 1 credit, 2 contact hours (0;2;0).

Corequisite: PHYS 111. Laboratory component of PHYS 111. Lab must be taken concurrently with PHYS 111.

PHYS 114. Introduction to Data Reduction with Applications. 3 credits, 3 contact hours (3;0;0).

Corequisite: MATH 111. Physics majors only. An introduction to both the theory and application of error analysis and data reduction methodology. Topics include the binomial distribution and its simplification to Gaussian and Poisson probability distribution functions, estimation of moments, and propagation of uncertainty. Forward modeling, including least-squares fitting of linear and polynomial functions are discussed. The course enables students to apply the concepts of the data reduction and error analysis using data analysis software to real data sets found in the physical sciences.

PHYS 121. Physics II. 3 credits, 3 contact hours (3;0;0).

Prerequisites: PHYS 111/PHYS 111A and MATH 111 all with a grade of C or better. Corequisites: PHYS 121A and MATH 112 with grade of C or better. This course deals with an introduction to electricity and magnetism. Topics include simple dc circuits, the electric field, the magnetic field, electric potential, capacitance relationships between electric and magnetic fields, inductance, and simple ac circuits. Lab must be taken concurrently. See PHYS 121A.

PHYS 121A. Physics II Lab. 1 credit, 2 contact hours (0;2;0).

Prerequisites: PHYS 111/PHYS 111A and MATH 111 all with grade of C or better. Corequisites: PHYS 121 or PHYS 122. Lab must be taken concurrently with PHYS 121 or PHYS 122. Laboratory component of PHYS 121 and PHYS 122.

PHYS 122. Electricity & Magntsm ECE Appl. 3 credits, 3 contact hours (3;0;0).

Prerequisites: PHYS 111/PHYS 111A and MATH 111 all with a grade of C or better. Corequisites: PHYS 121A and MATH 112 with grade of C or better. This course emphasizes applications of electricity and magnetism to circuit problems, explores electric fields and magnetic fields of non-trivial charge and current distributions, introduce students to complex variables, and emphasizes methods for solving large linear problems. It provides a strong coupling of the underlying physics with calculus. Lab must be taken concurrently. See PHYS 121A.

PHYS 202. Introductory Astronomy and Cosmology. 3 credits, 3 contact hours (3;0;0).
A non-mathematical presentation of contemporary views of the origin, evolution, and structure of the solar system, stars, galaxies, and the universe. Special topics include neutron stars, black holes, gravitationally strange objects, and the big bang.

PHYS 202A. Astronomy and Cosmology Laboratory. 1 credit, 2 contact hours (0;2;0).
Includes demonstration of physical principles applicable to astronomy. Use of telescope for lunar, solar and planetary observations. Optional laboratory course associated with PHYS 202.

PHYS 203. The Earth in Space. 3 credits, 3 contact hours (3;0;0).
Prerequisite: None. Introduces fundamental phenomena, such as plate tectonics, erosion, volcanism, and glaciation. Studies the interaction between the Earth's four major reservoirs?atmosphere, hydrosphere, biosphere and solid earth; investigates the dependence of the Earth on the Sun; the effect of the Moon on the Earth. Extends knowledge gained from studying the Earth to other planets in this solar system.

PHYS 203A. The Earth in Space Lab. 1 credit, 2 contact hours (0;2;0).
Corequisite: PHYS 203. Optional laboratory course associated with PHYS 203.

PHYS 204. Biophysics of Life. 3 credits, 3 contact hours (3;0;0).
A quantitative, but non-mathematical, view of how living entities work in terms of the basic concepts of physics and biology. We will use active, studio learning to explore how the nervous system, the heart and the lungs work and how the blood pressure results. We will discuss how these concepts underlie topics ranging from birth to death, from touch to pleasure, from vision to beauty, and from a thought to a heartbeat. The course is geared to all majors.

PHYS 231A. Physics III Lab. 1 credit, 2 contact hours (0;2;0).
Prerequisites: PHYS 111/PHYS 111A; PHYS 121/PHYS 121A and MATH 112, all with grade of C or better. Corequisites: PHYS 231H or PHYS 234. Optional course associated with PHYS 234 and PHYS 231H.

PHYS 231H. Physics III Honors. 4 credits, 4 contact hours (4;0;0).
Prerequisites: PHYS 111/PHYS 111A; PHYS 121/PHYS 121A; MATH 111; MATH 112; all with grade of C or better. Third semester of a three-semester program in Honors Physics. Physical optics is treated in greater detail. Modern physics includes a greater number of topics, with special emphasis on the wave-particle duality in nature. Lab must be taken concurrently. See PHYS 231A.

PHYS 234. Physics III. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 121/PHYS 121A or PHYS 122/PHYS 121A and MATH 112 with a grade of C or better. Elements of simple harmonic motion, wave motion, geometric and physical optics are considered. The wave and particle duality of nature is emphasized and made plausible by an examination of the important experiments and theories which lead to the modern concepts of matter and radiation. The conservation laws are broadened to include the equivalence of mass and energy.

PHYS 310. Introduction to Atomic and Nuclear Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234; MATH 222, all with grade of C or better. Selected topics in atomic physics including the Pauli Exclusion Principle and the Atomic Shell Model. In nuclear physics, the two-body problem, nuclear models, alpha, beta, and gamma radiation, acclerators, and nuclear detectors are studied. R750 403 may be substituted for this course.

PHYS 311. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisite: Acceptance into the co-op program. Students gain major-related experience and reinforcement of the academic program. Work assignments are facilitated and approved by the Office of Cooperative Education and Internships. Participation in seminars and a final report/project is mandatory. Note: Normal grading applies to this COOP Experience.

PHYS 320. Astronomy and Astrophysics I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 121, with grade of C or better. A quantitative introduction to the astronomy of the sun, earth, and solar system, with an emphasis on the physical principles involved. Includes celestial mechanics, planetary atmospheres and the physics of comets, asteroids and meteorites.

PHYS 321. Astronomy and Astrophysics II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 320, with grade of C or better. A quantitative introduction to the astronomy of the stars, the galaxy, and cosmology, with an emphasis on the physical principles involved. Includes stellar interiors, stellar evolution, galactic dynamics, large-scale structure and early history of the universe.

PHYS 322. Observational Astronomy. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 320, with grade of C or better. Most class time is spent in an observatory performing observations of celestial objects such as the Sun, Moon, planets, stars, stellar clusters, and galaxies. Experimental projects include charting the skies, asterophotography (film and CCD), measuring masses of planets, rotational period of the Sun, topography of the Moon, H-R diagrams of stellar clusters, etc.

PHYS 335. Introductory Thermodynamics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 211 or MATH 213, all with grade of C or better. Corequisites: MATH 222, MATH 238 or MATH 335. Introductory thermodynamics, kinetic theory, statistical physics. Topics include equations of state, the three laws of thermodynamics, reversible and irreversible processes. R750 315 may be substituted for this course.

PHYS 350. Biophysics I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 121 with a grade of C or better. This course presents an introduction to general biophysics. Students will learn the basic principles behind cells, thermodynamics and statistical mechanics applied to cellular environments forces affecting conformation of biological molecules, protein and nucleic acid biophysics, membrane biophysics, and basic physics principles behind nerve impulses and heart and lung function and malfunction. Demonstrations and measurements using basic medical measurements will be used when feasible.

PHYS 390. Selected Topics of Current Interest in Physics. 1 credit, 1 contact hour (1;0;0).
Prerequisite: PHYS 234 with grade of C or better. Seminar covering topics that are currently in the forefront of physics. The lecture series offers exposure to such topics as nuclear physics, solid state physics, plasma physics, the special and general theories of relativity, and the history and philosophy of science.

PHYS 411. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: PHYS 311, with grade of C or better, and acceptance into the co-op program. Provides for co-op work assignments which must be approved by the Office of Cooperative Education and Internships. Participation in seminars and a final -report/project are mandatory. Note: Normal grading applies to this COOP Experience.

PHYS 418. Fundamentals of Optical Imaging. 3 credits, 4 contact hours (2;2;0).
Prerequisites: PHYS 234 or PHYS 231, with grade of C or better. This is a course with both lectures and experiments and the emphasis is on the hands-on experiences. Upon completion of the course, students should not only grasp the basic concepts involved in imaging science, but also be able to work on simple real world imaging systems. The main content of the lecture part of this course can be summarized as the following: Optical sources, detectors and their working mechanism; Image formation and transmission; Optical imaging system and their characteristics; Imaging processing and algorithms. This course is developed in close collaboration with Edmund Optics Inc.

PHYS 420. Special Relativity. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 and MATH 222, all with grade of C or better. An introduction to Einstein's Special Theory of Relativity at the advanced undergraduate level. Topics include invariance of the speed of light, relativity of time and space, the Lorentz transformations, space-time diagrams, the twin paradox and time travel, relativistic mechanics, rotating reference frames, laser gyroscopes, superluminal motion, phase and group velocities, and applications in high-energy physics, relativistic engineering, nuclear physics, astrophysics, and cosmology.

PHYS 421. General Relativity. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 and MATH 222, all with grade of C or better. An introduction to Einstein's General Theory of Relativity at the advanced undergraduate level. Topics include review of Newton's Theory of Gravitation, review of Einstein's Special Theory of Relativity, tensor calculus on both flat and curved manifolds, the covariant derivative, curvature, Einstein's Gravitational Field Equations, the weak-field limit, gravitational radiation, the black hole solution, Hawking radiation, the No-Hair Theorem, cosmology, and a history of the Universe.

PHYS 430. Classical Mechanics I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 and MATH 222 and MATH 328 or MATH 335, all with grade of C or better. Newtonian mechanics of particles and systems. Lagrange's and Hamilton's approaches. Continuous systems. R750 361 may be substituted for this course.

PHYS 431. Classical Mechanics II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 430, with grade of C or better. Theory of small oscillations and mechanical waves. Rigid bodies. Topics include stability, linearization methods, forced vibrators and perturbation theory, fluids and mechanics of continuous media. R750 362 may be substituted for this course.

PHYS 432. Electromagnetism I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 234H or PHYS 231H and MATH 222 or MATH 222H and MATH 328 or MATH 335, all with grade of C or better. Electrostatics and magnetostatics, Maxwell's equations with applications, and electrodynamics.

PHYS 433. Electromagnetism II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 432, with grade of C or better. Maxwell's equations with applications and electrodynamics.

PHYS 441. Modern Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 222 , all with grade of C or better. Topics include wave-particle duality, wave mechanics, two-state quantum systems, the motion of an electron in a periodic lattice, band theory of solids, electrical, thermal and magnetic properties of solids, and plasmas and super fluid systems. R750 316 may be substituted for this course.

PHYS 442. Introduction to Quantum Mechanics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 430, with grade of C or better. Wave-particle duality, the Schrodinger and Heisenberg formulations of quantum mechanics. The hydrogen atom, perturbation theory, and concepts of degeneracy, composite states and general properties of eigenfunctions. R750 404 may be substituted for this course.

PHYS 443. Modern Optics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 222, all with a grade of C or better. Electromagnetic theory of light, interference, diffraction, polarization, absorption, double refraction, scattering, dispersion, aberration, and an introduction to quantum optics. Other topics include holography, lasers, information retrieval, spatial filtering, and character recognition.

PHYS 444. Fluid and Plasma Dynamics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 222 , all with grade of C or better. Introduces the basics of plasma physics. Covers the following plasma parameters, single particle motions, plasma as fluid, waves, diffusion and resistivity, equilibrium and instability, kinetic theory, nonlinear effects. Applications in three areas: controlled fusion, astrophysics, and interaction between light and plasma.

PHYS 446. Solid State Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 222, with grade of C or better. Corequisite: PHYS 442. An introduction to modern concepts of the solid state. Topics include crystal structure and diffraction, crystal binding and elastic properties, thermal properties, dielectric phenomena, band theory of solids and Fermi surfaces, electrical conductors, semiconductors, magnetism, and super-conductivity. R750 406 may be substituted for this course.

PHYS 450. Advanced Physics Lab. 3 credits, 5 contact hours (1;4;0).
Prerequisites: PHYS 335, PHYS 430, PHYS 432, all with grade of C or better. Introduction to electrical measurements; instrumentation; theoretical and applied electronics, solid state electronic devices, digital circuitry; computer design; experiments in modern physics.

PHYS 451. Biophysics of Electricity and Radiation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 103 or PHYS 121 with a grade of C or better. This course will survey the basic principles of biophysics using electromagnetic waves as our theme. We will learn the basic therapeutic and destructive aspects of radiation from electrical fields at frequencies from below 60 cps to x-rays and beyond. We will also use active learning and prepare reports on research projects in class. In a general sense, the biophysical properties of radiation are important in the human nervous systems, in cancer treatment and in carcinogenesis. During this course, we will explore how nuclear radiation is unnecessarily feared in some cases and appropriately feared in others. The course is designed for Biophysics and Biology majors, but is also geared to Biomedical Engineers and Chemists.

PHYS 452. Atomic and Nuclear Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 222, all with grade of C or better. Topics include atomic spectra, atomic structure, and nuclear physics.

PHYS 456. Introduction to Solid State Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 222, all with grade of C or better. Treats the same topics as PHYS 446 while introducing the necessary modern physics. Designed for students choosing a minor in applied physics. Students majoring in applied physics are ineligible.

PHYS 461. Mathematical Methods of Theoretical Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 430, PHYS 432, PHYS 433, all with grade of C or better. Topics include vector and tensor analysis, matrix methods, complex variables, Sturm-Liouville theory, special functions, Fourier series and integrals, integral equations, and numerical solutions of differential equations.

PHYS 480. Topics in Applied Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Permission of instructor. Current topics and interests in applied physics and physics. Emphasis is on research and scientific development in microelectornics, optoelectronics, optical physics, materials science, surface science, solar physics, and modern physics.

PHYS 481. Applied Solid State Physics: Microelectronics I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 446, with grade of C or better. Topics include physics of bipolar and field effect devices, Phonon and optical spectra, unipolar devices, and thermal and high field properties of semiconductor devices.

PHYS 482. Applied Solid State Physics: Microelectronics II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 446, with grade of C or better. Topics include large-scale integrated circuits, device characteristics, charge-coupled devices, LED and semiconductor lasers, photodetectors, and electrical and optical properties of materials.

PHYS 483. Applied Solid State Physics. 3 credits, 6 contact hours (0;6;0).
Prerequisite: PHYS 446, with grade of C or better. Introduction to digital concepts; binary circuits and microprocessor architecture. Applications of discrete solid-state devices and integrated circuits are explored both in theory and practice. The laboratory also serves as an introduction to hardware and software components of a typical microcomputer.

PHYS 485. Computer Modeling of Applied Physics Problems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 222, all with grade of C or better. General computer programming modeling methods and techniques. Numerical solutions to integro-differential equations. Eigenvalues problems. Application of computer-aided-design and other packages. R750 461 may be substituted for this course.

PHYS 490. Independent Study. 3 credits, 3 contact hours (0;0;3).
Prerequisite: Departmental approval. Undertake individual research or a project under the supervision of a member of the physics department. 21&62 750 485, 486 may be substituted for this course.

PHYS 491. Independent Study II. 3 credits, 3 contact hours (0;0;3).

PSY 2. Psychology Elective. 3 credits, 3 contact hours (3;0;0).**

PSY 201. Orientation to Psychology as a Behavioral Science. 3 credits, 3 contact hours (3;0;0).
This course will serve as an orientation to psychology in general and cyberpsychology in particular. Students will examine theories and research related to career and professional development. Topics include the utility of career development theory, the nature of the world of work, evaluation of career information, and the role of empirical research in career development theory and practice. Students will also use self-assessments of interests, goals, and strengths as they relate to career and vocational opportunities.

PSY 210. Introduction to Psychology. 3 credits, 3 contact hours (3;0;0).
Introduction to the study of human behavior. Topics include motivation, perception, learning, cognitive development, personality and emotion, individual difference, and biological basis of behavior, as well as methodology in psychological research. This course can be used to satisfy either the three credit 200 GER in History and Humanities or the three credit GER in Social Sciences, but not both.

PSY 215. Biology of Behavior. 3 credits, 3 contact hours (3;0;0).
Pre or Corequisite: PSY 210. This course provides a general introduction to the underlying biological principles and mechanisms that give rise to complex human behaviors. Topics include neurons, neural communication, brain structure and function, processing in sensory systems, cognitive neuroscience, and neural and hormonal influences on health and emotion. This course focuses on emerging methods and approaches to an integrated understanding of complex behavior, with an emphasis on applications for STEM professional practice.

PSY 3. Psychology Elective. 3 credits, 3 contact hours (3;0;0).**

PSY 321. Social Psychology. 3 credits, 3 contact hours (3;0;0).
Pre or Corequisites: PSY 210. Social psychology is the study of how individuals affect and are affected by other people and by their social and physical environments. Social psychology helps us to understand and explain how our thoughts, feelings, and behaviors are influenced by the actual, imagined, and implied presence of others. Social psychology is the recognition that human responses are influenced by social situations, in addition to, the products of our individual personalities. Social psychologists study interpersonal and group dynamics and social challenges, such as prejudice, implicit bias, bullying, criminal activity and substance abuse. They research social interactions and the factors that influence them, such as group behavior, attitudes, public perceptions and leadership. This course will provide students an introduction and overview of research and theory in social psychology. This course does not satisfy the three credit 300 GER in History and Humanities.

PSY 333. Principles of Psychometrics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PSY 210. Corequisites: STS 307A. This course exposes students to the scientific methods by which psychologists strive to conceptualize, operationalize, and measure human behavior in such areas as skills, aptitudes, attitudes, values, personality, and intelligence. The course emphasizes an epistemological approach to psychometric theories in order to develop a critical language as well as to define the limitations of psychological measurement. Topics include reliability, validity, scale development, and applications of psychometric assessment in applied, clinical, and research contexts.

PSY 339. Psychology of Diversity. 3 credits, 3 contact hours (3;0;0).
Pre or Corequisites: PSY 210. This course will provide a comprehensive introduction to psychological theories and research related to identity, group dynamics, and diversity. This course explores the relationship between psychology and identity, including group and identity formation, stereotyping, prejudice, stigma, intergroup contact, and multiculturalism. Students will examine diversity as constituted through intersections of social categories such as race, gender, ethnicity, nationality, age, language, citizenship, religion, class, sexual orientation, physical ability, etc. with an emphasis on structural agency, power, and privilege. This course does not satisfy the three credit 300 GER in History and Humanities.

PSY 358. Moral Psychology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An introduction to moral philosophy with emphasis on the biological and psychological mechanisms underlying moral thought, judgment and action. Topics covered include altruism and egoism; utilitarianism, deontology and virtue ethics; the situationist critique of character; and agency and responsibility. Readings draw from classical and contemporary philosophers as well as from current empirical psychology. This course satisfies the three credit 300 GER in History and Humanities.

PSY 359. Foundations of Cyberpsychology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Introduction to the study of the effects of the Internet and cyberspace on the psychology of individuals and groups. Some topics covered include online identity, online relationships, personality types in cyberspace, transference to computers, addiction to computers and the Internet, regressive behavior in cyberspace, and online gender-switching. This course satisfies the three credit 300 GER in History and Humanities.

PSY 361. Found of Cyberpsychology II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PSY 359. Pre or Corequisites: PSY 210. This course applies the behavioral and psychological sciences to study of the effects of the internet and contemporary information and communication technologies (ICTs) on individuals and groups. Topics include artificial intelligence, robotics, big data and machine learning, artificial and virtual realities, telepsychology, health applications of ICTs, distance learning and professional development, online assessment and evaluation, online research, and data analytics.

PSY 389. Psychopathology. 3 credits, 3 contact hours (3;0;0).
Pre or Corequisites: PSY 210. This course addresses psychopathology from multiple frames including biological, developmental, cultural, and interactional. Students will study psychopathology from an individual descriptive, symptom logic perspective, as well as from a contextual, systemic perspective including developmental hallmarks, familial patterns, and sociocultural contributors. Readings about traditional diagnostic approaches and alternative approaches to assessment will be examined. Students will critically examine assessment, diagnosis, treatment, and evaluation of success.

PSY 490. Co-op Work Experience. 3 credits, 3 contact hours (3;0;0).
Restrictions: Senior standing and departmental approval. Students gain major-related work experience and reinforcement of their academic program. Work assignments are facilitated and approved by the co-op office. Requires mandatory participation in seminars and completion of a report. Note: Normal grading applies to this co-op experience.

PSY 491. Research and Independent Study. 3 credits, 3 contact hours (3;0;0).
Restrictions: Senior standing and departmental approval. Research in forensic science. Each student works under the supervision of a forensic science or associated faculty member. A research paper or poster are required.

PSY 495. Senior Seminar. 3 credits, 3 contact hours (3;0;0).

Restrictions: Senior standing and departmental approval. Offers cyberpsychology students the opportunity to enhance their understanding of professional practice through their integration of skills and knowledge gained in prior courses. The resultant research paper and presentation represents the culmination of the undergraduate disciplinary experience. Guest speakers will be invited to present on topics relevant to their area of expertise within the field of the behavioral and psychological sciences.

R460 101. Intro To The Earth. 3 credits, 3 contact hours (3;0;0).

R460 102. Africa:A Virtual Tour. 3 credits, 0 contact hours (0;0;0).

R460 103. Planet Earth. 3 credits, 3 contact hours (3;0;0).

R460 104. Planet Earth Lab. 1 credit, 1 contact hour (1;0;0).

R460 106. Environ. Geol. 3 credits, 3 contact hours (3;0;0).

R460 107. Environ Geology Lab. 1 credit, 1 contact hour (1;0;0).

R460 114. Earth & Life History. 3 credits, 3 contact hours (3;0;0).

R460 115. Earth & Life Hist Lab. 1 credit, 1 contact hour (1;0;0).

R460 201. Earthquakes - Volcano. 3 credits, 3 contact hours (3;0;0).

R460 203. Natural Disasters. 3 credits, 3 contact hours (3;0;0).

R460 206. Env Geology. 3 credits, 0 contact hours (0;0;0).

R460 207. Env Geology Lab. 1 credit, 1 contact hour (0;1;0).

R460 215. Environmental Disasters. 3 credits, 3 contact hours (3;0;0).

R460 225. Intro Oceanography. 3 credits, 3 contact hours (3;0;0).

R460 230. Weather And Climate. 3 credits, 3 contact hours (3;0;0).

R460 309. Geomorphology. 3 credits, 3 contact hours (3;0;0).

R460 311. Geologic Field Problems. 3 credits, 3 contact hours (3;0;0).

R460 314. Stratigraphy. 4 credits, 4 contact hours (4;0;0).

R460 320. Structural Geology. 4 credits, 0 contact hours (0;0;0).

R460 321. Mineralogy. 4 credits, 3 contact hours (3;0;0).

R460 322. Petrology. 3 credits, 3 contact hours (3;0;0).

R460 323. Rocks and Minerals. 4 credits, 4 contact hours (4;0;0).

R460 325. Intro to GIS. 3 credits, 3 contact hours (3;0;0).

R460 331. Oceanography. 3 credits, 3 contact hours (3;0;0).

R460 375. Quant Methods Geosci. 4 credits, 4 contact hours (4;0;0).

R460 400. Intro to Soil Science. 4 credits, 4 contact hours (4;0;0).

R460 401. Intro Geochemistry. 3 credits, 3 contact hours (3;0;0).

R460 406. Applied Geophys. 3 credits, 3 contact hours (3;0;0).

R460 415. Geologic Problems. 3 credits, 3 contact hours (3;0;0).

R460 416. Geologic Problems. 3 credits, 3 contact hours (3;0;0).

R460 427. Hydrogeology. 3 credits, 3 contact hours (3;0;0).

R830 101. Principles Of Psychology I. 3 credits, 3 contact hours (3;0;0).

R830 102. Prin Of Psychology. 3 credits, 0 contact hours (0;0;0).

R830 103. Cognitive Science. 3 credits, 3 contact hours (3;0;0).

R830 104. Cognitive Science II. 3 credits, 3 contact hours (3;0;0).

R830 131. Intermediate Russian. 3 credits, 3 contact hours (3;0;0).

R830 204. Cognitive Proce. 3 credits, 0 contact hours (0;0;0).

R830 209. Principle Of Psychology. 3 credits, 3 contact hours (3;0;0).

R830 229. Prin Of Psychology. 3 credits, 0 contact hours (0;0;0).

R830 246. Abnormal Psyc. 3 credits, 0 contact hours (0;0;0).

R830 251. Business & Prof Ethics. 3 credits, 3 contact hours (3;0;0).

R830 255. Meth & Theory Psych. 3 credits, 3 contact hours (3;0;0).

R830 290. Principle Of Psychology. 3 credits, 0 contact hours (0;0;0).

R830 300. Research Methods Psyc. 3 credits, 3 contact hours (3;0;0).

R830 301. Stat Meth Cog & Beh. 4 credits, 4 contact hours (4;0;0).

R830 302. Exp Meth Cog & Beh. 4 credits, 3 contact hours (3;0;0).

R830 303. Memory & Attention. 3 credits, 3 contact hours (3;0;0).

R830 304. Cognitive Processes. 3 credits, 3 contact hours (3;0;0).

STS 205. Intro to Research Methods. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENGL 102 with a grade of C or higher. This course is intended to give second year undergraduate students an understanding of what research is, what it is used for, how it is conducted, and how it is reported. It provides an overview of applying the scientific method to real-life research, including ethical concerns, qualitative and quantitative methods (and how and when they should be used), and how to critically evaluate published research findings. This course can be used to satisfy either the three credit 200 GER in History and Humanities or the three credit GER in Social Sciences, but not both.

STS 221. Introduction to Sociology. 3 credits, 3 contact hours (3;0;0).
An examination of modern society and culture, analyzing the forces for stability and change. Topics covered include the individual and society (socialization, conformity, alienation, and class structure), social institutions (religion, law, education, family, and state), social processes (conflicts and harmony, cohesion and dissolution, power, authority, and revolution), urbanization, industrialization, and technological change. This course can be used to satisfy either the three credit 200 GER in History and Humanities or the three credit GER in Social Sciences, but not both.

STS 230. Introduction to Anthropology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with a grade of C or higher. Corequisites: ENGL 102 may be taken concurrently as a co-requisite. This course is an introduction to the discipline of Anthropology, to include the subfields of Cultural Anthropology. Physical Anthropology, Archeology, and Linguistic Anthropology. Anthropology is the study of the human species with the subfields united in their focus on culture. Physical (or Biological) Anthropology studies the evolution of the species that has resulted in its capacity for having culture. Archeology studies the preserved artifacts from past human societies to discover the cultures of prehistoric times. Linguistic Anthropology studies the development and use of languages, and how language is related to other aspects of culture. Cultural Anthropology studies the systems of culture in contemporary social groups, analyzing their similarities and difference. This course satisfies the three credit GER in Social Sciences.

STS 257. Technology, Society and Culture: An American View. 3 credits, 3 contact hours (3;0;0).
This course will examine several key cases in the way technology fits into society. The politics, sociology, and ethics of technological development will be investigated. Topics include several significant advances of the twentieth century: nuclear warfare, fast food, the simplicity movement, and futuristic enhancement. What do all these things have to do with one another? This course satisfies the three credit 200 GER in History and Humanities.

STS 258. Technology, Society and Culture: A Global View. 3 credits, 3 contact hours (3;0;0).
This course will investigate the issues and problems inherent in the globalization of technology and culture at the beginning of this new millennium. Countries and economies are becoming more entwined in each other’s identities and economies, and cultural diversity is both threatened and proliferating at one and the same time. How much can the world's markets continue to grow and connect? How does the spread of information change what we know about one another? Should we be afraid of progress? Does the world understand the United States? Do we understand the world? How can "Growth" or "development" be sustained? How can we guide its change? This course satisfies the three credit 200 GER in History and Humanities.

STS 300. Legal Reasoning, Writing, and Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Integrates the process of legal research and fundamentals of legal writing with analysis of law. Focuses upon legal reasoning through analysis of fact and upon the logic of law in judicial opinions, statutory construction, and constitutional interpretation as contemporary issues are analyzed. This course satisfies the three credit 300 GER in History and Humanities.

STS 301. Independent Study. 1 credit, 3 contact hours (0;0;3).
Prerequisites: Junior standing in the STS program and written approval of the program director. Consists of self-paced study on an individual or small group basis in a specific area integral to a student's STS concentration but not available on a regular course basis. This course does not satisfy the three credit 300 GER in History and Humanities.

STS 302. Independent Study. 2 credits, 3 contact hours (3;0;0).
Prerequisites: Junior standing in the STS program and written approval of the program director. See STS 301. This course does not satisfy the three credit 300 GER in History and Humanities.

STS 303. Independent Study. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Junior standing in the STS program and written approval of the program director. See STS 301. This course satisfies the three credit 300 GER in History and Humanities.

STS 304. Qualitative Research Methods in the Social and Behavioral Sciences. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Develop skills for collecting and evaluating social scientific data using qualitative research methods including content analysis, case study techniques, participant observation, ethnographies, interviews, survey design, and focus groups. The course also highlights essential issues pertaining to recruitment of research respondents and ethical fieldwork practices. This course satisfies the three credit 300 GER in History and Humanities.

STS 304A. Qualitative Research Methods Lab. 1 credit, 2 contact hours (0;2;0).
Corequisite: STS 304. This course is the laboratory component of STS 304 and must be taken concurrently.

STS 306. American Mosaic: Understanding Cultural Diversity. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An examination of multiculturalism in the United States. The course provides students with a methodological framework for understanding cultural diversity in the United States and around the world. This course satisfies the three credit 300 GER in History and Humanities.

STS 307. Quantitative Research Methods in the Social and Behavioral Sciences. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Focuses on quantitative research methods in the field of science, technology and society including basic statistical techniques for empirical data analysis. The course provides instruction in hypothesis testing, data collection, selection of appropriate instruments and techniques, experimental design, and quantitative modeling using statistical software. This course satisfies the three credit 300 GER in History and Humanities.

STS 307A. Quantitative Research Methods Lab. 1 credit, 2 contact hours (0;2;0).
Corequisite: STS 307. This course is the laboratory component of STS 307 and must be taken concurrently.

STS 308. Globalization. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course will investigate the issues and problems inherent in the globalization of technology, economics, and culture in this new century. Introduces the important public issues that technology brings to the modern world, such as global trade, new energy technologies, and climate change. Emphasizes the close connections between science and technology, social institutions, and cultural values. Also analyzes today's "global village", the changing relations in culture and trade between East and West, North and South. This course satisfies the three credit 300 GER in History and Humanities.

STS 309. Advocacy and the Law. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Offers opportunities to explore the retrieval and use of legal and law-related materials while developing skills in oral advocacy and in writing persuasive legal documents, such as motion memoranda and briefs. Includes learning to listen to participants in the legal process as well as developing effective styles and forms of speech in the classroom. This course satisfies the three credit 300 GER in History and Humanities.

STS 310. Technology and Human Values. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines the interactions between science, technology and human values. Specifically, explores psychological, moral, and philosophical consequences of, and humanistic responses to, technological change. Readings, essays, fiction, and research articles treat such topics as the philosophical foundations of modern science, scientism, technicism; the impact of technology on images of man found in modern literature; and the moral implications of various kinds of recent technology. This course satisfies the three credit 300 GER in History and Humanities.

STS 311. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op Office. Mandatory participation in seminars and completion of a -report. Note: Normal grading applies to this COOP Experience.

STS 312. Technology and Policy in Contemporary America. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A study of technology and politics in recent America. Focuses on the role of the federal government in shaping technology, especially through funding technological innovations and applications. Topics will include the origins of technology policy in World War II, the influence of the Cold War, the science and technology policy advisory system, and political and cultural influences on technology policy. This course satisfies the three credit 300 GER in History and Humanities.

STS 315. Sports, Technology and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course addresses philosophical and sociological issues surrounding sports, especially questions that arise with advances in technology. For instance: How do advances in technology affect sports? Should sports limit technology, or should they adapt and change with advances in technology? Should performance-enhancing drugs be allowed in sports? What about other forms of technological enhancement? How should we judge sports performance, and how could technology help? Can technology make sports safer? How do various media affect sports? This course satisfies the three credit 300 GER in History and Humanities.

STS 316. Mass Communications, Technology and Culture. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Uses the tools of the humanities and social sciences to study the interplay between technology and mass culture. Focuses on motion pictures, electronic music, and television as both technologies and as forms of art. Devotes special attention to the portrayal of science and technology in the media. This course satisfies the three credit 300 GER in History and Humanities.

STS 318. Educational Media Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 201. Educational Media Design employs the instructional principles of constructivist pedagogy as the process used to develop a solution to develop courseware for K-12 audience. The course builds on the participatory design model of software engineering in order to develop integrated learning environments that support visual and verbal literacy; enables student to be able to plan, organize, and systematically develop instructional materials. This course implements instructional design theory and pedagogy in order to create an actual application for a computer-based environment. Same as IT 380. This course does not satisfy the three credit 300 GER in History and Humanities.

STS 325. ST:. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An in-depth examination of a current STS issue. A new topic is addressed each time the course is offered. This course satisfies the three credit 300 GER in History and Humanities.

STS 342. Gender, Technology and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course uses an interdisciplinary and intersectional approach to analyze how gender identities are constructed and contested in the world today, with special emphasis on gender issues in the high-tech workplace. Course topics include: essentialist and social constructionist theories of gender identity; transgender identities; the interrelationship between sexism, homophobia and racism; the historical contributions of women and underrepresented minorities in science, technology, architecture and design; issues facing women in technologically-developing countries; and communication in the workplace between people of different cultures and identities. Course materials include case studies and autobiographical narratives, films, novels, and short stories as well as historical and sociological research work. This course satisfies the three credit 300 GER in History and Humanities.

STS 344. Communications Policy. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Study of communication environments and developing communications technologies as central elements of evolving political and social systems. Analysis of philosophical, military, economic, and technical premises for communications policy and the process of regulation. This course satisfies the three credit 300 GER in History and Humanities.

STS 346. Pragmatism and Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines the relationship between the American philosophy of pragmatism and the role of technology in the contemporary world. How do philosophical ideas affect the development of technology and science? How has pragmatism shaped the current view of the meaning and value of technological progress? Readings from both the traditional authors of American pragmatism--Peirce, James, and Dewey--and contemporary texts. This course satisfies the three credit 300 GER in History and Humanities.

STS 347. Music and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one Cultural Literacy GER 200 level course with a grade of C or higher. This course is an overview of the role music has played in society, from ancient to present times, and considers various types: Western, Eastern, folk, world, classical, jazz, rock, and electronic. The course enables students to develop an informed and critical appreciation of the vast array of music available today and its importance in political and social discourse and influence. Also covered is the role that technology has played in transforming how we experience and create music, from the development of the earliest musical instruments to the Internet. Students will have extensive opportunities to listen to and write about music. This course satisfies the three credit 300-level GER in Cultural Literacy.

STS 349. Electronic Music in Practice. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Students will learn the basics of notebook computer-based music composition and production. Emphasis will be on composition and making of music, learning the aesthetics necessary to get the most out of your machine. Course will require extensive work on your own laptop computer. Computer requirements: A PC or Macintosh system running Ableton Live. This course satisfies the three credit 300 GER in History and Humanities.

STS 350. Computers and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines the societal diffusion of computing and the role of computers in processes of social change. Special consideration is given to how computers have contributed to the emergence of new work routines, social practices, and mobility patterns. This course satisfies the three credit 300 GER in History and Humanities.

STS 351. Minds and Machines. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An introduction to the philosophy of mind and cognitive science. Topics covered include the computational theory of mind; artificial intelligence; connectionism; embodied theory of mind; and dynamical theories of mind. Readings from recent and contemporary philosophy, psychology and computer science. This course satisfies the three credit 300 GER in History and Humanities.

STS 352. Race and Ethnicity. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Explores the concepts of race and ethnicity in both national and international arenas. Scientific, sociological, political, and global implications are addressed. Upon completion of this course, students will be able to competently address the impact of race on micro and macro levels, from both individual and policy perspectives. Special topics are negotiated with students at the start of each class. Such topics can include immigration, affirmative action, educational curricula, institutional racism, or the impact of multiculturalism on families. Emphasis is on the interaction between race and technology. This course satisfies the three credit 300 GER in History and Humanities.

STS 360. Ethics and the Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An examination of contemporary environmental problems from the perspective of ethics or moral philosophy. An analysis of the ethical presuppositions and value principles underlying environmental policy. The study of ethical theories and their application to the environmental crisis. This course satisfies the three credit 300 GER in History and Humanities.

STS 362. Environmental Economics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher, and ECON 201 with a grade of C or higher. Presents a detailed overview of the relationship between political economy and the environment. Draws on diverse case studies including global warming, harvesting of minerals on the ocean's floor, destruction of old growth forests, and contamination of the nation's water, air, and soils. Explores the economic remedies to the fast-changing relationship between society and nature. This course does not satisfy the three credit 300 GER in History and Humanities.

STS 363. Introduction to Sustainability Studies. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The course introduces students to sustainability studies, examines the roots of the concept, and explores its roles as feature of international politics. Particular attention is devoted to the economically, advanced nations and the challenges of planning for a more sustainable future. The course also considers how the sustainability agenda is likely to evolve in an era of climate change and biophysical constraints. This course satisfies the three credit 300 GER in History and Humanities.

STS 364. Sustainability Policy and Practice. 3 credits, 3 contact hours (3;0;0).
Prerequisites: STS 201, EPS 202 and STS 363, each with a grade of C or better. Formulation of effective sustainability policies requires appreciation of the linkages between conceptual understanding and empirical practice. The course highlights the macroeconomic drivers of contemporary sustainability challenges. Topics discussed include efficiency improvements, economic relocalization, green consumerism, and efforts to build a green economy.

STS 365. Animal Intelligence and Ethics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course offers a detailed look into contemporary debates in Animal Ethics and the Philosophy of Animal Minds. These debates are inherently multi-disciplinary, ranging from questions in evolutionary biology, ethology, cognitive science, developmental psychology, and artificial intelligence. This course investigates and demythologizes the concept of “human nature” by drawing cognitive and moral similarities between species. This course satisfies the three credit 300 GER in History and Humanities.

STS 375. AI and the Human Mind. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. What does it mean for a machine to know? What does this say about the possibility of human knowledge? In this course, we will explore what artificial intelligence (or, AI) is, how it works, how the field has developed, how the specific technical implementations of AI influence and are influenced by sociocultural factors, what barriers exist to AI research, what threats AI development may pose, and what AI can tell us about ourselves. This is not a programming course, and although some attention will be paid to AI technologies and algorithms, no coding will be involved. This course is appropriate for students at any level of previous AI experience. This course satisfies the three credit 300 GER in History and Humanities.

STS 376. Cyborg Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher and one 200-level Social Science or Cultural Literacy GER course with a grade of C or higher. A cyborg, short for cybernetic organism, is a human being with technological enhancement or augmentation that improves the human body beyond its natural state. This course looks at ourselves as cyborgs and human enhancements from prosthetic, biological, nano-technological, informational, and computational technologies. Cyborg theory requires us to reevaluate the boundaries of the self such as differences between humans and machines, humans and animals, male and female. Topics include cyborg theory's impact on politics, gender, race and ethnicity, space travel, war, the prescience of science fiction, and the exponential growth of future cyborg technology. This course can be used to satisfy either the three credit 300 GER in History and Humanities or the three credit GER in Social Sciences, but not both.

STS 378. Literature and Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Literature reveals and interprets the natural world. Students examine the ways that nature has been used in non-fiction and fiction. Students also learn the challenge of describing the natural world in their own words. Representative writers include Percy Shelley, Henry David Thoreau, Octavio Paz, Denise Levertov, Gary Snyder, Joyce Carol Oates, and Annie Dillard. Co-listed as LIT 378. This course satisfies the three credit 300 GER in History and Humanities.

STS 380. Policy Issues in the Coastal Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An examination of coastal environments from the standpoint of the scientist, the engineer, and the resource manager. Topics include beach and shoreline characteristics, technological innovations to address coastal erosion problems, and current debates in coastal policy and resource management. Case studies are used to illustrate coastal management practices and the scientific, technical, and social constraint to policy formulation. This course satisfies the three credit 300 GER in History and Humanities.

STS 382. Geographical Perspectives on the Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Designed to introduce students to the field of geography. Focuses on the natural processes that sculpt the physical and biological terrain, and the environmental interrelationships between human societies and nature. Combining physical, human and environmental perspectives on the earth's surface, explores, in depth, topics such as famine, societal response to natural and technological hazards, and water issues in the United States. This course satisfies the three credit 300 GER in History and Humanities.

STS 401. Independent Study. 1 credit, 3 contact hours (0;0;3).

STS 403. Independent Study. 3 credits, 3 contact hours (0;0;3).
This course satisfies the three credit 300 GER in History and Humanities.

STS 411. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: STS 311 or its equivalent with a grade of C or better, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience. Mandatory participation in seminars and completion of requirements that include a report and/or project. Note: Normal grading applies to this COOP Experience.

STS 490. Project and Seminar I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: senior standing in the STS program. Each student undertakes a comprehensive study of an issue in science technology and human affairs. The solution requires application of knowledge and skills acquired in course work, self-study, and library research as well as consultation with persons in the academic community, industry, and government. The completed study is submitted as a detailed written report. The seminar meets weekly. Speakers from education, government, and industry address themselves in topics of current interest to STS students.

STS 491. Project & Seminar II. 2 credits, 4 contact hours (0;0;4).
Prerequisite: STS 490. A continuation of STS 490.

STS 492. Technology and the Future of Work. 2 credits, 3 contact hours (2;0;1).
Prerequisites: Senior status and permission of the program director. The course examines and evaluates our digital society, computerization, automation, artificial intelligence, and emerging technologies and explores how they are changing the nature of work, the societal understanding of work and the workplace, and the anticipated impacts on individuals, communities, culture, economics, and society. The course introduces ideas and theories and evaluates the relationship between technology, automation, society, and work.

THTR 1. Theatre Elective Lowe Div. 3 credits, 3 contact hours (3;0;0).**

THTR 101. Living Theatre. 3 credits, 3 contact hours (3;0;0).
An introduction to the basic elements of theater through an examination of the roles of the playwright, director, designer, and actor. Attend select current plays and professional productions.

THTR 102. Acting Fundamentals. 3 credits, 3 contact hours (3;0;0).
Developing acting skills in a studio environment. Work with improvisation comedy and drama, scene study based on known contemporary and classical plays, and basic theater exercises that develop physical skills for character development and performance endurance. Emphasis on vocal skills using presentation exercises and theatrical audition techniques will be developed through the class.

THTR 2. Theatre Elective Lower Div. 3 credits, 3 contact hours (3;0;0).**

THTR 208. Movement for Theatre. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a corequisite. Introduces skill-oriented movement exercises through an exploration of the physical nature of acting and character work. Movement is basic to actor training. The movement exercises used in this course will explore not only the physical age of the characters from plays chosen in class, but also work with the character social movements based on the cultural history of the times the plays were written or the historical period they represent. This course satisfies the three credit 200 GER in History and Humanities.

THTR 209. Voice and Speech for Theatre I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a corequisite. The objective of the course is for students to learn to use voice as a vocal instrument. Beginning with breath control, students learn how to project the voice, the use of resonators, and the placement of the voice in space. This is an essential training for the actor or public speaker. Exercises will be generated from plays from around the world. The character work from these plays will include the study of dialects, sustainability, phonetics, and culturally specific vocals. This course satisfies the three credit 200 GER in History and Humanities.

THTR 210. Voice & Speech for Theater II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a co-requisite Working with plays, poetry, and narratives, students learn to analyze texts vocally and to explore the relationship between physical and vocal expression. This course satisfies the three credit 200 GER in History and Humanities.

THTR 212. From Page to Stage. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a co-requisite. The course is an introduction to understanding the relationship between the literary nature of plays and how they are produced for the stage. Attendance to current professional productions and on-campus productions will be used as a launching point for class papers, discussions, and exercises. This course satisfies the three credit 200 GER in History and Humanities.

THTR 213. Directing I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken as a corequisite. Students will learn major directoral techniques in the production of short plays and other workshop scenarios. There is an emphasis on the process of synthesizing theatrical elements of direction in order to oversee and orchestrate the mounting of a theater production. The goal of the course is for students to learn what directors do to ensure the quality and completeness of theater production by collaborating with a team of individuals involved in stagecraft, costume design, props, lighting design, acting, set design, stage combat, and sound design for the production. This course satisfies the three credit 200 GER in History and Humanities.

THTR 215. Acting II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a corequisite. Advanced scene study, audition techniques, and ensemble techniques are explored. Interpretation of scenes from selected dramas for stage performance, evaluation of practiced techniques in character portrayal through dialogue and action. Participation in a performance workshop is stressed. This course satisfies the three credit 200 GER in History and Humanities.

THTR 216. Improvisational Theatre Short Form. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a corequisite. THTR 216 introduces the techniques of short-form improvisational performance through in-class practical exercises that promote spontaneity and creative space work. Students work with game structure and short narratives leading to public performances so the student gains insights only the live setting can impart. This course satisfies the three credit 200 GER in History and Humanities.

THTR 217. Improvisational Theatre Long Form. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a corequisite. This course includes exercises that promote long-form interactive narrative and story development skills. In addition to exploring storytelling this technique is used in other media such as, music, movement, and film. The students will perform multiple times getting feedback only a live show can give. This course satisfies the three credit 200 GER in History and Humanities.

THTR 220. Instr Ensemble Performance I. 1 credit, 3 contact hours (0;3;0).
Prerequisite: permission of course coordinator and conductor. This course involves membership in an instrumental music group led by a professional conductor. The group will meet once a week to rehearse concert pieces. Students must play an instrument with a significant level of accomplishment in order to register for this course. There will be continuous assessment of individual performance by the conductor and a final concert in a campus venue. This is one of three performance courses. Musicians may join one or more of these ensembles, wind, string, jazz, etc. In order to register for this course, contact instructor for permission. This course does not satisfy the three credit 300 GER in History and Humanities.

THTR 221. Instr Ensemble Performance II. 1 credit, 3 contact hours (0;0;3).
Prerequisite: permission of course coordinator and conductor. This course involves membership in an instrumental music group led by a professional conductor. The group will meet once a week to rehearse concert pieces. Students must play an instrument with a significant level of accomplishment in order to register for this course. There will be continuous assessment of individual performance by the conductor and a final concert in a campus venue. This is one of three performance courses. Musicians may join one or more of these ensembles, wind, string, jazz, etc. In order to register for this course, contact instructor for permission. This course does not satisfy the three credit 300 GER in History and Humanities.

THTR 222. Instr Ensemble Performance III. 1 credit, 3 contact hours (0;0;3).
Prerequisite: permission of course coordinator and conductor. This course involves membership in an instrumental music group led by a professional conductor. The group will meet once a week to rehearse concert pieces. Students must play an instrument with a significant level of accomplishment in order to register for this course. There will be continuous assessment of individual performance by the conductor and a final concert in a campus venue. This is one of three performance courses. Musicians may join one or more of these ensembles, wind, string, jazz, etc. In order to register for this course, contact instructor for permission. This course does not satisfy the three credit 300 GER in History and Humanities.

THTR 261. Performance I. 3 credits, 3 contact hours (3;0;0).
Departmental approval required. A lecture/workshop that combines class with a play production. An in-depth study of the author of the play and contemporaries of his/her time will be made throughout the semester. A different style or genre of theater is studied each term the course is offered based on the chosen mainstage production. This course satisfies the three credit 200 GER in History and Humanities.

THTR 262. Performance II. 3 credits, 3 contact hours (3;0;0).
Departmental approval required. A study will be made of the chosen playwright, contemporaries of the writer, and an in-depth study of costume design, music of period, and set design of the play chosen for production. A production team will coordinate the main stage production. This course satisfies the three credit 200 GER in History and Humanities.

THTR 310. Theatre History I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Study of Euro-American theater history from Greece and Rome through early post-Renaissance Europe. The course covers the dramatic literature of the times and how the socioeconomic influences reflect the theatrical style, community interaction, and the technical uses of stage devices. This course satisfies the three credit 300 GER in History and Humanities.

THTR 315. Theatre History II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Study of Euro-American theatre history from post-Renaissance Europe to present. Dramatic literature will be related to the historical events that reflect theatrical style, political movements, and technical advancements in society. This course satisfies the three credit 300 GER in History and Humanities.

THTR 344. American Musical Theater. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Course covers the development of American Musical Theatre decade by decade, starting with the turn of the 20th century until the present day. Examples of music and lyrics are demonstrated in class and students attend contemporary and revival Broadway musicals. This course satisfies the three credit 300 GER in History and Humanities.

THTR 360. Drama. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Follows the development of play structure from folkloric origins to contemporary theater. Emphasis is on text, history of text development, and the changing purpose of theatrical presentations. This course satisfies the three credit 300 GER in History and Humanities.

THTR 362. Non-Western Drama. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Explores classical and contemporary theater and drama in China, Japan, India, Africa, and the Middle East. This course satisfies the three credit 300 GER in History and Humanities.

THTR 363. Ethnic and Minority Drama. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Using contemporary dramas as social, historical, and cultural artifacts, examines the experience of Latinos, Asian Americans, Native Americans, and African Americans. This course satisfies the three credit 300 GER in History and Humanities.

THTR 364. Technology in Performance. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Interdisciplinary course in a theatre area (e.g., acting, improvisation, writing, design, audio, lighting, etc.) to work with another department or program using an enhanced technology component (e.g., CGI, motion capture, electronic circuitry, media, etc.) to explore and develop alternative ways of presenting performances in a live setting. This course satisfies the three credit 300 GER in History and Humanities.

THTR 365. Principles of Playwriting. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The course objective is to write and rewrite three short plays during the semester. These new plays will have a first reading and a staged reading in the classroom, followed by analytical discussions about playwriting and the craft's applied techniques. Students will attend two professional plays and write subsequently one experience paper and one research paper; attend both campus shows for discussion and in-class improvisational playwriting exercises. The original plays developed in class will be submitted by the student for playwriting competitions at the end of the semester. This course satisfies the three credit 300 GER in History and Humanities.

THTR 384. Musical Theater Adaptations. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The content of this course is primarily literary. It examines the original texts that are used for theatrical adaptations in contemporary Broadway and Off-Broadway musicals. The origin stories are drawn from literature, graphic novels, and cultural folk stories. Students will attend selected musicals. This course satisfies the three credit 300 GER in History and Humanities.

THTR 396. Internship-Theater. 3 credits, 3 contact hours (0;0;3).
Open to junior or senior Theater majors or minors or Communication majors with Theater Specialization. Permission of division director or faculty advisor in conjunction with the instructor directing the course. The internship is with a professional performing or media arts organization. The student is expected to work with the host company for professional experience.

THTR 411. Special Topics in Theatre. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This specialty course will feature a different aspect of theater each semester depending on the area of expertise of the instructor. Some examples: The course could cover playwriting, advanced playwriting, film writing, and musical theater techniques, advanced theater directing, auditioning skills, advanced acting or acting: history and practice.

THTR 414. Directing II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: THTR 213 or departmental approval. Assistant directing main stage production with faculty director or other independent directing project. Intense study of directing style through practice and research.

THTR 465. Performance II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: THTR 261 or THTR 262 and ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This is an advanced study of one playwright's work leading to a performance of one of his/her plays. A study will be made of the chosen playwright, contemporaries of the writer, and an in depth study of costume design, music of period, and set design of the play chosen for production.

THTR 480. Independent Theatre Practicum. 2 credits, 4 contact hours (0;0;4).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The core of this course is a supervised and assigned independent involvement in a main stage production, which is pre-approved by an instructor. The student will take a leadership role and participate in pre-production activities all the way through to the conclusion of production of the show. An ongoing journal of activities is required to be submitted at the end of the production process. The production work will be in one of the following areas: performance, dramaturge, stage management, design, props, public relations or other areas related directly to the designated main stage production.

THTR 483. Independent Study in Theater I. 3 credits, 3 contact hours (0;0;3).
By arrangement only through a theater faculty advisor, the student will take on a specialized creative theater project for the semester. This would cover a specific aspect of theatrical production development and cumulate in one of the following depending on the nature of the assignment: a journal or portfolio of completed production work, an original play or screenplay script, or research document.

THTR 484. Independent Study in Theater II. 3 credits, 3 contact hours (0;0;3).
This course is for junior and seniors only by arrangement through a theater faculty advisor. The student will take on a more advanced specialized creative theater project for the semester. As this would cover a specific aspect of theatrical production development, the student will be expected to take on a leadership role in the chosen area of study. Documentation of the project development and completion is required.

Aerospace Studies

The Aerospace Studies Department is affiliated with the Air Force Reserve Officer Training Corps (AFROTC) based at NJIT, and AFROTC Detachment 490 is committed to graduating outstanding officer leaders for the U.S. Air Force. Students enrolled in AFROTC take classes in aerospace history, leadership and management, national security, and physical fitness. Cadets can compete for excellent scholarship support and receive an exceptional education in preparation for the many career opportunities available while serving as a U.S. Air Force officer after graduation.

Cadets can learn to lead and achieve personal success in careers such as piloting, remote-piloting, engineering, physics, intelligence, space operations, communications, nursing, and many more fields. For more information about aerospace studies at NJIT, visit njit.edu/rotc (http://njit.edu/rotc/) or call 973-596-3626, and learn more about AFROTC at afrotc.com (http://www.afrotc.com).

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Aerospace Studies Courses

AS 111. Heritage and Values of the United States Air Force I. 1 credit, 1 contact hour (1;0;0).
A survey course designed to introduce students to the United States Air Force and provide an overview of the basic characteristics, missions, and organization of the Air Force. Air Force communications skills and leadership abilities are developed through group leadership problems and Leadership Laboratory (LLAB).

AS 112. Heritage and Values of the United States Air Force II. 1 credit, 1 contact hour (1;0;0).
Prerequisite: AS 111 or approval of the Professor of Aerospace Studies. A survey course that continues introducing students to the United States Air Force and providing an overview of the basic characteristics, missions, and organization of the Air Force. Air Force communications skills and leadership abilities are developed through group leadership problems and Leadership Laboratory (LLAB).

AS 221. Team & Leadership Fundamentals. 1 credit, 1 contact hour (1;0;0).
Prerequisite: AS 112 or approval of the Professor of Aerospace Studies. This course focuses on laying the foundation for teams and leadership. The topics include skills that will allow cadets to improve their leadership on a personal level and within a team. The courses will prepare cadets for their field training experience where they will be able to put the concepts learned into practice. The purpose is to instill a leadership mindset and motivate students to transition from AFROTC cadet to AFROTC officer candidate.

AS 222. Team and Leadership Fundamentals II. 1 credit, 1 contact hour (1;0;0).
Prerequisite: AS 221 or approval of the Professor of Aerospace Studies. This course continues to focus on laying the foundation for teams and leadership. The topics include skills that will allow cadets to improve their leadership on a personal level and in a team. The course will prepare cadets for their field training experience where they will be able to put the concepts into practice. The purpose is to instill a leadership mindset and motivate students to transition from AFROTC cadet to AFROTC officer candidate.

AS 301. Aerospace Independent Study. 3 credits, 3 contact hours (0;0;3).

AS 333. Leading People & Effective Com. 3 credits, 3 contact hours (3;0;0).
Prerequisite: AS 222 or approval of the Professor of Aerospace Studies. This course teaches cadets advanced skills and knowledge in management and leadership. Special emphasis is placed on enhancing leadership skills and communication. Cadets have an opportunity to try out these leadership and management techniques in a supervised environment as juniors and seniors.

AS 334. Leading Peo & Effective Com II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: AS 333 or approval of the Professor of Aerospace Studies. This course continues to teach cadets advanced skills and knowledge in management and leadership. Special emphasis is placed on enhancing leadership skills and communication. Cadets have an opportunity to try out these leadership and management techniques in a supervised environment as juniors and seniors.

AS 335. Leadership Lab. 0 credits, 0 contact hours (0;0;0).

AS 336. POC Leadership Lab. 0 credits, 0 contact hours (0;0;0).

AS 401. Aeropsace Independent Study. 3 credits, 0 contact hours (0;0;0).

AS 443. National Security Affairs/Prep Act. 3 credits, 3 contact hours (3;0;0).
Prerequisite: AS 334 or approval of the Professor of Aerospace Studies. This course is designed for college seniors and gives them the foundation to understand their role as military officers in American society. It is an overview of the complex social and political issues facing the military profession and requires a measure of sophistication commensurate with the senior college level.

AS 444. Preparation for Active Duty. 3 credits, 3 contact hours (0;0;3).
Prerequisite: AS 443 or approval of the Professor of Aerospace Studies. This course is designed for college seniors and continues to give them the foundation to understand their role as military officers in American society. It is an overview of the complex social and political issues facing the military profession and requires a measure of sophistication commensurate with the senior college level.

Leadership and Aerospace Studies Minor

Open only to AFROTC students

Code	Title	Credits
AS 100		
AS 200		
AS 300		
AS 400		
Leadership Lab		
One elective course (with the approval of the minor coordinator)		

Biological Sciences

NJIT's Department of Biological Sciences is federated with Rutgers University-Newark, an affiliation that offers comprehensive opportunities for study and research, with diplomas issued jointly by NJIT and Rutgers. Students thus benefit from the best of both universities. NJIT emphasizes the quantitative and technical aspects of biology, while the focus at Rutgers is on the cellular and molecular aspects of biology, as well as ecology and evolution. Ample opportunities to participate in research at the undergraduate and graduate levels include neural-network function, neuro-immunology, waves and diffusion of ions in the brain, respiratory physiology, population dynamics, and global climate and ecosystem change.

NJIT Faculty

B

Barden, Phillip M, Assistant Professor

Bucher, Dirk M., Associate Professor

Bunker, Daniel E., Assistant Professor

D

Devan, Caroline M, University Lecturer

F

Flammang-Lockyer, Brooke E., University Lecturer

Fortune, Eric S., Associate Professor

G

Garnier, Simon J., Assistant Professor

Golowasch, Jorge P., Professor

H

Haspel, Gal, Assistant Professor

K

Konsolaki, Mary, University Lecturer

N

Nadim, Farzan, Professor

R

Russell, Gareth J., Associate Professor

S

Severi, Kristen E, Assistant Professor

Soares, Daphne F., Assistant Professor

Stanko, Maria L., University Lecturer

T

Tai, Xiaonan

Y

Yarotsky, John J., University Lecturer

Programs

- Biology - B.A. (p. 313)
- Biology - B.S. (p. 316)

Accelerated Programs (p. 102)

- Biology - B.A./M.D. (p. 320)
- Biology - B.A./D.M.D., O.D. (p. 323)
- Biology - B. A. in Biology/Doctor in Physical Therapy (DPT) - Ph.D. (p. 327)
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Double Majors (p. 102)

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- Cell Biology Concentration (B.A. in Biology) (p. 333)
- Ecology and Evolution Concentration (B.A. in Biology) (p. 336)
- Neurobiology Concentration (B.A. in Biology) (p. 338)

Biological Sciences Courses

BIOL 115. Evolution and Biology of Sex. 3 credits, 3 contact hours (3;0;0).
This course will examine the biological basis of sex determination and resultant gendered behavior in all animals, including humans. We will discuss how and why sex evolved, how different organisms express (& often change) their gender, and what selection pressures shape mating systems and mate selection. In addition, we will examine how gender-specific selection influences offspring care and attachment, aggression and friendship. Throughout the course, we will evaluate which principals can and cannot be extrapolated to human behavior as well as how we as humans project our ideas of gender onto our study of the natural world. We will critically discuss contemporary articles concerning gender in the popular media.

BIOL 150. Living in a Variable Universe. 4 credits, 6 contact hours (3;3;0).
This laboratory course uses real-world case studies and dramatic experimental examples from across the natural sciences to explore the origin, structure, perception and regulation of variability in the world. Why do we so often misunderstand the nature and consequences of variability? Why do our efforts to manage environment variability often fail? What are the benefits of variability? How can we plan more effectively for an uncertain future? Students will leave the course with a better understanding of how variability affects both themselves as individuals, and society at large. They will also be exposed to a broad sampling of different disciplines within the natural sciences, including physics, statistics, neuroscience, psychology, ecology, and geography.

BIOL 200. Concepts in Biology. 4 credits, 4 contact hours (4;0;0).
Prerequisites: MATH 107 or MATH 108 or Co-requisites: MATH 110, or MATH 111 or MATH 138. This course will introduce student to the study of biology at the beginning of their course of study. Central ideas in the biological sciences will be highlighted, with an emphasis on the process of scientific discovery and investigation. The course will provide the basis for more advanced coursework and learning experiences in the biological sciences as students delve into the curriculum of study.

BIOL 201. Found of Biol: Cell & Molecula. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 200 or R120 200 and CHEM 121 or CHEM 125. This course will expose students to an in-depth examination of the structure and function of cells; methods of study; thermodynamics and metabolism; membrane biology, energy utilization and transfer; protein and nucleic acid structure and function; transcription, translation, and genetic regulation. The laboratory course BIOL 202 must be taken concurrently, although they are separate courses.

BIOL 202. Found of Biol: Cell & Molecula. 1 credit, 3 contact hours (0;3;0).
Prerequisites: BIOL 200 or R120 200 and CHEM 121 or CHEM 125. Corequisite: BIOL 201. This course is a complement to the corresponding lecture course BIOL 201. The laboratory course will give students the opportunity to apply, in an experimental setting, the concepts that they are exploring in the accompanying lecture course and will offer them a hands-on experience that will enhance their learning of the Cellular and Molecular Biology content. Both courses (BIOL 201 and BIOL 202) must be taken concurrently.

BIOL 205. Foundations of Biology: Ecology and Evolution Lecture. 3 credits, 3 contact hours (3;0;0).
Prerequisite: BIOL 200 with a C or better, co-requisite BIOL 206. This introductory course considers the population level of biological organizations. Topics include Mendelian and population genetics, evolution, and ecology of populations and communities.

BIOL 206. Foundations of Biology: Ecology and Evolution Lab. 1 credit, 3 contact hours (0;3;0).
Prerequisite: BIOL 200 with a C or better, Co-requisite BIOL 205. The laboratory reinforces the topics covered in Foundations of Ecology and Evolution Lecture (Biol 205) lecture with hands-on activities and exposes students to current methods of research and analysis in these areas.

BIOL 222. Evolution. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This course will provide a comprehensive introduction to the field of evolutionary biology. Topics will include: the development of evolutionary theory, the history of the evolution of life on Earth, the genetic basis of variation and heredity, natural selection, evolution and development, and speciation.

BIOL 250. Biology of Neotropical Habitats: Ecuador and Galapagos Islands. 3 credits, 4 contact hours (2;2;0).
This course is an introduction to tropical biology and evolution held in Ecuador's Highlands, Rain Forest, and in the Galapagos islands. The course uses a hands-on approach to study the flora and fauna of these unique habitats. The course also addresses the history, politics, and culture of Ecuador, with emphasis on how these issues influence the management and sustainability of Ecuadorian natural resources.

BIOL 280. Ecology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 205 and BIOL 201. Overview of the science of ecology, which aims to understand interactions among biological species and among species and the abiotic environment. Topics include population ecology, species interactions, communities, and ecosystems. Topics will be addressed in light of global change including climate change, biodiversity loss, and impacts on human health and wellbeing.

BIOL 310. Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Departmental approval and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report.Note: Normal grading applies to this COOP Experience.

BIOL 315. Principles of Neurobiology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This course will review neuroscience concepts at a basic level. It will cover basics of cellular physiology, molecular biology and developmental biology of nerve cells, network physiology, behavior, cognition and memory and learning. This course will prepare students who are interested in a neuroscience sequence for their major.

BIOL 320. Discovering Biological Research. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102, (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. Success in the constantly evolving field of biology necessitates staying current in scientific literature. This requires competency in skills such as analysis of primary sources, synthesis of information from multiple sources, and oral and written communication skills. This course focuses on these competencies. Students will develop skills need to read and analyze scientific literature, and to communicate science. Each semester the content theme of the course will change depending on the expertise of the faculty member teaching the course.

BIOL 321. Comp Vertebrate Anatomy. 4 credits, 6 contact hours (3;3;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) and (PHYS 102 and PHYS 102A or PHYS 111 and PHYS 111A) with grade of C or better. This course introduces students to the groups of vertebrates and explores the anatomical evolution of vertebrates within the context of the functional interrelationships of organs and the changing environments to which vertebrates have adapted. An ideal entry point into the ways living creatures interact with their immediate physical world, we examine how the forms and activities of animals reflect the materials available to nature and consider rules for structural design under environmental forces.

BIOL 328. Ornithology - The Life of Birds. 3 credits, 5 contact hours (1;4;0).
Prerequisites: BIOL 205, BIOL 201. Ornithology is the study of birds and bird biology. Topics include bird observation and identification, evolutionary origins and biodiversity, form and function, behavior, reproduction, ecology, and conservation. This field/lab course will include numerous field trips to natural areas in New Jersey.

BIOL 337. Collective Intel in Biol Syst. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This course will provide an overview of the fundamental principles underlying the organization of animal and human societies. It will include detailed consideration of behavioral, social, and physical processes that are responsible for the coordination of activities in large animal and human groups and social.

BIOL 338. Ecology of the Dining Hall. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This course will use the examination of an on-campus ecosystem, the dining hall, as a framework for learning about a number of applied ecological concepts. We will investigate topics such as food webs, nutrient cycling, microbial ecology, and agroecology as they apply to the organisms and biological processes, present in our dining hall. Course work will involve extensive reading and discussion of scientific and popular literature, supplemented by regular class trips to the dining hall and related on-campus facilities.

BIOL 340. Mammalian Physiology. 4 credits, 6 contact hours (3;3;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This course will review general principles of the function of the human body as a mammal, with emphasis on the function and regulation of neuromuscular, cardiovascular, respiratory, endocrine, digestive, and excretory systems. The goal is to provide students with the basic knowledge to understand how their own bodies operate.

BIOL 342. Developmental Biology (Embryology). 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. Descriptive and experimental approaches to molecular, cellular and organismal changes during embryonic development; mechanisms of cell differentiation, organogenesis, morphogenesis, and pattern formation.

BIOL 347. Lab Approaches in Neuroscience. 4 credits, 6 contact hours (3;3;0).
Prerequisite: BIOL 315 Students will perform neurophysiological experiments, including assembling neurophysiological equipment, preparing neural tissues, selecting and presenting stimuli, recording, analyzing, and interpreting data. Students will perform experiments of increasing technical complexity. Each will reinforce theoretical and practical concepts related to the amplification and sampling of biopotentials. A lecture part will prepare the students for the concepts relevant to the lab day, and a data discussion meeting will aid the students in analyzing and presenting the data.

BIOL 350. Immunology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. The objective of this course is to facilitate an understanding of preliminary knowledge of the immune system in humans and other mammals. Students will be able to translate a basic understanding of the immune system and how that knowledge translates to further understanding medicine, research topics in cell biology, and broad topics in public health policy.

BIOL 352. Genetics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better.

BIOL 375. Conservation Biology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This course will provide a comprehensive introduction to the field of conservation biology, as well as philosophical and economic concerns.

BIOL 376. Biological Applications of Geographic Information Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 205, BIOL 201. This course offers an introduction to concepts underlying geographic information systems (GIS) and methods of managing and processing geographic information. The course is designed for students who have little background but want to learn the fundamentals and applications of GIS. The nature of geographic information, data models and structures for geographic information, geographic data input, data manipulation and data storage, spatial analytic and modeling techniques will be discussed. Students will be exposed to both theoretical knowledge and technical skills in this course. Assignments and a course project will promote students' application of concepts and skills in solving real-world problems.

BIOL 382. Animal Behavior. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 205 and BIOL 206 or R120 205 and R120 206) and (BIOL 201 and BIOL 202 or R120 201 and R120 202). The objective of this course is to expose students to the broad field of animal behavior. The course will include the historical underpinnings of the field as well as the contemporary theories for a wide variety of behaviors. Behavioral ecology and the evolution of animal behaviors as adaptations will be intertwined throughout the course, as well potential applications of knowledge about animal behavior. Students will be able to analyze existing evidence and investigate modern practices in order to evaluate existing theories and consider potential future directions of animal behavior. Using current scientific literature, as well as case-studies, students will be able to come up with their own hypotheses and determine how different hypotheses related to animal behavior can be tested experimentally. Students will also gain hands-on experience in trying out some of the fundamental techniques.

BIOL 383. Neural Basis of Behavior. 3 credits, 3 contact hours (3;0;0).
Prerequisite (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. This lecture course explores the neural mechanisms underlying animal behavior. This course is intended for upper-level undergraduate students who have some background in biology, hence the prerequisite for Foundation of Biology. This courses would also be of interest to graduate students interested in neuroscience, such as, students in the Quantitative Neuroscience (QNS) program, students in the Integrative Neuroscience (INS) program, and students at the Center for Molecular and Behavioral Neuroscience (CMB). It is unnecessary for the students to have taken animal behavior or neurobiology; however, these courses would be helpful.

BIOL 400. Biology in Science Fiction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (R120 340 or BIOL 340) and (R120 355 or R120 356 or BIOL 352 or R120 352). Popular science fiction media will be utilized to initiate thinking critically and creatively about the biological sciences; from the molecular level to whole organism physiology. Students will explore the potential biology of fictitious organisms, and determine real-life analogues. These topics will be used as a vehicle to improve scientific writing and to apply biological knowledge in a new and unique way.

BIOL 410. Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: BIOL 310. Restriction: departmental approval and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic progam. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report.Note: Normal grading applies to this COOP Experience.

BIOL 423. Physiological Mechanisms. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 340 or R120 340 with a grade of C or better. This course will utilize clinical (pathological) case studies to reinforce physiologic knowledge and provide students a strong basis for future studies in biomedical and health related fields.

BIOL 424. Comparative Physiology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 340 or R120 340 or (R120 141 and R120 142) with grades of C or better. We will use a comparative approach to examine the physiology of animals including major physiological systems, with an emphasis on vertebrates. Topics to be covered include metabolic, temperature, osmotic and ionic regulation; respiration and circulatory transport, digestive, muscle, nervous, and locomotor systems; endocrine regulation and biological rhythms. We will further examine how physiological systems are integrated and thus allow animals to respond, physiologically, in different environment.

BIOL 432. Intro to Comp Neuroscience. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222; BIOL 315; BNFO 135 or CS 101 or CS 100 or CS 115 (grade C or better in all prerequisites), or permission by instructor. Introduction to the modeling, computational and analysis techniques for single neurons and small neuronal networks. This course will approach cellular and small network neuroscience beginning with a review and understanding of outstanding problems in neuroscience. The course work will then focus on students developing an independent modeling/computational project around which neuroscience concepts will be discussed. The required knowledge of electric circuits and numerical tools for the solution of differential equations will be introduced as needed.

BIOL 436. Advanced Neuroscience Modeling. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 432 or MATH 430 or permission by instructor. Modeling and computational analysis of biological neuronal networks. The course consists of lectures, and scientific paper presentations aimed at acquiring a clear understanding of the biological issues in systems neuroscience. Students will work on developing an independent modeling/computational project during the duration of the semester around which biological topics will be discussed.

BIOL 440. Cell Biology of Disease: Cells gone Bad!. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 340 or R120 340) and (R120 355 or R120 356) with a grade of C or better. This course will briefly review the normal physiology of mammals and humans and will then extensively explore the basis of many human diseases at the cellular level. The goal is to understand how alterations in normal functions of cells affect the function of the whole system by reviewing current research in the field of cell biology abnormalities.

BIOL 441. Neurophysiology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: R120 201 and R120 202 with a grade of C or better. This course will examine the physiology of neurons such as excitability, impulse conduction, synaptic communication and neural and synaptic plasticity. The objective is to provide students with a basic understanding of neural signaling and communication.

BIOL 443. Biology of Addiction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 201 and BIOL 202 (or R120 201 and R120 202), and BIOL 205 and BIOL 206 (or R120 205 and R120 206) with grade of C or better, or Permission of Instructor. This course will explore Substance Use Disorder from a biological viewpoint. The psychological, epidemiological, social and economical aspects of addiction will be touched upon as needed. The course will consist of several Modules that would be taught in parallel. The Modules include: ‘Psychopharmacology’, ‘The Structure and Function of the Nervous System’, ‘Neurotransmitters and Neuromodulators’, ‘Substances of Abuse’, and ‘What is Addiction?’ The goal is to provide students with a comprehensive understanding of biological mechanisms, both in the body and in the brain, that lead to and underlie Substance Use Disorder.

BIOL 445. Endocrinology. 3 credits, 3 contact hours (3;0;0).
Prerequisites:(BIOL 340 or R120 340)and (R120 355 or R120 356) with a grade of C or better. This course will discuss endocrinology from both an enatomical and physicologic view. We will discuss synthesis, distribution and regulation of the entire human endocrine system. The goal is to provide students with a basic knowledge of the complex endocrine system.

BIOL 447. Systems Neurobiology. 3 credits, 3 contact hours (3;0;0).
Prerequisite: BIOL 315 with a grade of C or better. This course will examine, from a systems perspective, phenomena that relate to neuronal network activity and behavior. Neuronal systems will be studied in detail. The overall goal of the course is to provide students with the basic knowledge of the neurobiological basis of behavior.

BIOL 448. Neuropathophysiology: Nervous System Gone Bad!. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BIOL 315 or BIOL 340 or R120 340 or BIOL 341 or R120 444 or BIOL 447 with a grade of C or better. This course will briefly examine the normal physiology of the nervous system and then would extensively explore the basis of many neuronal diseases. The goal is to understand how any alteration in normal functions of the nervous system affects the function of the whole system by reviewing current research in the field of nervous system abnormalities.

BIOL 451. Cell Physiology and Imaging. 4 credits, 4 contact hours (1;3;0).
Prerequisites: PHYS 111, PHYS 121 and R120 455. This course will examine celluar phenomena, such as subcellular structure, secretion, intracellular calcium regulation, etc., from a physiological perspective and using imaging techniques as a tool to understand them. Cell biology, and optics and the user of microscopes, will be discussed in detail.

BIOL 453. Applied Genetics & Genomics. 3 credits, 4 contact hours (3;1;0).
Prerequisites: BIOL 352 or R120 352. This is an advanced course in modern genetics and genomics. It offers students a class that presents a modern understanding of Genetic and genomic applications, given the ongoing explosion of technological developments in this field. An understanding of state-of-the-art genetics and genomics is indispensable for continuing education in fields that include but are not limited to: cell and molecular biology, clinical lab science, bio-mechanical engineering, biotechnology, agriculture, and medicine.

BIOL 462. Comparative Biomechanics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: R120 201, R120 202, BIOL 205 and BIOL 206 all with a C or better. This course takes a comprehensive look at the mechanical aspects of life. We will examine how the forms and activities of animals and plants reflect the materials available to nature, consider rules for fluid flow and structural design, and explore how organisms contend with environmental forces. Drawing on physics, we look at how animals swim and fly, modes of terrestrial locomotion, organism responses to winds and water currents, circulatory and suspension-feeding systems, the relationship between size and mechanical design, and the links between the properties of biological materials (eg spider silk, jellyfish jelly, and muscle) and their structural and functional roles.

BIOL 468. Disease Ecology & Evolution. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) and (MATH 111 or MATH 238) with grade of C or better. This course addresses those aspects of ecology and evolutionary biology most relevant to understanding the origin, dynamics and treatment of disease (both infectious and hereditary/genetic). The class will be a mixture of lecture and discussion of case studies. Material covered will include biology, mathematical models, and some aspects of human behavior.

BIOL 470. Dynamic Princ in Systems BIOL. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222, and BNFO 135 or CS 100 or CS 115 grade C or better, or permission by instructor. Introduction to the dynamic and computational modeling of biological systems, including chemical, biochemical, metabolic and genetic networks. The course includes the description of basic principles and case studies and provides the necessary mathematical and computational tools to understand the mechanisms underlying the dynamics of this type of networks. The necessary knowledge on the biology will be introduced during the course.

BIOL 475. Ecological Field Methods and Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisites: R120 280 or R120 370 with a C or better and permission of instructor. This field-orientated class will study animal and plant communities using a combination of field, laboratory and theory work. The goal of this course is to understand ecological principles and to introduce students to modern methodology for field work, the techniques and instruments used, as well as the theoretical basis for their application. Students will collect data, analyze them and report the results in written and oral format.

BIOL 484. Evolution of Animal Behavior Laboratory. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (BIOL 201 and BIOL 202 or R120 201 and R120 202) and (BIOL 205 and BIOL 206 or R120 205 and R120 206) with grade of C or better. A lab course focusing on research in Animal Behavior. This course will cover foraging, predator avoidance, territoriality, and mate choice. Labs will be inquiry based with students designing experiments to test hypotheses concerning aspects of animal behavior.

BIOL 491. Research and Independent Study. 3 credits, 3 contact hours (0;0;3).
Restriction: Departmental approval required. Research in Biology. Each student works under the supervision of a Biology or associated faculty member. A research paper and poster are required.

BIOL 492. Research and Independent Study. 3 credits, 3 contact hours (0;0;3).
Restriction: Departmental approval required. Research in Biology. Each student works under the supervision of a Biology or associated faculty member.

BIOL 495. Honors Seminar in Biology. 3 credits, 3 contact hours (3;0;0).
Prerequisite: BIOL 320 with a grade of C or better. The honors seminar allows students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students will be required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. This course satisfies NJIT's Honors Capstone requirement.

BIOL 498. Special Topics in Biology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Permission by instructor. This course explores a special topic in biology.

Rutgers-Newark Courses

100-level courses do not apply to biology majors

R120 101. General Biology. 4 credits, 0 contact hours (0;0;0).

R120 101L. General Biology I. 0 credits, 0 contact hours (0;0;0).

R120 102. General Biology II. 4 credits, 4 contact hours (4;0;0).

R120 102L. General Biology II-Lecture. 0 credits, 0 contact hours (0;0;0).

R120 104. Human Health & Disease. 3 credits, 3 contact hours (3;0;0).

R120 105. Environ Issues. 3 credits, 3 contact hours (3;0;0).

R120 106. General Horticulture. 3 credits, 3 contact hours (3;0;0).

R120 107. Horticulture Lab. 1 credit, 1 contact hour (0;1;0).

R120 108. Human Sexuality. 3 credits, 3 contact hours (3;0;0).

R120 109. Basic Plant Science. 3 credits, 3 contact hours (3;0;0).

R120 110. Basic Plant Sci Lab. 1 credit, 0 contact hours (0;0;0).

R120 111. Human Biology. 3 credits, 3 contact hours (3;0;0).

R120 141. Anatomy & Physiology. 4 credits, 4 contact hours (4;0;0).

R120 142. Anatomy & Physiology. 4 credits, 4 contact hours (4;0;0).

R120 171. Human Ecology. 3 credits, 3 contact hours (3;0;0).

R120 201. Foundations Of Biology. 3 credits, 3 contact hours (3;0;0).

R120 202. Foundations Of Biology Lab. 1 credit, 1 contact hour (1;0;0).

R120 203. Plant Bio. 3 credits, 0 contact hours (0;0;0).

R120 204. Economic Botany. 3 credits, 3 contact hours (3;0;0).

R120 205. Environmental Issues. 3 credits, 3 contact hours (3;0;0).

R120 206. General Horticulture. 3 credits, 3 contact hours (3;0;0).

R120 207. Horticulture Lab. 1 credit, 1 contact hour (1;0;0).

R120 208. Human Sexuality. 3 credits, 1 contact hour (1;0;0).

R120 211. Plant Kingdom. 4 credits, 4 contact hours (4;0;0).

R120 214. Microbiology. 3 credits, 3 contact hours (3;0;0).

R120 222. Evolution. 3 credits, 3 contact hours (3;0;0).

R120 227. Biol Invertebrates. 4 credits, 4 contact hours (4;0;0).

R120 230. Biology Of Seed Plants. 4 credits, 4 contact hours (4;0;0).

R120 235. Microbiology. 4 credits, 4 contact hours (4;0;0).

R120 237. Environmental Microbiology. 4 credits, 6 contact hours (3;3;0).

R120 240. Human Physiology. 3 credits, 3 contact hours (3;0;0).

R120 241. Anatomy & Physiology. 4 credits, 4 contact hours (4;0;0).

R120 242. Anatomy & Physiology. 4 credits, 4 contact hours (4;0;0).

R120 245. Pathophysiology. 3 credits, 3 contact hours (3;0;0).

R120 280. Ecology. 3 credits, 3 contact hours (3;0;0).

R120 282. Animal Behavior. 3 credits, 3 contact hours (3;0;0).

R120 285. Comparative Vertebrate Anatomy. 4 credits, 4 contact hours (4;0;0).

R120 303. Molecular Biology. 3 credits, 3 contact hours (3;0;0).

R120 305. Vertebrate Evolution. 3 credits, 3 contact hours (3;0;0).

R120 311. Flora of New Jersey. 4 credits, 4 contact hours (4;0;0).

R120 313. Mycology. 4 credits, 4 contact hours (4;0;0).

R120 320. Comp Vert Anatomy. 4 credits, 4 contact hours (4;0;0).

R120 322. Evolution. 3 credits, 0 contact hours (0;0;0).

R120 323. Developmental Psychology. 3 credits, 3 contact hours (3;0;0).

R120 325. Animal Parasites. 3 credits, 3 contact hours (3;0;0).

R120 326. Parasitology Lab. 1 credit, 1 contact hour (1;0;0).

R120 327. Biol Invertebrates. 4 credits, 4 contact hours (4;0;0).

R120 328. Ornithology. 3 credits, 3 contact hours (3;0;0).

B.A. in Biology

(120 credit minimum)

First Year		
1st Semester		**Credits**
BIOL 200	Concepts in Biology	4
CHEM 125 or CHEM 121	General Chemistry I [1] or Fundamentals of Chemical Principles I	3
MATH 138	General Calculus I	3
ENGL 101	English Composition: Introduction to Academic Writing	3
CHEM 125A	General Chemistry Lab I	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 126A	Gen Chemistry Lab II	1
CHEM 126 or CHEM 122	General Chemistry II [1] or Fundamentals of Chemical Principles II	3
MATH 238	General Calculus II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 243	Organic Chemistry I	3
BNFO 135 or CS 101	Programming for Bioinformatics or Computer Programming and Problem Solving	3
MATH 105	Elementary Probability and Statistics	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
Biology Functional Laboratory Elective Cluster B		4
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry I Laboratory	2
Social Science GER (p. 114)		3
Free Elective [2]		3
	Term Credits	**15**
Third Year		
1st Semester		
Biology Laboratory Elective		4
Biology Cluster A or C Elective		3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
History and Humanities GER 300+ level (p. 108)		3
Free Elective [2]		3
	Term Credits	**17**
2nd Semester		
Biology Laboratory Elective [3]		3
Biology Cluster A or C Elective		3
PHYS 103	General Physics	3

PHYS 103A	General Physics Lab	1
History and Humanities GER 300+ level (p. 108)		3
Technical Elective [3]		4
	Term Credits	**17**
Fourth Year		
1st Semester		
Biology Elective		3
Biology Elective		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
Technical Elective [4]		3
Free Elective [2]		3
	Term Credits	**15**
2nd Semester		
Biology Elective		3
Technical Elective [4]		3
Technical Elective [4]		3
Free Elective [2]		3
	Term Credits	**12**
	Total Credits	**120**

Biology Credits: 38

Technical Electives

Any course in chemistry, math or physics beyond major requirements. Any course in environmental science, computer science or engineering. Additional biology courses can be used as technical electives.

Free Electives

Any course in any subject at any level.

Biology Electives

One course must be taken from each cluster.

Concept Cluster Ecology and Evolution

Code	Title	Credits
BIOL 382	Animal Behavior	3
BIOL 222	Evolution	3
or R120 222	Evolution	
R120 280	Ecology	3
R120 370	Plant Ecology	3

Concept Cluster Molecular and Cellular

Code	Title	Credits
R120 355	Cell Biology	3
BIOL 352	Genetics	3
or R120 352	Genetics	
R120 356	Molecular Biology	3
CHEM 473	Biochemistry	3
or R120 360	Biochemistry	

Concept Cluster Functional Organism(4 cr)

Code	Title	Credits
R120 211	Plant Kingdom	4
R120 230	Biology Of Seed Plants	4

R120 330	Plant Physiology	4
R120 335	General Microbiology	4
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4
BIOL 340	Mammalian Physiology	4
or R120 340	Mammalian Physiology	

Laboratory/ Field Experience (7 credits, At least one 4-credit lab)

Code	Title	Credits
Four Credit Laboratories		
R120 211	Plant Kingdom	4
R120 227	Biol Invertebrates	4
R120 230	Biology Of Seed Plants	4
R120 311	Flora of New Jersey	4
R120 313	Mycology	4
BIOL 321	Comp Vertebrate Anatomy	4
R120 325 & R120 326	Animal Parasites and Parasitology Lab	4
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
BIOL 340	Mammalian Physiology	4
or R120 340	Mammalian Physiology	
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4
BIOL 347	Lab Approaches in Neuroscience	4
R120 404	Intro to Neuroanatomy	4
R120 405	Microanatomy of Cells	4
R120 430	Plant Growth & Development	4
BIOL 451	Cell Physiology and Imaging	4
R120 452	Molecular Biol Techniques	4
FRSC 307	Crime Scene Investigation &Lab	4
FRSC 480	Forensic Microscopy & Lab	4
CHEM 475 & CHEM 473	Biochemistry Lab I and Biochemistry	5
Three Credit Laboratories		
R120 328	Ornithology	3
R120 371	Field Study Plant Ecology	3
R120 380	Field Ecology	3
R120 381	Ecological History of North Am	3
BIOL 484	Evolution of Animal Behavior Laboratory	3
BIOL 475	Ecological Field Methods and Analysis	3
R120 486	Tropical Field Biology	2

Biology Electives

Code	Title	Credits
Any concept cluster or lab course or any of the following		
BIOL 315	Principles of Neurobiology	3
BIOL 320	Discovering Biological Research	3
BIOL 337	Collective Intel in Biol Syst	3
BIOL 338	Ecology of the Dining Hall	3
BIOL 441	Neurophysiology	3
BIOL 342	Developmental Biology (Embryology)	3
BIOL 423	Physiological Mechanisms	3

BIOL 424	Comparative Physiology	3
R120 346	Neurobiology	3
BIOL 350	Immunology	3
R120 365	Evolutions of Humans	3
BIOL 468	Disease Ecology & Evolution	3
BIOL 375	Conservation Biology	3
BIOL 383	Neural Basis of Behavior	3
BIOL 400	Biology in Science Fiction	3
R120 402	Biology of Cancer	3
R120 422	Biological Invasions	3
BIOL 440	Cell Biology of Disease: Cells gone Bad!	3
BIOL 445	Endocrinology	3
or R120 445	Endocrinology	
BIOL 447	Systems Neurobiology	3
BIOL 448	Neuropathophysiology: Nervous System Gone Bad!	3
BIOL 453	Applied Genetics & Genomics	3
R120 455	Molec Cell Biology	3
BIOL 462	Comparative Biomechanics	3
R120 472	Environmental Assessment	3
CHEM 474	Biochemistry II	3
BIOL 491 & BIOL 492	Research and Independent Study and Research and Independent Study	6
R120 493 & R120 494	Seminar In Biology and Seminar In Biol	2
BIOL 495	Honors Seminar in Biology	3
BIOL 498	Special Topics in Biology	3

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

[1] CHEM 121 and CHEM 122 require permission from academic advisor
[2] Free Elective - Any course in any subject at any level
[3] Laboratory Elective - 3 or 4-credit laboratory
[4] Technical Elective - Any course in BIOL, CHEM, CS, EVSC, IT, IS, PHYS, FRSC, MATH, MIS, MIT, and BME or any other engineering course

B.S. in Biology

(120 credit minimum)

First Year		
1st Semester		**Credits**
BIOL 200	Concepts in Biology	4
CHEM 125 or CHEM 121	General Chemistry I [1] or Fundamentals of Chemical Principles I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I	4
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 126 or CHEM 122	General Chemistry II [1] or Fundamentals of Chemical Principles II	3
CHEM 126A	Gen Chemistry Lab II	1

MATH 112	Calculus II	4
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**15**
Second Year		
1st Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 243	Organic Chemistry I	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
MATH 211	Calculus III A	3
BNFO 135 or CS 101	Programming for Bioinformatics or Computer Programming and Problem Solving	3
	Term Credits	**17**
2nd Semester		
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
BNFO 236 or CS 101	Programming for Bioinformatics II or Computer Programming and Problem Solving	3
Biology Laboratory Elective		4
	Term Credits	**16**
Third Year		
1st Semester		
Biology Laboratory Elective		3
Biology Cluster A or C Elective		3
MATH 222	Differential Equations	4
History and Humanities GER 200 level (p. 106)		3
Social Science GER (p. 114)		3
	Term Credits	**16**
2nd Semester		
Biology Laboratory Elective		4
Biology Cluster A or C Elective		3
MATH 333	Probability and Statistics	3
Technical Elective [3]		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
Fourth Year		
1st Semester		
Biology Elective		3
Biology Cluster D Elective		3
History and Humanities GER 300+ level (p. 108)		3
Technical Elective [4]		4
	Term Credits	**13**
2nd Semester		
Biology Elective		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
Free Elective [2]		3

Free Elective [2]	3
Term Credits	**12**
Total Credits	**120**

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

[1] CHEM 121 and CHEM 122 require permission from the academic adviser
[2] Free Elective – Any course in any subject at any level.
[3] Technical Elective - MATH 337 Linear Algebra Recommended
[4] Technical Elective - Any course in BIOL, BME, CHEM, MATH, PHYS, FRSC IS, IT, MIT, MIS, CS. Must be four credits.

Biology Credits: 35 (Including General Biology I, II, and Foundations of Biology)

BIOLOGY ELECTIVES MUST BE CHOSEN AS OUTLINED BELOW:

One course must be taken from each cluster.

Concept Cluster Computational Biology

Code	Title	Credits
MATH 371	Physiology And Medicine	3
MATH 372	Population Biology	3
MATH 373	Introduction to Mathematical Biology	3
BIOL 432	Intro to Comp Neuroscience	3
BIOL 436	Advanced Neuroscience Modeling	3
BIOL 470	Dynamic Princ in Systems BIOL	3

Concept Cluster Ecology and Evolution

Code	Title	Credits
BIOL 222	Evolution	3
or R120 222	Evolution	
R120 370	Plant Ecology	3
R120 280	Ecology	3
BIOL 382	Animal Behavior	3

Concept Cluster Functional Organism(4 cr)

Code	Title	Credits
R120 211	Plant Kingdom	4
R120 230	Biology Of Seed Plants	4
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
BIOL 340	Mammalian Physiology	4
or R120 340	Mammalian Physiology	
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4

Concept Cluster Molecular and Cellular

Code	Title	Credits
BIOL 352	Genetics	3
or R120 352	Genetics	
R120 355	Cell Biology	3
R120 356	Molecular Biology	3
CHEM 473	Biochemistry	3
or R120 360	Biochemistry	

Laboratory Experience Courses

Code	Title	Credits
R120 211	Plant Kingdom	4
R120 227	Biol Invertebrates	4
R120 230	Biology Of Seed Plants	4
R120 311	Flora of New Jersey	4
R120 313	Mycology	4
BIOL 321	Comp Vertebrate Anatomy	4
R120 325 & R120 326	Animal Parasites and Parasitology Lab	4
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
BIOL 340	Mammalian Physiology	4
or R120 340	Mammalian Physiology	
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4
BIOL 347	Lab Approaches in Neuroscience	4
R120 404	Intro to Neuroanatomy	4
R120 405	Microanatomy of Cells	4
R120 430	Plant Growth & Development	4
BIOL 451	Cell Physiology and Imaging	4
Any course from Functional Organism Cluster		4
R120 328	Ornithology	3
R120 371	Field Study Plant Ecology	3
R120 380	Field Ecology	3
R120 381	Ecological History of North Am	3
BIOL 475	Ecological Field Methods and Analysis	3
R120 486	Tropical Field Biology	2

Biology Electives

Code	Title	Credits
BIOL 315	Principles of Neurobiology	3
BIOL 320	Discovering Biological Research	3
BIOL 337	Collective Intel in Biol Syst	3
BIOL 338	Ecology of the Dining Hall	3
BIOL 441	Neurophysiology	3
BIOL 423	Physiological Mechanisms	3
BIOL 424	Comparative Physiology	3
R120 346	Neurobiology	3
BIOL 350	Immunology	3
R120 365	Evolutions of Humans	3
BIOL 468	Disease Ecology & Evolution	3
BIOL 375	Conservation Biology	3
BIOL 383	Neural Basis of Behavior	3
BIOL 400	Biology in Science Fiction	3
R120 402	Biology of Cancer	3
R120 422	Biological Invasions	3
BIOL 440	Cell Biology of Disease: Cells gone Bad!	3
BIOL 445	Endocrinology	3
BIOL 447	Systems Neurobiology	3
BIOL 448	Neuropathophysiology: Nervous System Gone Bad!	3
BIOL 453	Applied Genetics & Genomics	3

R120 455	Molec Cell Biology	3
R120 456	Virology	3
BIOL 462	Comparative Biomechanics	3
R120 472	Environmental Assessment	3
BIOL 491 & BIOL 492	Research and Independent Study and Research and Independent Study	6
BIOL 492	Research and Independent Study	3
R120 493 & R120 494	Seminar In Biology and Seminar In Biol	2
BIOL 498	Special Topics in Biology	3
BIOL 495	Honors Seminar in Biology	3

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Accelerated B.A. in Biology/M.D.

(120 Minimum credits)

First Year		
1st Semester		**Credits**
BIOL 200	Concepts in Biology	4
CHEM 125 or CHEM 121	General Chemistry I [3] or Fundamentals of Chemical Principles I	3
CHEM 125A	General Chemistry Lab I	1
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
MATH 138	General Calculus I	3
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**18**
2nd Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 126 or CHEM 122	General Chemistry II [3] or Fundamentals of Chemical Principles II	3
CHEM 126A	Gen Chemistry Lab II	1
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
MATH 238	General Calculus II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**18**
Summer		
CHEM 243	Organic Chemistry I [1]	3
	Term Credits	**3**
Second Year		
1st Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
BNFO 135 or CS 101	Programming for Bioinformatics or Computer Programming and Problem Solving	3
PSY 210	Introduction to Psychology	3

Social Science GER (p. 114)		3
	Term Credits	**18**
2nd Semester		
Biology Functional Laboratory Cluster B Elective		4
MATH 105	Elementary Probability and Statistics	3
CHEM 473 or R120 360	Biochemistry or Biochemistry	3
STS 221	Introduction to Sociology [2]	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
Third Year		
1st Semester		
Biology Laboratory Elective [4]		4
Biology Cluster - Ecology and Evolution Elective		3
Biology Elective		3
History and Humanities GER 300+ level (p. 108)		3
Technical Elective [5]		3
	Term Credits	**16**
2nd Semester		
Biology Laboratory Elective [4]		3
Biology Elective		3
Biology Elective		3
Humanities and Social Science Senior Seminar GER (p. 112) [2]		3
Technical Elective [5]		3
Free Elective [4]		3
	Term Credits	**18**
	Total Credits	**107**

Code	Title	Credits
Technical Elective [5]		4
Technical Elective [5]		3
Free Elective [4]		3
Free Elective [4]		3

* Rutgers New Jersey Medical School, St. Georges's University Medical School, American University of Antigua Medical School.

1 Organic Chemistry I may be taken at NJIT or Rutgers Newark in the summer. Out of state students must consult with the Chemistry department to find an equivalent course.

2 Required to take MCAT

3 CHEM 121 and CHEM 122 require permission from the academic adviser

4 Free Elective – Any course in any subject at any level

5 Technical Elective – Any STEAM course

6 Laboratory Elective – 3 or 4 credits biology laboratory

Code	Title	Credits
NJIT Credits		107
Transfer Credits		13
Biology Credits		38

Biology Electives

One course must be taken from each cluster.

Cluster A – Ecology and Evolution

Code	Title	Credits
BIOL 222	Evolution	3
or R120 222	Evolution	
R120 280	Ecology	3
R120 370	Plant Ecology	3
BIOL 382	Animal Behavior	3

Cluster B – Functional Organism

Code	Title	Credits
R120 211	Plant Kingdom	4
R120 230	Biology Of Seed Plants	4
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
BIOL 340	Mammalian Physiology	4
or R120 340	Mammalian Physiology	
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4

Cluster C – Molecular and Cellular

Code	Title	Credits
BIOL 352	Genetics	3
or R120 352	Genetics	
R120 355	Cell Biology	3
R120 356	Molecular Biology	3
CHEM 473	Biochemistry	3
or R120 360	Biochemistry	

Biology Electives

Code	Title	Credits
Any concept cluster or lab course or any of the following		
BIOL 315	Principles of Neurobiology	3
BIOL 320	Discovering Biological Research	3
BIOL 337	Collective Intel in Biol Syst	3
BIOL 338	Ecology of the Dining Hall	3
BIOL 441	Neurophysiology	3
BIOL 342	Developmental Biology (Embryology)	3
BIOL 423	Physiological Mechanisms	3
BIOL 424	Comparative Physiology	3
R120 346	Neurobiology	3
BIOL 350	Immunology	3
R120 365	Evolutions of Humans	3
BIOL 468	Disease Ecology & Evolution	3
BIOL 375	Conservation Biology	3
BIOL 383	Neural Basis of Behavior	3
BIOL 400	Biology in Science Fiction	3
R120 402	Biology of Cancer	3
R120 422	Biological Invasions	3
BIOL 432	Intro to Comp Neuroscience	3
BIOL 436	Advanced Neuroscience Modeling	3
BIOL 440	Cell Biology of Disease: Cells gone Bad!	3
BIOL 445	Endocrinology	3

BIOL 447	Systems Neurobiology	3
BIOL 448	Neuropathophysiology: Nervous System Gone Bad!	3
BIOL 453	Applied Genetics & Genomics	3
R120 455	Molec Cell Biology	3
R120 456	Virology	3
BIOL 462	Comparative Biomechanics	3
BIOL 470	Dynamic Princ in Systems BIOL	3
BIOL 491	Research and Independent Study	3
BIOL 492	Research and Independent Study	3
R120 493	Seminar In Biology	1
R120 494	Seminar In Biol	1
BIOL 495	Honors Seminar in Biology	3
BIOL 498	Special Topics in Biology	3

Laboratory Experience Courses

(7 Credits, At Least One 4-Credit Lab)

Code	Title	Credits
Four Credit Laboratories		**4**
R120 211	Plant Kingdom	
R120 227	Biol Invertebrates	
R120 230	Biology Of Seed Plants	
R120 311	Flora of New Jersey	
R120 313	Mycology	
BIOL 321	Comp Vertebrate Anatomy	4
R120 325 & R120 326	Animal Parasites and Parasitology Lab	
R120 330	Plant Physiology	
R120 335	General Microbiology	
BIOL 340	Mammalian Physiology	
or R120 340	Mammalian Physiology	
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	
R120 358	Microanatomy Cells	
BIOL 347	Lab Approaches in Neuroscience	
R120 404	Intro to Neuroanatomy	
R120 405	Microanatomy of Cells	
R120 430	Plant Growth & Development	
BIOL 451	Cell Physiology and Imaging	
Three Credit Laboratories		**3**
R120 328	Ornithology	
R120 371	Field Study Plant Ecology	
R120 380	Field Ecology	
R120 381	Ecological History of North Am	
BIOL 484	Evolution of Animal Behavior Laboratory	
BIOL 475	Ecological Field Methods and Analysis	
R120 485	Tropical Field Ecology	

Accelerated B.A. in Biology/ D.M.D., O.D

(120 credits minimum)

First Year		
1st Semester		**Credits**
BIOL 200	Concepts in Biology	4
CHEM 125 or CHEM 121	General Chemistry I [1] or Fundamentals of Chemical Principles I	3
CHEM 125A	General Chemistry Lab I	1
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
MATH 138	General Calculus I	3
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**18**
2nd Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 126 or CHEM 122	General Chemistry II [1] or Fundamentals of Chemical Principles II	3
CHEM 126A	Gen Chemistry Lab II	1
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
MATH 238	General Calculus II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**18**
Second Year		
1st Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 243	Organic Chemistry I	3
BNFO 135 or CS 101	Programming for Bioinformatics or Computer Programming and Problem Solving	3
MATH 105	Elementary Probability and Statistics	3
History and Humanities GER 200 level (p. 106)		3
Free Elective [2]		3
	Term Credits	**19**
2nd Semester		
Biology Functional Laboratory Cluster Elective		4
Biology Cluster A or C Elective		3
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
Social Science GER (p. 114)		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**18**
Third Year		
1st Semester		
Biology Laboratory Elective [4]		4
Biology Cluster A or C Elective		3
Biology Elective		3
History and Humanities GER 300+ level (p. 108)		3
BIOL 310 or Technical Elective [3]	Work Experience I	3
	Term Credits	**16**

2nd Semester	
Biology Laboratory Elective [4]	3
Biology Elective	3
Biology Elective	3
Humanities and Social Science Senior Seminar GER (p. 112)	3
Technical Elective [3]	3
Free Elective [2]	3
Term Credits	**18**
Total Credits	**107**

Code	Title	Credits
Technical Elective		4
Technical Elective		3
Field Elective		3
Free Elective [1]		3
Total Credits		**13**

[1] CHEM 121 and CHEM 122 require permission from the academic adviser
[2] Free Elective- Any course in any subject at any level.
[3] Technical Elective- Any STEAM course. Optometry students must take Co-op, BIOL 310
[4] Laboratory Elective- 3 or 4 credit laboratory

BIOLOGY ELECTIVES MUST BE CHOSEN AS OUTLINED BELOW:

Code	Title	Credits
Concept Cluster Ecology and Evolution		
BIOL 222	Evolution	3
or R120 222	Evolution	
R120 280	Ecology	3
R120 370	Plant Ecology	3
BIOL 382	Animal Behavior	3
Concept Cluster Functional Organism		
R120 211	Plant Kingdom	4
R120 230	Biology Of Seed Plants	4
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
BIOL 340	Mammalian Physiology	4
or R120 340	Mammalian Physiology	
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4
Concept Cluster Molecular and Cellular		
BIOL 352	Genetics	3
R120 355	Cell Biology	3
R120 356	Molecular Biology	3
R120 360	Biochemistry	3
Biology Electives		
Any concept cluster or lab course or any of the following		
BIOL 315	Principles of Neurobiology	3
BIOL 320	Discovering Biological Research	3
BIOL 337	Collective Intel in Biol Syst	3
BIOL 338	Ecology of the Dining Hall	3
BIOL 441	Neurophysiology	3
BIOL 423	Physiological Mechanisms	3
R120 346	Neurobiology	3

BIOL 424	Comparative Physiology	3
BIOL 350	Immunology	3
R120 365	Evolutions of Humans	3
BIOL 468	Disease Ecology & Evolution	3
BIOL 375	Conservation Biology	3
BIOL 383	Neural Basis of Behavior	3
BIOL 400	Biology in Science Fiction	3
R120 402	Biology of Cancer	3
R120 422	Biological Invasions	3
BIOL 440	Cell Biology of Disease: Cells gone Bad!	3
BIOL 432	Intro to Comp Neuroscience	3
BIOL 436	Advanced Neuroscience Modeling	3
BIOL 445	Endocrinology	3
or R120 445	Endocrinology	
BIOL 447	Systems Neurobiology	3
BIOL 447	Systems Neurobiology	3
BIOL 448	Neuropathophysiology: Nervous System Gone Bad!	3
BIOL 453	Applied Genetics & Genomics	3
R120 455	Molec Cell Biology	3
R120 456	Virology	3
BIOL 462	Comparative Biomechanics	3
BIOL 470	Dynamic Princ in Systems BIOL	3
R120 472	Environmental Assessment	3
BIOL 491	Research and Independent Study	3
or BIOL 492	Research and Independent Study	
R120 493	Seminar In Biology	1
or R120 494	Seminar In Biol	
BIOL 495	Honors Seminar in Biology	3
BIOL 498	Special Topics in Biology	3
Laboratory/ Field Experience		
(7 Credits, at least one 4-credit lab)		
Four Credit Laboratories		
R120 211	Plant Kingdom	4
R120 227	Biol Invertebrates	4
R120 230	Biology Of Seed Plants	4
R120 311	Flora of New Jersey	4
R120 313	Mycology	4
BIOL 321	Comp Vertebrate Anatomy	4
R120 325	Animal Parasites	1-3
or R120 326	Parasitology Lab	
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
BIOL 340	Mammalian Physiology	4
or R120 340	Mammalian Physiology	
R120 342	Developmental Biology	1-3
or R120 343	Developmental Biology Lab	
BIOL 347	Lab Approaches in Neuroscience	4
R120 404	Intro to Neuroanatomy	4
R120 405	Microanatomy of Cells	4
R120 430	Plant Growth & Development	4
BIOL 451	Cell Physiology and Imaging	4
Three Credit Laboratories		

R120 328	Ornithology	3
R120 371	Field Study Plant Ecology	3
R120 380	Field Ecology	3
R120 381	Ecological History of North Am	3
BIOL 484	Evolution of Animal Behavior Laboratory	3
BIOL 475	Ecological Field Methods and Analysis	3
R120 485 Tropical field Biology		3
Optometry Transfer Courses *		13
BVS 121		3
BVS 106		3
BVS 131		3
BVS 181		3
Dental Transfer Courses(13 Credits) *		
ANAT 7109		
NEUR 7109		

* Other courses may be substituted as necessary

Accelerated B. A. in Biology/Doctor in Physical Therapy (DPT)

[1] CHEM 121 and CHEM 122 require permission from the academic adviser

(120 Minimum credits)

First Year		
1st Semester		**Credits**
BIOL 200	Concepts in Biology	4
CHEM 125 or CHEM 121	General Chemistry I [1] or Fundamentals of Chemical Principles I	3
CHEM 125A	General Chemistry Lab I	1
MATH 138	General Calculus I	3
ENGL 101	English Composition: Introduction to Academic Writing	3
BNFO 135 or CS 101	Programming for Bioinformatics or Computer Programming and Problem Solving	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 126 or CHEM 122	General Chemistry II [1] or Fundamentals of Chemical Principles II	3
CHEM 126A	Gen Chemistry Lab II	1
MATH 238	General Calculus II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
PSY 210	Introduction to Psychology	3
	Term Credits	**17**
Summer		
BIOL 310	Work Experience I	3
BIOL 410	Work Experience II	3
	Term Credits	**6**
Second Year		
1st Semester		
BIOL 201	Found of Biol: Cell & Molecula	3

BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 243	Organic Chemistry I	3
MATH 105	Elementary Probability and Statistics	3
Social Science GER (p. 114)		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
Biology Cluster A or C Elective		3
BIOL 340	Mammalian Physiology	4
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
Technical Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**18**
Third Year		
1st Semester		
BIOL 321	Comp Vertebrate Anatomy	4
Biology Cluster A or C Elective		3
Biology Elective		3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**17**
2nd Semester		
Biology Laboratory Elective		3
Biology Elective		3
Biology Elective		3
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
Free Elective		3
	Term Credits	**16**
	Total Credits	**107**

Code	Title	Credits
Technical Elective	PTDR 5110 Gross Anatomy	4
Technical Elective	PTDR 5120 Gross Anatomy	3
Free Elective	PTDR 5130 Pathophysiolgy I	3
Free Elective	PTDR 5310 Examination and Measurement	3
Total Credits		**13**

Biology Electives

One course must be taken from each cluster.

Cluster A – Ecology and Evolution

Code	Title	Credits
BIOL 222	Evolution	3
R120 280	Ecology	3
BIOL 382	Animal Behavior	3
R120 370	Plant Ecology	3

Cluster B – Functional Organism

Code	Title	Credits
R120 211	Plant Kingdom	4
R120 230	Biology Of Seed Plants	4
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
BIOL 340	Mammalian Physiology	4
or R120 340	Mammalian Physiology	
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4

Cluster C – Molecular and Cellular

Code	Title	Credits
BIOL 352	Genetics	3
or R120 352	Genetics	
R120 355	Cell Biology	3
R120 356	Molecular Biology	3
CHEM 473	Biochemistry	3
or R120 360	Biochemistry	

Laboratory Experience Courses

Code	Title	Credits
R120 227	Biol Invertebrates	4
R120 285	Comparative Vertebrate Anatomy	4
R120 311	Flora of New Jersey	4
R120 313	Mycology	4
R120 325 & R120 326	Animal Parasites and Parasitology Lab	4
BIOL 347	Lab Approaches in Neuroscience	4
R120 358	Microanatomy Cells	4
R120 430	Plant Growth & Development	4
R120 481	Marine Biology	4
Any course from Functional Organism Cluster		4
R120 328	Ornithology	3
R120 371	Field Study Plant Ecology	3
R120 381	Ecological History of North Am	3
R120 380	Field Ecology	3
BIOL 475	Ecological Field Methods and Analysis	3
R120 486	Tropical Field Biology	2

Biology Electives

Code	Title	Credits
BIOL 315	Principles of Neurobiology	3
BIOL 320	Discovering Biological Research	3
BIOL 337	Collective Intel in Biol Syst	3
BIOL 338	Ecology of the Dining Hall	3
BIOL 441	Neurophysiology	3
BIOL 342	Developmental Biology (Embryology)	3
BIOL 423	Physiological Mechanisms	3
BIOL 424	Comparative Physiology	3
R120 346	Neurobiology	3
BIOL 350	Immunology	3

R120 365	Evolutions of Humans	3
BIOL 468	Disease Ecology & Evolution	3
MATH 371	Physiology And Medicine	3
MATH 372	Population Biology	3
MATH 373	Introduction to Mathematical Biology	3
BIOL 375	Conservation Biology	3
BIOL 383	Neural Basis of Behavior	3
BIOL 400	Biology in Science Fiction	3
R120 403	Biological Ultrastructure	3
R120 404	Intro to Neuroanatomy	4
R120 422	Biological Invasions	3
MATH 430	Analytical and Computational Neuroscience	3
BIOL 436	Advanced Neuroscience Modeling	3
BIOL 432	Intro to Comp Neuroscience	3
BIOL 440	Cell Biology of Disease: Cells gone Bad!	3
R120 445	Endocrinology	3
BIOL 447	Systems Neurobiology	3
BIOL 448	Neuropathophysiology: Nervous System Gone Bad!	3
R120 451	Lab Cell Biophysics	4
R120 452	Molecular Biol Techniques	4
BIOL 453	Applied Genetics & Genomics	3
R120 455	Molec Cell Biology	3
BIOL 462	Comparative Biomechanics	3
BIOL 470	Dynamic Princ in Systems BIOL	3
R120 471	Ecological Physiology	3
R120 487	Syst Ecol:Ecosys in Landscape	3
BIOL 491 & BIOL 492	Research and Independent Study and Research and Independent Study	6

B.A. in Biology/Physician Assistant

(120 credit minimum)

First Year		
1st Semester		**Credits**
BIOL 200	Concepts in Biology	4
CHEM 125 or CHEM 121	General Chemistry I [1] or Fundamentals of Chemical Principles I	3
CHEM 125A	General Chemistry Lab I	1
MATH 138	General Calculus I	3
ENGL 101	English Composition: Introduction to Academic Writing	3
BNFO 135 or CS 101	Programming for Bioinformatics or Computer Programming and Problem Solving	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 126 or CHEM 122	General Chemistry II [1] or Fundamentals of Chemical Principles II	3
CHEM 126A	Gen Chemistry Lab II	1
MATH 238	General Calculus II	3
ENGL 102	English Composition: Introduction to Writing for Research	3

PSY 210	Introduction to Psychology	3
	Term Credits	**17**
Summer		
R120 141	Anatomy & Physiology (or BIO 121) [2]	
R120 142	Anatomy & Physiology (or BIO 122) [2]	
	Term Credits	**0**
Second Year		
1st Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 243	Organic Chemistry I	3
MATH 105	Elementary Probability and Statistics	3
Social Science GER		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
BIOL 340	Mammalian Physiology	4
CHEM 473 or R120 360	Biochemistry or Biochemistry	3
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Third Year		
1st Semester		
BIOL 321	Comp Vertebrate Anatomy	4
R120 335	General Microbiology	4
Biology Ecology & Evolution Cluster Elective [3]		3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**18**
2nd Semester		
BIOL 352 or R120 352	Genetics or Genetics	3
Biology Elective		3
Biology Elective		3
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
Free Elective		3
	Term Credits	**16**
	Total Credits	**99**

1 CHEM 121 and CHEM 122 require permission from the academic adviser

2 Anatomy and Physiology may be taken at Rutgers Newark (R120 141/142) or Essex County College (BIO 121/122) or at another institution with approval from NJIT Biology Department

3 Choice of Evolution (Biol 222 or R120:222), Ecology (R120:280), Animal Behavior (BIOL 382), Plant Ecology (R120:370)

* Other courses may be substituted as necessary

Code	Title	Credits
Physical Assistant Courses Transferred to NJIT*		
Technical Elective	PHYA4139 Microbiology and Immunology	4
Technical Elective	PHYA4120 Anatomy and Physiology I	3

Free Elective	PHYA4180 Biochemistry	3
Free Elective	PHYA4161 Cell Biology & Histology	3
Total Credits		**13**

Code	Title	Credits
NJIT Credits		107
Transfer Credits		13
Biology Credits		39
Total Credits		120

Biology Electives

Code	Title	Credits
BIOL 315	Principles of Neurobiology	3
BIOL 320	Discovering Biological Research	3
R120 325 & R120 326	Animal Parasites and Parasitology Lab	4
R120 328	Ornithology	3
BIOL 337	Collective Intel in Biol Syst	3
R120 330	Plant Physiology	4
BIOL 338	Ecology of the Dining Hall	3
BIOL 441	Neurophysiology	3
BIOL 342	Developmental Biology (Embryology)	3
BIOL 423	Physiological Mechanisms	3
BIOL 424	Comparative Physiology	3
BIOL 350	Immunology	3
R120 355	Cell Biology	3
R120 356	Molecular Biology	3
R120 365	Evolutions of Humans	3
BIOL 468	Disease Ecology & Evolution	3
R120 370	Plant Ecology	3
BIOL 375	Conservation Biology	3
BIOL 383	Neural Basis of Behavior	3
BIOL 492	Research and Independent Study	3
BIOL 400	Biology in Science Fiction	3
R120 402	Biology of Cancer	3
R120 422	Biological Invasions	3
R120 430	Plant Growth & Development	4
BIOL 432	Intro to Comp Neuroscience	3
BIOL 436	Advanced Neuroscience Modeling	3
BIOL 440	Cell Biology of Disease: Cells gone Bad!	3
BIOL 445	Endocrinology	3
BIOL 447	Systems Neurobiology	3
BIOL 448	Neuropathophysiology: Nervous System Gone Bad!	3
BIOL 453	Applied Genetics & Genomics	3
R120 455	Molec Cell Biology	3
R120 456	Virology	3
BIOL 462	Comparative Biomechanics	3
BIOL 470	Dynamic Princ in Systems BIOL	3
R120 472	Environmental Assessment	3
BIOL 475	Ecological Field Methods and Analysis	3
BIOL 498	Special Topics in Biology	3

BIOL 491 & BIOL 492	Research and Independent Study and Research and Independent Study	6
BIOL 495	Honors Seminar in Biology	3

Biological Sciences Minor

(22 credits)

Code	Title	Credits
Required Core Courses		
R120 101	General Biology	4
R120 102	General Biology II	4
R120 201	Foundations Of Biology	3
R120 202	Foundations Of Biology Lab	1
Additional Courses		
Select one of the following Ecology and Evolution courses:		3
BIOL 222	Evolution	
R120 280	Ecology	
R120 282	Animal Behavior	
R120 370	Plant Ecology	
Select one of the following Functional Organism courses:		4
R120 230	Biology Of Seed Plants	
R120 330	Plant Physiology	
R120 335	General Microbiology	
R120 340	Mammalian Physiology	
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	
Select one of the following Molecular and Cellular Mechamisms courses		3
R120 356	Molecular Biology	
R120 352	Genetics	
R120 355	Cell Biology	
R120 360 or CHEM 475	Biochemistry Biochemistry Lab I	
Total Credits		**22**

Cell Biology Concentration

First Year		
1st Semester		**Credits**
BIOL 200	Concepts in Biology	4
CHEM 125 or CHEM 121	General Chemistry I [1] or Fundamentals of Chemical Principles I	3
CHEM 125A	General Chemistry Lab I	1
MATH 138	General Calculus I	3
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 126 or CHEM 122	General Chemistry II [1] or Fundamentals of Chemical Principles II	3
CHEM 126A	Gen Chemistry Lab II	1
MATH 238	General Calculus II	3

ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 243	Organic Chemistry I	3
BNFO 135 or CS 101	Programming for Bioinformatics or Computer Programming and Problem Solving	3
History and Humanities GER 200 level (p. 106)		3
MATH 105	Elementary Probability and Statistics	3
	Term Credits	**16**
2nd Semester		
BIOL 222	Evolution	3
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
Cell Biology Laboratory Elective		4
Social Science GER (p. 114)		3
	Term Credits	**15**
Third Year		
1st Semester		
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4
R120 356	Molecular Biology	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
History and Humanities GER 300+ level (p. 108)		3
Free Elective [2]		3
	Term Credits	**17**
2nd Semester		
R120 355	Cell Biology	3
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
Cell Biology Elective		3
Technical Elective [3]		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
Fourth Year		
1st Semester		
Cell Biology Laboratory Elective		4
Technical Elective [2]		3
Technical Elective		3
Free Elective [1]		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**16**
2nd Semester		
Cell Biology Elective		3
Technical Elective [3]		3
Free Elective [2]		3

Free Elective [2]	3
Term Credits	**12**
Total Credits	**120**

Biology Credits: 39

[1] CHEM 121 and CHEM 122 require permission from the academic adviser
[2] Free Elective - Any course in any subject at any level
[3] Technical Elective - Any course in BIOL, CHEM, CS, EVSC, IT, IS, PHYS, or any engineering course

Electives

Technical Electives

Any course in chemistry, math or physics beyond major requirements. Any course in environmental science, computer science or engineering. Additional biology electives can be used as technical electives.

Free Electives

Any course in any subject at any level.

Cell Biology Electives

Code	Title	Credits
BIOL 315	Principles of Neurobiology	3
BIOL 441	Neurophysiology	3
BIOL 423	Physiological Mechanisms	3
BIOL 350	Immunology	3
or R120 350	Immunology	
BIOL 352	Genetics	3
or R120 352	Genetics	
R120 360	Biochemistry	3
R120 402	Biology of Cancer	3
BIOL 440	Cell Biology of Disease: Cells gone Bad!	3
R120 444	Cell Neurobiology	3
BIOL 447	Systems Neurobiology	3
BIOL 448	Neuropathophysiology: Nervous System Gone Bad!	3
BIOL 453	Applied Genetics & Genomics	3
R120 455	Molec Cell Biology	3
R120 456	Virology	3
CHEM 474	Biochemistry II	3
BIOL 491	Research and Independent Study	1-3
or R120 491	Problems In Biology	
BIOL 492	Research and Independent Study	3
or R120 492	Problems In Biology	

Cell Laboratory Electives(Two Required)

Code	Title	Credits
R120 325 & R120 326	Animal Parasites and Parasitology Lab	4
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
BIOL 347	Lab Approaches in Neuroscience	4
R120 404	Intro to Neuroanatomy	4
R120 405	Microanatomy of Cells	4
BIOL 451	Cell Physiology and Imaging	4

R120 452	Molecular Biol Techniques	4
CHEM 473 & CHEM 475	Biochemistry and Biochemistry Lab I	5

Ecology and Evolution Concentration

(120 credits minimum)

First Year		
1st Semester		**Credits**
BIOL 200	Concepts in Biology	4
CHEM 125 or CHEM 121	General Chemistry I [1] or Fundamentals of Chemical Principles I	3
CHEM 125A	General Chemistry Lab I	1
MATH 138	General Calculus I	3
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 126 or CHEM 122	General Chemistry II [1] or Fundamentals of Chemical Principles II	3
CHEM 126A	Gen Chemistry Lab II	1
MATH 238	General Calculus II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 243	Organic Chemistry I	3
BNFO 135 or CS 101	Programming for Bioinformatics or Computer Programming and Problem Solving	3
MATH 105	Elementary Probability and Statistics	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
R120 211	Plant Kingdom	4
BIOL 222	Evolution	3
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
Social Science GER (p. 114)		3
	Term Credits	**15**
Third Year		
1st Semester		
R120 280	Ecology	3
Molecular and Cellular Cluster Elective		3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
History and Humanities GER 300+ level (p. 108)		3
Free Elective [2]		3
	Term Credits	**16**

2nd Semester		
Field Course Elective		3
Ecology & Evolution Elective		3
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
History and Humanities GER 300+ level (p. 108)		3
Technical Elective [3]		3
	Term Credits	**16**
Fourth Year		
1st Semester		
Ecology and Evolution Laboratory Elective		4
Technical Elective [2]		3
Technical Elective [2]		3
Free Elective [2]		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**16**
2nd Semester		
Ecology and Evolution Elective		3
Technical Elective [3]		4
Free Elective [2]		3
Free Elective [2]		3
	Term Credits	**13**
	Total Credits	**120**

Biology Credits: 38

1. CHEM 121 and CHEM 122 require permission from academic adviser
2. Free Elective - Any course in any subject at any level
3. Technical Elective - Any course in BIOL, BME, FRSC, CHEM, CS, EVSC, IT, IS, MIS, MIT, PHYS. **One Technical Elective must be four credits**.

Electives

Technical Electives

Any course in chemistry, math or physics beyond major requirements. Any course in environmental science, computer science or engineering. Additional biology electives can be used as technical electives.

Free Electives

Any course in any subject at any level.

ECOLOGY AND EVOLUTION LABORATORY ELECTIVES (One Required)

Code	Title	Credits
R120 230	Biology Of Seed Plants	4
R120 311	Flora of New Jersey	4
BIOL 321	Comp Vertebrate Anatomy	4
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
R120 342	Developmental Biology	1-3
or R120 343	Developmental Biology Lab	
R120 452	Molecular Biol Techniques	4

FIELD COURSE ELECTIVES (One Required)

Code	Title	Credits
R120 328	Ornithology	3
R120 371	Field Study Plant Ecology	3
R120 380	Field Ecology	3
BIOL 484	Evolution of Animal Behavior Laboratory	3
R120 430	Plant Growth & Development	4
BIOL 475	Ecological Field Methods and Analysis	3

MOLECULAR AND CELLULAR (One Requried)

Code	Title	Credits
BIOL 352	Genetics	3
or R120 352	Genetics	
R120 356	Molecular Biology	3

ECOLOGY AND EVOLUTION ELECTIVES(Two Required)

Code	Title	Credits
R120 305	Vertebrate Evolution	3
BIOL 337	Collective Intel in Biol Syst	3
BIOL 338	Ecology of the Dining Hall	3
R120 365	Evolutions of Humans	3
BIOL 468	Disease Ecology & Evolution	3
R120 370	Plant Ecology	3
BIOL 375	Conservation Biology	3
R120 381	Ecological History of North Am	3
BIOL 382	Animal Behavior	3
R120 422	Biological Invasions	3
R120 431	Modern Plant Biology	3
BIOL 491	Research and Independent Study	1-3
or R120 491	Problems In Biology	
BIOL 492	Research and Independent Study	3
or R120 492	Problems In Biology	

Neurobiology Concentration

First Year		
1st Semester		**Credits**
BIOL 200	Concepts in Biology	4
CHEM 125 or CHEM 121	General Chemistry I [1] or Fundamentals of Chemical Principles I	3
CHEM 125A	General Chemistry Lab I	1
MATH 138	General Calculus I	3
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 126 or CHEM 122	General Chemistry II [1] or Fundamentals of Chemical Principles II	3
CHEM 126A	Gen Chemistry Lab II	1
MATH 238	General Calculus II	3

ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 243	Organic Chemistry I	3
BNFO 135 or CS 101	Programming for Bioinformatics or Computer Programming and Problem Solving	3
MATH 105	Elementary Probability and Statistics	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
BIOL 315	Principles of Neurobiology	3
BIOL 340 or R120 340	Mammalian Physiology or Mammalian Physiology	4
Social Science GER (p. 114)		3
	Term Credits	**15**
Third Year		
1st Semester		
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
BIOL 222	Evolution	3
Cellular and Systems Neuroscience Elective		3
History and Humanities GER 300+ level (p. 108)		3
Free Elective [2]		3
	Term Credits	**16**
2nd Semester		
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
Cellular and Systems Neuroscience Elective		3
Neurobiology Laboratory Elective		4
Technical Elective [3]		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**17**
Fourth Year		
1st Semester		
Neurobiology Laboratory Elective		4
Technical Elective [3]		3
Technical Elective [3]		3
Free Elective [2]		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**16**
2nd Semester		
Neuroscience Elective		3
Technical Elective [3]		3
Free Elective [2]		3

Free Elective [2]	3
Term Credits	**12**
Total Credits	**120**

Biology Credits: 39

[1] CHEM 121 and CHEM 122 require permission from the academic adviser
[2] Free Elective - Any course in any subject at any level
[3] Technical Elective - Any course in BIOL, CHEM, CS, EVSC, IT, IS, PHYS, or any engineering course.

Electives

Technical Electives

Any course in chemistry, math or physics beyond major requirements. Any course in environmental science, computer science or engineering. Additional biology electives can be used as technical electives.

Free Electives

Any course in any subject at any level.

NEUROBIOLOGY LABORATORY ELECTIVES (Two Required)

Code	Title	Credits
BIOL 321	Comp Vertebrate Anatomy	4
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4
BIOL 347	Lab Approaches in Neuroscience	4
BIOL 484	Evolution of Animal Behavior Laboratory	3
BIOL 451	Cell Physiology and Imaging	4
R120 452	Molecular Biol Techniques	4

CELLULAR AND SYSTEMS NEUROSCIENCE ELECTIVES (Two Required)

Code	Title	Credits
R120 444	Cell Neurobiology	3
BIOL 447	Systems Neurobiology	3
BIOL 441	Neurophysiology	3

ADDITIONAL NEUROBIOLOGY ELECTIVES

Code	Title	Credits
BIOL 337	Collective Intel in Biol Syst	3
BIOL 441	Neurophysiology	3
BIOL 423	Physiological Mechanisms	3
BIOL 424	Comparative Physiology	3
BIOL 352	Genetics	3
BIOL 382	Animal Behavior	3
BIOL 383	Neural Basis of Behavior	3
BIOL 432	Intro to Comp Neuroscience	3
BIOL 436	Advanced Neuroscience Modeling	3
R120 444	Cell Neurobiology	3
BIOL 445	Endocrinology	3
or R120 445	Endocrinology	
BIOL 447	Systems Neurobiology	3
BIOL 448	Neuropathophysiology: Nervous System Gone Bad!	3
BIOL 453	Applied Genetics & Genomics	3
BIOL 462	Comparative Biomechanics	3
BIOL 470	Dynamic Princ in Systems BIOL	3

BIOL 491	Research and Independent Study	1-3
or R120 491	Problems In Biology	
BIOL 492	Research and Independent Study	3
or R120 492	Problems In Biology	

Chemistry and Environmental Science

NJIT's Department of Chemistry and Environmental Science provides a unique focus for addressing some of today's most pressing scientific and social challenges. The chemistry program's solid grounding in science, mathematics and engineering, along with lab skills, allows students to apply theory to practical solutions based on chemistry. NJIT has particular strengths in analytical, medical and environmental chemistry. Students can conduct research with faculty mentors with expertise in such areas as energy, pharmaceuticals, materials and environmental chemistry. Through the environmental science program, students acquire a well-rounded background in the field, drawing on chemistry, geology and biological sciences. Students also learn to use computer modeling, data analysis, digital mapping and more — skills that clearly afford a significant advantage in the job market.

The Department's addition of Biochemistry and Forensic Science undergraduate degree programs has further enhanced the range of experiences we offer to our students. The Bachelor of Science in Forensic Science is the first of its kind in New Jersey, and gives students the opportunity to learn from high caliber forensics experts drawn from government and law enforcement, as well as academia. The Forensic Science program leverages the strong foundation of chemistry, biochemistry, and biology courses available at NJIT to deliver a world-class education to its majors.

NJIT Faculty

B

Belfield, Kevin D., Professor

Bonchonsky, Michael P., University Lecturer

C

Casado-Zapico, Sara, Assistant Professor

Champagne, Pier Alexandre, Assistant Professor

Chen, Hao, Professor

Conley, Robert J., Emeritus

D

DeSantis, Christopher, University Lecturer

F

Farinas, Edgardo T., Associate Professor

Fisher, David R., Professor of Practice

G

Getzin, Donald, Associate Professor Emeritus

Gulotta, Miriam, University Lecturer

Gund, Tamara M., Professor

K

Kebbekus, Barbara B., Professor Emeritus

Khalizov, Alexei, Associate Professor

Kim, Yong I., Assistant Professor

L

Lambert, Donald G., Associate Professor Emeritus

Lei, George Y., Associate Professor Emeritus

Li, Mengyan, Assistant Professor

M

Mitra, Somenath, Distinguished Professor

Momenitaheri, Mohammadreza, University Lecturer

P

Pacheco, Carlos N., Senior University Lecturer

Petrova, Roumiana S., Senior University Lecturer

Q

Qiu, Zeyuan, Professor

S

Sadik, Omowunmi A., Distinguished Professor

Shakib, Farnaz A., Assistant Professor

V

Venanzi, Carol A., Distinguished Professor Emeritus

W

Warner Genoa, Assistant Professor

Z

Zhang, Lijie, Assistant Professor

Zhang, Yuanwei, Assistant Professor

Programs

- BioChemistry - B.S. (p. 347)
- Chemistry - B.S. (p. 351)
- Environmental Science - B.S. (p. 352)
- Forensic Science - B.S. (p. 354)

Double Majors (p. 102)

- Forensic Science & Law, Technology & Culture - B.S (p. 405)
- Chemistry & Law, Technology and Culture (p. 403)

- Chemistry Minor (p. 359) (not for Chemical Engineering majors)
- Chemistry Minor (p. 552) (for Chemical Engineering majors)
- Environmental Science Policy Minor (p. 359)
- Forensic Science Minor (p. 360)

Chemistry and Environmental Science Courses

CHEM 105. Applied Chemical Principles. 4 credits, 5 contact hours (3;2;0).
Prerequisite: high school algebra or equivalent. The fundamentals and relation of chemistry to living in today's society. Suitable laboratory experiments illustrate the course material. Not open to engineering or science students, or students who have completed a college level chemistry course.

CHEM 108. College Chemistry I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: a one-year college prep high school chemistry course, high school math including algebra and trigonometry. Delivered as a telecourse, the course provides the first of a two-semester sequence of college chemistry for high school students and other distance learners seeking college credit and/or preparation for the AP Examination. Matriculated undergraduates may not receive credit for this course.

CHEM 109. College Chemistry II. 3 credits, 4 contact hours (3;1;0).
Prerequisite: CHEM 108. A continuation of CHEM 108.

CHEM 121. Fundamentals of Chemical Principles I. 3 credits, 3 contact hours (3;0;0).
Introduces the basic concepts of chemistry, including chemical reactions, and bonding, electronic and molecular structure, gases and thermochemistry. Students requiring lab should also register for lab CHEM 125A.

CHEM 122. Fundamentals of Chemical Principles II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHEM 121 with a grade C or better. Continuation of the CHEM 121 sequence. Introduces the basic concepts of chemistry, including equilibrium, chemical kinetics, thermodynamics, electrochemistry, and nuclear chemistry.

CHEM 125. General Chemistry I. 3 credits, 3 contact hours (3;0;0).
Co-requisite: MATH 110 or higher. The first semester of a two-semester sequence in chemistry. Introduces the basic concepts of chemistry, including chemical reactions and bonding, electronic and molecular structure, gases, and thermochemistry. Students requiring lab should also register for lab CHEM 125A.

CHEM 125A. General Chemistry Lab I. 1 credit, 3 contact hours (0;3;0).
Corequisites: CHEM 125 or CHEM 121. General Chemistry Lab I is a laboratory course; it is designed to be taken currently with CHEM 125 or CHEM 121. Instructions are in the lab manual and concepts are from the text and lecture of the CHEM 125/CHEM 121 courses. The experiments are designed to provide undergraduate students with practical experience and train students with laboratory techniques/equipment common to chemistry laboratories.

CHEM 126. General Chemistry II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 110 or higher and CHEM 125 or CHEM 121 with a C or better. The second semester of a two-semester sequence in chemistry. Introduces the basic concepts of chemistry, including equilibrium, chemical kinetics, thermodynamics, and electrochemistry. Students requiring 2 semesters of Chemistry lab should also register for lab CHEM 126A.

CHEM 126A. Gen Chemistry Lab II. 1 credit, 3 contact hours (0;3;0).
Prerequisites: CHEM 125A with a grade of C or better. Corequisites: CHEM 126 or CHEM 122. This new course is designed to be taken concurrently with CHEM 126. Instructions are in the lab manual and concepts are from the text and lecture of the CHEM 126. The experiments are designed to provide undergraduate students with practical experience and techniques in the chemistry laboratory. Also they will help students understand the underlying concepts covered in the lecture course.

CHEM 210. Frontiers in Chemistry. 1 credit, 1 contact hour (1;0;0).
Prerequisites: CHEM 125 or CHEM 121. Restrictions: Sophomore standing. Offers CES students to come together and learn about the different subdisciplines within the department. This course will give them an opportunity to learn about the research projects of various CES faculty. The course will provide students with opportunities to enhance their understanding of classroom knowledge through research presentation from internal and external invited speakers. Through exposure to research methods, the course will also introduce them to pathways for students to engage in undergraduate research.

CHEM 221. Analytical Chemical Methods. 2 credits, 4 contact hours (0;4;0).
Corequisite: CHEM 222. Laboratory introducing quantitative chemical analyses by gravimetry, titration, spectroscopy, chromatography, and potentiometry.

CHEM 222. Analytical Chemistry. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (CHEM 122 or CHEM 126), CHEM 124 or (CHEM 125A and CHEM 126A) with grade of C or better. Lecture course introducing concepts of chemical analyses by gravimetry, titration, spectroscopy, chromatography, and potentiometry.

CHEM 231. Physical Chemistry I. 3 credits, 4 contact hours (3;0;1).
Prerequisites: CHEM 122 or CHEM 126 , PHYS 111 and MATH 211 or MATH 213 or MATH 309 with a grade of C or better. The topics covered include the properties of ideal and non-ideal gases and liquids, solutions, thermochemistry, thermodynamics, the phase rule, and phase equilibria.

CHEM 235. Physical Chemistry II. 3 credits, 4 contact hours (3;0;1).
Prerequisite: CHEM 231 with a grade of C or better. A continuation of CHEM 231. The topics include homogeneous and heterogeneous chemical equilibria, ionic equilibria, electrochemistry, kinetic theory of gases, transport phenomena, kinetics, and irreversible processes.

CHEM 235A. Physical Chemistry II Laboratory. 2 credits, 4 contact hours (0;4;0).
Prerequisites: CHEM 221, CHEM 235 with a grade of C or better. Corequisite: MATH 225 (special section for chemical engineering and chemistry majors). Laboratory experiments apply and extend the basic knowledge of physical chemistry acquired in the lecture. Reports and presentations are an essential part of the course.

CHEM 236. Physical Chemistry for Chemical Engineers. 4 credits, 5 contact hours (4;0;1).
Prerequisites: (CHEM 122 or CHEM 126) and CHEM 125A and (CHE 230 or CHE 232) with a grade C or better. This course will introduce the chemical engineering students to the concepts of order, disorder, chemical equilibrium and phase equilibrium. Credit for this course will not be given if credit for CHEM 235 has been given.

CHEM 238. Analytical/Organic Chem Lab for Chemical Engineers. 2 credits, 4 contact hours (0;4;0).
Prerequisites: CHEM 124 and CHEM 245 with a grade of C or better. This course will offer the CHE students experience in organic and analytical laboratory experiments. These experiments will reinforce concepts learned in the organic chemistry lecture classes. This laboratory course will also provide exposure to analytical and other techniques useful in the chemistry and chemical engineering laboratories.

CHEM 243. Organic Chemistry I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 122 or CHEM 126 with a grade of C or better. Systematic study of the theories, principles and applications of Organic Chemistry. This course covers topics such as bonding theories and structure, conformations and stereochemistry, and functional groups like alkanes, alkenes, and alkynes. This course will also cover topics such as spectroscopy and mass spectrometry.

CHEM 244. Organic Chemistry II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHEM 243 with a grade of C or better. The second semester in the two-semester Organic Chemistry sequence. Systematic study of the theories, principles, applications and techniques of Organic Chemistry. The course will cover topics such as alcohols, conjugated and aromatic compounds, carbonyl derivatives and amines.

CHEM 244A. Organic Chemistry I Laboratory. 2 credits, 4 contact hours (0;4;0).
Prerequisites: CHEM 125A or CHEM 124 with a grade C or better. Corequisites: CHEM 245 or CHEM 243. Synthesis, purification and characterization of organic compounds are performed. Students will learn techniques such as multi-step synthesis, distillation, crystallization, separation and chromatography. Techniques such as UV, IR, NMR and mass spectrometry will be used for compound characterization.

CHEM 245. Organic Chemistry for Chemical Engineers. 4 credits, 5 contact hours (4;0;1).
Prerequisites: CHEM 126 or CHEM 122 with a grade of C or better. This course is a one-semester course(opposed to classic two-semester sequence) to provide chemical engineering students with a basic understanding of organic compounds and their reactions.

CHEM 246A. Organic Chemistry Laboratory. 4 credits, 4 contact hours (0;4;0).
Prerequisite: CHEM 244A with a grade of C or better. This course will cover some common reaction types that are not included in CHEM 244A. The experiments will be carried out in microscale. Students will learn new concepts in organic synthesis, including multi-step synthesis, organometallic reagents, and green chemistry for chemical synthesis, catalytic reactions, protecting groups, and peptide couplings. NMR and IR will be used for compound characterization.

CHEM 301. Chemical Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisites: high school algebra and trigonometry or equivalent with a grade of C or better. Designed for engineering technology majors. Not open to students who have completed a college level chemistry course. Covers principles of chemistry, with a focus on chemical energetics and chemistry of materials. Suitable laboratory experiments illus-trate the course material.

CHEM 310. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Restriction: completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report. Cannot be used for degree credit.Note: Normal grading applies to this COOP Experience.

CHEM 311. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: CHEM 310 with a grade C or better.

CHEM 336. Quantum Chemistry. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222 and CHEM 126 with a grade of C or better. An introduction to quantum mechanics, statistical mechanics, spectroscopy, and solid state.

CHEM 339. Analytical/Physical Chem Lab for Chemical Engineers. 2 credits, 4 contact hours (0;4;0).
Prerequisites: CHEM 236 with grade C or better. Co-requisite: MATH 225 This course will offer students an introduction to physical and analytical chemistry laboratory techniques. The application of principles learned in lecture will be reinforced by the experiments done in this lab. They will also provide exposure to analytical and other techniques used in chemistry and chemical engineering.

CHEM 340. Chemistry of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 244 or CHEM 245 with a grade of C or better. Covers chemistry of materials and introduces relevant concepts of bonding and structure. Topics covered include the crystalline solid state, bonding and thermodynamics, semiconductors/electronic materials, nanoscale materials, biomaterials, chemistry at interfaces, characterization techniques, and application of materials in devices.

CHEM 360. Environmental Chemistry of Air Pollution and Climate Change. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126 or CHEM 122 with a grade of C or better. Chemistry of the environment with emphasis on the atmosphere. Included are an introduction to the composition and chemistry of the natural and polluted atmosphere, thermodynamics and kinetics of atmospheric reactions, indoor and outdoor air pollution, air quality and its impact on human health, air quality regulations, and climate change. Examples of specific environmental issues covered in this course are the stratospheric ozone depletion, classical and photochemical smog, acid rain, and climate change.

CHEM 361. Environmental Chemistry of Water and Soil Pollution. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 360 or one of the following courses (CHEM 222, CHEM 231, CHEM 236, CHEM 243, CHEM 245) with a grade of C or better. Chemistry of the environment, including the hydrosphere and geosphere. Principles of physical, inorganic, and organic chemistry are applied to understand the origins of environmental pollutants, their transport, distribution, and decomposition pathways in water and soil environments.

CHEM 391. Research and Independent Study. 3 credits, 3 contact hours (0;0;3).
Restriction: Junior standing in Chemistry. Provides an opportunity to work on a reserch project under the individual guidance of a member of the department.

CHEM 412. Inorganic Chemistry. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHEM 244 with a grade of C or better. The course covers structure, bonding, properties, and reactivity in inorganic chemistry. Topics covered will include inorganic structure/bonding, molecular orbitals, coordination chemistry, organometallic chemistry, catalysis, symmetry, and group theory.

CHEM 437. Applications of Computational Chemistry and Molecular Modeling. 3 credits, 3 contact hours (3;0;0).
This class introduces students to applications and fundamental aspects of computational chemistry and molecular modeling for application and understanding in organic, bio- or physical chemistry. It is an introductory course involving hands-on applications of computational chemistry and molecular modeling. The course provides training application and computer programs for students to use in determining fundamental thermochemical parameters, elementary reaction paths, and design of molecular structures to try and optimize and/or improve biochemical / pharmaceutical products or industrial chemical processes. Students will use chemical software packages to perform calculations in order to identify optimum interaction structures for pharmaceutical or industrial chemical systems. The course teaches the student to evaluate relative energy of different structures plus chemical species stability, reactivity and equilibrium rations in chemical environments. The course is relevant to organic, inorganic, physical bio- and pharmaceutical chemistry. It is also relevant to optimization of chemical engineering processes.

CHEM 473. Biochemistry. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHEM 244 or CHEM 245 with a grade of C or better. Covers the fundamentals of biochemistry including buffers, blood, proteins, enzymes, carbohydrates, fats, and nucleic acids. Emphasis on the relationship of biochemistry to biotechnology and medicine.

CHEM 474. Biochemistry II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHEM 473 with grade of C or better. This course focuses on transducing and storing energy, synthesizing the molecules of life, and responding to environmental changes. Topics include concepts of metabolism, glycolysis, gluconeogenesis, citric acid cycle, oxidative phosphorylation, photosynthesis, fatty acid metabolism, protein turnover, amino acid catabolism, biosynthesis of amino acids, DNA replication and recombination, RNA synthesis and processing, protein synthesis, gene expression control, immune system, and drug development.

CHEM 475. Biochemistry Lab I. 2 credits, 4 contact hours (0;4;0).
Prerequisites: CHEM 244 or CHEM 473 with a grade of C or better. This course will offer the chemistry and related (chemical engineering, biology, bioinformatics, bioengineering)students fundamental laboratory approaches for biochemistry and biotechnology. These experiments will reinforce concepts learned in biochemistry lecture classes.

CHEM 480. Instrumental Analysis. 2 credits, 4 contact hours (0;4;0).
Prerequisites: CHEM 221, CHEM 222 or equivalent with a grade of C or better. Laboratory exploring the principles of operation of modern instruments for chemical analysis. Ultra-violet and infrared spectroscopy, mass spectrometry, gas chromatography, high performance liquid chromatography, voltametry, and potentiometry are among the instruments utilized. Apply calibration methods, statistical data treatment, and sample preparation techniques are applied.

CHEM 490. Special Topics in Chemistry. 3 credits, 3 contact hours (3;0;0).
Prerequisite: depends upon the nature of the course given. Course is offered in specific areas as interest develops.

CHEM 491. Research and Independent Study I. 3 credits, 3 contact hours (0;0;3).
Prerequisite: senior standing in chemistry or chemical engineering. Provides an opportunity to work on a research project under the individual guidance of a member of the department.

CHEM 492. Research and Independent Study II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: CHEM 491 with a grade of C or better. A continuation of CHEM 491.

EPS 202. Society, Technology, and the Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENGL 101. Uses case studies to examine the relationships between the creation and use of technologies, the human and natural environment, and the development of social and cultural institutions. Its central theme is the manner in which human society structures the environment in which it lives: nature and culture, city and country, civilization and development. This course satisfies 3 credits of the Basic Social Sciences GUR. Honors Note: See HSS 101.

EPS 312. Technology and Policy in Contemporary America. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101, HSS 202 or their equivalents; two from HSS 211, HSS 212, HIST 213 or their equivalents. A study of technology and politics in recent America. Focuses on the role of the federal government in shaping technology, especially through funding technological innovations and applications. Topics will include the origins of technology policy in World War II, the influence of the Cold War, the science and technology policy advisory system, and political and cultural influences on technology policy. Honors Note: See HSS 101.

EPS 313. Environmental History and Policy. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101, HSS 202 or their equivalents; two from HSS 211, HSS 212, HIST 213 or their equivalents. Covers the rise of the modern environmental debate, and examines its current priorities and values, politics and economics, and impacts on industry and society. Students review the role of regulatory agencies, private industry, public interest groups, and the media. Current major issues in New Jersey are considered, as well as environmental debate on a national and global level. Honors Note: See HSS 101.

EPS 362. Environmental Economics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101, HSS 202, SS 201 or their equivalents. Presents a detailed overview of the relationship between political economy and the environment. Draws on diverse case studies including global warming, harvesting of minerals on the ocean's floor, destruction of old growth forests, and contamination of the -nation's water, air, and soils. Explores the economic remedies to the fast-changing relationship between society and nature. Honors Note: See HSS 101.

EPS 380. Policy Issues in the Coastal Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101, HSS 202 or their equivalents; two from HSS 211, HSS 212, HIST 213 or their equivalents. An examination of coastal environments from the standpoint of the scientist, the engineer, and the resource manager. Topics include beach and shoreline characteristics, technological innovations to address coastal erosion problems, and current debates in coastal policy and resource management. Case studies are used to illustrate coastal management practices and the scientific, technical, and social constraint to policy formulation.

EPS 381. Field Techniques and Research. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101, HSS 202 or their equivalents; two from HSS 211, HSS 212, Hist 213 or their equivalents.; STS 307. An introduction to research methods. The objectives of the course are to provide opportunity to pursue specialized, in-depth research in a subfield of science, technology and society of the student's choice; to develop skills in problem identification, research design and problem solving; to increase familiarity with methods of data analysis; to strengthen library research skills; to provide an opportunity to gather original field data in a team-oriented environment; and to improve oral and written communication skills.

EVSC 125. Fundamentals of Environmental Sciences. 3 credits, 3 contact hours (3;0;0).
An introductory course that will present freshman EVSC students with general concepts and topics on Environment, including chemistry, ecosystems, geological and soil resources, water quality, agricultural and Environment, atmosphere, noise and ionizing radiation.

EVSC 325. Energy and Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 125 with a grade C or better and PHYS 111 with grade C or better. An advanced course to instruct EVSC students, topics on energy and environmental issues such as introduction to energy, natural energy conservation, environmental issues of energy production and consumption, regulation and legislation related to energy, public policy development in energy and environment.

EVSC 335. Environmental Law. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENGL 102 with a grade of C or better. The prerequisite is a college ability to communicate competently in the English language including the ability to research and prepare essay compositions and to articulate the major points in a presentation format. The introduction to Environmental Law will cover the regulatory system developed over time that has forged a complex system of environmental rules influencing industrial and other private and public actions that impact the environment. The course will review these rules from the vantage point of the practicing technical environmental engineer and scientist. Students will become familiar with the background and derivation of these laws as well as the major operational features such as environmental permits and enforcement. Several major environmental cases will be analyzed that give definition to the key features of these laws. Each class module will direct itself to the practical application of these laws.

EVSC 340. Environmental Health and Safety. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126. This course includes an interdisciplinary review of fundamental scientific principles necessary to understand basic environmental health science. Basic science and engineering knowledge is applied to the recognition, evaluation and control of physical, chemical and biological processes that influence human health and welfare. The impact of contaminants ranging from industrial pollutants to biological agents and environmental disease vectors will be analyzed. This course is based on the premise that exposures to the environmental stressors that cause harm can be recognized through the observation of environmental quality parameters and mitigated by source controls and pollution prevention.

EVSC 375. Environmental Biology. 3 credits, 3 contact hours (3;0;0).
An introductory ecological approach to understanding man's impact and dependence on the natural environment. Broad topics include ecosystems, nutrient cycles, pollution, pest management, conservation of natural resources, energy, and human population.

EVSC 381. Geomorphology. 3 credits, 3 contact hours (3;0;0).
This is a course in geomorphology, the study of landforms and the contemporary processes that create and modify them. The course will emphasize earth surface processes and quantitative analysis of landform change. Lectures will stress geomorphic principles and two field-based problems will enable students to apply these principles to contemporary geomorphic problems in engineering and management with a focus on the natural environment.

EVSC 385. Environmental Microbiology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: R120 101 and R120 102, or BIOL 205 and BIOL 206, with grade of C or better. The main goals of this course are to present an overview of the important microbes involved in environmental microbiology, to discuss the environments where they are found, to learn how they are detected and monitored, and to describe their effects on humans. Lectures and exams will be supplemented with discussions of experimental design and data interpretation by reading current research articles.

EVSC 391. Research and Independent Study. 3 credits, 3 contact hours (0;0;3).
Provides an opportunity to work on a research project under the individual guidance of a member of the department.

EVSC 416. Environmental Toxicology. 3 credits, 3 contact hours (3;0;0).
The course is intended to explore the general principles of toxicology and apply them to the assessment of acute, subacute and chronic effects of hazardous and toxic chemicals. Qualitative and quantitative measures of toxicity and testing protocols are addressed. The role of toxicology in risk assessment and risk management is discussed.

EVSC 484. Environmental Analysis. 3 credits, 4 contact hours (2;2;0).
The analysis of environmental samples is studied from the acquisition of representative samples, through sample handling, chain of custody, sample storage, analytical method selection, analysis, and data treatment.

EVSC 490. Special Topics in Environmental Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: This will depend upon the course given. The course will be offered in specific areas as interest develops.

FRSC 201. Intro to Forensic Science. 3 credits, 3 contact hours (3;0;0).
This course explores the scientific and legal praxis of forensic science. Forensic science is an integral and important part of the legal system by providing investigators credible science to corroborate or refute statements, and offering factual reports of scientific-based findings to a trial judge and jury. Students will be introduced to the science behind examination techniques used in forensic science labs. Guest lecturers and practitioners will offer insights into their day-to-day investigative and technological challenges and success.

FRSC 307. Crime Scene Investigation &Lab. 4 credits, 5 contact hours (3;2;0).
Prerequisite: FRSC 201. Overview and analysis of the cardinal principles and techniques of crime scene investigation, with an emphasis on a rigorous scientific approach. Students will be introduced to: documentation with notes, sketches, and photography; specialized techniques for the recognition and enhancement of physical evidence; preparation and maintenance of case folders; communication of results and preparation of formal reports; management of resources, including equipment and personnel; and ethics and bias in criminalistics.

FRSC 359. Physical Methods of Forensic Analysis & Lab. 4 credits, 6 contact hours (2;4;0).
Prerequisites: FRSC 201; FRSC 307 (FRSC 307 may be taken as a co-requisite). This course is designed to prepare undergraduate students in the forensic science program for impression, pattern, and trace evidence analysis. Students will learn the principles of criminalistics, proper evaluation and comparison of impression evidence, and the theory and practical application of forensic microscopy to the analysis of unknown materials. There will be an emphasis on the necessity of an objective and rigorous scientific approach to forensic investigations.

FRSC 475. Forensic Chemistry & Lab. 4 credits, 6 contact hours (2;4;0).
Prerequisite: CHEM 221. Forensic Chemistry is the application of modern analytical chemistry to matters of law. This course will describe methods of analysis commonly performed in forensic laboratories for the analysis of controlled substances, forensic toxicology, fire debris analysis, trace evidence, and other types of evidence. The laboratory component of the course will prepare students for forensic science careers with practical examples of commonly performed tests and examinations.

FRSC 479. Forensic Biology & Lab. 4 credits, 6 contact hours (2;4;0).
Prerequisite: BIOL 352. Forensic Biology will expose students to Forensic Serology and Forensic DNA. It covers the different types of analyses that are performed in forensic biology sections of crime laboratories. The course will introduce students to human identity testing, focusing on the theory, methods, procedures and statistics associated with this forensic science. The course also contains a weekly laboratory component.

FRSC 480. Forensic Microscopy & Lab. 4 credits, 6 contact hours (2;4;0).
Prerequisite: CHEM 221. This course provides students with the basic knowledge and skills necessary to explore the application of microscopy to the forensic sciences. This course incorporates lectures and laboratory exercises organized in a format to engage each registrant in the analytical and investigative roles of the light microscope in the forensic professions. The general topics and techniques covered in this course include microscope nomenclature, alignment and focus, microscopic sample handling, and photographic documentation of samples.

FRSC 490. Co-op Work Experience. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Senior standing and departmental approval. Students gain major-related work experience and reinforcement of their academic program. Work assignments are facilitated and approved by the co-op office. Requires mandatory participation in seminars and completion of a report. Note: Normal grading applies to this co-op experience.

FRSC 491. Research & Indep Study I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Senior standing and departmental approval. Research in forensic science. Each student works under the supervision of a forensic science or associated faculty member. A research paper or poster are required.

FRSC 495. Senior Seminar. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Senior standing and departmental approval. Offers forensic science students the opportunity to enhance their understanding of professional practice through their integration of skills and knowledge gained in prior courses. The resultant research paper and presentation represents the culmination of the undergraduate disciplinary experience. Guest speakers will be invited to present on topics relevant to their area of expertise within the field of forensic science.

FRSC 498. Special Topics in Forensic Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Permission of instructor. Special topics course in the field of forensic science.

B.S. in Biochemistry

(120 Credits)

First Year		
1st Semester		**Credits**
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I [a]	4
FYS SEM	First-Year Student Seminar	0

BIOL 200	Concepts in Biology	4
	Term Credits	**15**
2nd Semester		
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
MATH 112	Calculus II	4
ENGL 102	English Composition: Introduction to Writing for Research	3
R120 201	Foundations Of Biology	3
R120 202	Foundations Of Biology Lab	1
	Term Credits	**15**
Second Year		
1st Semester		
CHEM 222	Analytical Chemistry	3
CHEM 243	Organic Chemistry I	3
MATH 211	Calculus III A	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
CHEM 221	Analytical Chemical Methods	2
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
BNFO 135	Programming for Bioinformatics [b]	3
	Term Credits	**18**
Third Year		
1st Semester		
CHEM 473	Biochemistry [1]	3
CHEM 475	Biochemistry Lab I [1]	2
CHEM 231	Physical Chemistry I	3
EPS 202	Society, Technology, and the Environment	3
Free Elective		1
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
CHEM 235	Physical Chemistry II	3
R120 352	Genetics [1]	3
CHEM 474	Biochemistry II [1]	3
CHEM 480	Instrumental Analysis [1]	2
Free Elective		3
	Term Credits	**14**
Fourth Year		
1st Semester		
CHEM 235A	Physical Chemistry II Laboratory	2
MATH 225	Survey of Probability and Statistics	1
R120 356	Molecular Biology [1]	3
EVSC 385	Environmental Microbiology [1]	3

Technical Elective [1]		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
Humanities and Social Science Senior Seminar GER (p. 112)		3
Technical Elective [1]		3
Technical Elective [1]		3
Technical Elective [1]		3
	Term Credits	**12**
	Total Credits	**120**

1 33 credits of these courses must be taken at NJIT, Rutgers-Newark, or Essex County College by all students.

a Students who do not place initially into Math 111 must take the prerequisite(s) first and catch up to the math sequence ASAP.

b CS 113 is also acceptable, but it has a pre-requisite of CS 100, adding 3 more credits unless AP or transfer credit is obtained.

All students are required to satisfy the General Education Requirements (GER). Refer to the General Education Requirements (p. 105) "Refer to the General Education Requirements for specific information for GER courses"

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Biochemistry and Forensic Science (Forensic Biology option)

(129 Credits)

First Year		
1st Semester		**Credits**
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I [a]	4
FYS SEM	First-Year Student Seminar	0
BIOL 200	Concepts in Biology	4
	Term Credits	**15**
2nd Semester		
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
MATH 112	Calculus II	4
ENGL 102	English Composition: Introduction to Writing for Research	3
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
	Term Credits	**15**
Second Year		
1st Semester		
CHEM 222	Analytical Chemistry	3
CHEM 243	Organic Chemistry I	3
MATH 211	Calculus III A	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1

History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
CHEM 221	Analytical Chemical Methods	2
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
	Term Credits	**15**
Third Year		
1st Semester		
CHEM 473	Biochemistry	3
CHEM 475	Biochemistry Lab I	2
CHEM 231	Physical Chemistry I	3
FRSC 201	Intro to Forensic Science	3
MATH 333	Probability and Statistics	3
	Term Credits	**14**
2nd Semester		
CHEM 235	Physical Chemistry II	3
FRSC 307	Crime Scene Investigation &Lab	4
CHEM 474	Biochemistry II	3
R120 356	Molecular Biology	3
	Term Credits	**13**
Fourth Year		
1st Semester		
CHEM 235A	Physical Chemistry II Laboratory	2
BNFO 135	Programming for Bioinformatics	3
BIOL 352	Genetics	3
FRSC 359	Physical Methods of Forensic Analysis & Lab	4
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
HIST 320	Law and Evidence	3
FRSC 479	Forensic Biology & Lab	4
FRSC 480	Forensic Microscopy & Lab	4
CHEM 480	Instrumental Analysis	2
	Term Credits	**13**
Fifth Year		
1st Semester		
BIOL 340	Mammalian Physiology	4
EVSC 385	Environmental Microbiology	3
FRSC 490 or FRSC 491 or FRSC 495	Co-op Work Experience or Research & Indep Study I or Senior Seminar	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**13**
	Total Credits	**129**

a Students who do not place initially into Math 111 must take the prerequisite(s) first and catch up to the math sequence ASAP.

B.S. in Chemistry

(120 credits minimum)

First Year		
1st Semester		**Credits**
CHEM 125 or CHEM 121	General Chemistry I or Fundamentals of Chemical Principles I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I [a]	4
BNFO 135	Programming for Bioinformatics [b]	3
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
CHEM 126 or CHEM 122	General Chemistry II or Fundamentals of Chemical Principles II	3
CHEM 126A	Gen Chemistry Lab II	1
MATH 112	Calculus II	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**15**
Second Year		
1st Semester		
CHEM 222	Analytical Chemistry	3
CHEM 243	Organic Chemistry I	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
MATH 211	Calculus III A	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
CHEM 221	Analytical Chemical Methods	2
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
Free Elective		2
MATH 222	Differential Equations	4
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
Third Year		
1st Semester		
CHEM 473	Biochemistry [1]	3
Technical Elective [1]		3
CHEM 231	Physical Chemistry I	3
EPS 202	Society, Technology, and the Environment	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
CHEM 235	Physical Chemistry II	3
CHEM 480	Instrumental Analysis [1]	2
CHEM 412	Inorganic Chemistry [1]	3
Technical Elective [1]		3

Technical Elective [1]		3
	Term Credits	**14**
Fourth Year		
1st Semester		
CHEM 235A	Physical Chemistry II Laboratory	2
CHEM 336	Quantum Chemistry [1]	3
CHEM 340	Chemistry of Materials [1d]	3
MATH 225	Survey of Probability and Statistics	1
Technical Elective [1]		3
Technical Elective [1]		3
	Term Credits	**15**
2nd Semester		
Humanities and Social Science Senior Seminar GER (p. 112)		3
Technical Elective [1]		3
Technical Elective [1]		3
Technical Elective [1]		3
Technical Elective [1]		3
	Term Credits	**15**
	Total Credits	**120**

1 33 credits of these courses must be taken at NJIT, Rutgers-Newark, or Essex County College by all students.
a Students who do not place initially into Math 111 must take the prerequisite(s) first and catch up to the math sequence ASAP.
b CS 113 is also acceptable, but it has a pre-requisite of CS 100, adding 3 more credits unless AP or transfer credit is obtained.
c Mgmt 390 is recommended; students can instead take 3 credits of a free elective class.
d MTSE 301 can be substituted for Chem 340.

For a listing of GER and Electives Refer to the General Education Requirements (p. 105) "Refer to the General Education Requirements for specific information for GER courses"

Department Regulations

For departmental regulations on prerequisites, grades and withdrawals, consult with the departmental undergraduate advisor. Students cannot receive a B.S. in Chemistry unless they achieve a minimum GPA of 2.0 in chemistry courses.

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Environmental Science

(120 credit minimum)

First Year		
1st Semester		**Credits**
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I [a]	4
BIOL 200	Concepts in Biology	4
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1

ENGL 102	English Composition: Introduction to Writing for Research	3
BNFO 135	Programming for Bioinformatics [b]	3
R120 201	Foundations Of Biology	3
R120 202	Foundations Of Biology Lab	1
EVSC 125	Fundamentals of Environmental Sciences	3
	Term Credits	**17**
Second Year		
1st Semester		
EPS 202	Society, Technology, and the Environment	3
R460 103	Planet Earth	3
R460 104	Planet Earth Lab	1
CHEM 222	Analytical Chemistry	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**17**
2nd Semester		
CHEM 243	Organic Chemistry I	3
R460 206	Env Geology	3
R460 207	Env Geology Lab	1
CHEM 221	Analytical Chemical Methods	2
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
	Term Credits	**17**
Third Year		
1st Semester		
CHEM 360	Environmental Chemistry of Air Pollution and Climate Change [c]	3
Technical Elective		3
EVSC 381	Geomorphology [c]	3
MATH 105	Elementary Probability and Statistics	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
EVSC 375	Environmental Biology [c]	3
EVSC 325	Energy and Environment [c]	3
BIOL 375 or BIOL 475	Conservation Biology [c] or Ecological Field Methods and Analysis	3
History and Humanities GER 300+ level (p. 108)		3
CHEM 361	Environmental Chemistry of Water and Soil Pollution [c]	3
	Term Credits	**15**
Fourth Year		
1st Semester		
EVSC 385	Environmental Microbiology [c]	3
EVSC 484	Environmental Analysis [c]	3
Technical Elective		3
Technical Elective		3
	Term Credits	**12**
2nd Semester		
EVSC 416	Environmental Toxicology [c]	3
Humanities and Social Science Senior Seminar GER (p. 112)		3

Technical Elective	3
Technical Elective	3
Term Credits	**12**
Total Credits	**120**

a Students who do not place initially into Math 111 must take the prerequisite(s) first and catch up to the math sequence ASAP.
b CS 113 is also acceptable, but it has a pre-requisite of CS 100, adding 3 more credits unless AP or transfer credit is obtained.
c 33 credits of these courses must be taken at NJIT, Rutgers-Newark, or Essex County College by all students.

Technical Electives

Code	Title	Credits
Chemistry		
CHEM 244	Organic Chemistry II	3
CHEM 473	Biochemistry	3
CHEM 231	Physical Chemistry I	3
Environmental Science		
EVSC 613	Environmental Problem Solving	3
Biology		
BIOL 222	Evolution	3
BIOL 375	Conservation Biology	3
BIOL 475	Ecological Field Methods and Analysis	3
R120 330	Plant Physiology	4
R120 370	Plant Ecology	3
R120 371	Field Study Plant Ecology	3
R120 381	Ecological History of North Am	3
R120 470	Field Ecology	3
R120 481	Marine Biology	4
R120 352	Genetics	3
Civil and Environmental Engineering		
CE 342	Geology	3
Environmental Policy and Sustainability		
EPS 312	Technology and Policy in Contemporary America	3
EPS 313	Environmental History and Policy	3
EPS 362	Environmental Economics	3
EPS 380	Policy Issues in the Coastal Environment	3
EPS 381	Field Techniques and Research	3
Geology Courses		
R460 331	Oceanography	3
R460 427	Hydrogeology	3
Mathematics		
MATH 112	Calculus II	4

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Forensic Science

B.S. in Forensic Science (120 credits)

Forensic science is the application of sciences to matters of law. The Bachelor of Science in Forensic Science requires foundational coursework in mathematics and the natural sciences. In addition, students complete the program's forensic science core, which is designed to equip students with a background in forensic science core concepts, evidence collection, technical analysis, data interpretation, and professional regulatory practices.

Students complete advanced coursework in analytical chemistry as well as upper-level courses in one of the program's three options: digital forensics, forensic biology, or forensic chemistry. Students must complete the Forensic Science Assessment Test (FSAT) in order to be certified for graduation.

B.S. in Forensic Science: Forensic Biology Option

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FYS SEM	First-Year Student Seminar	0
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
	Term Credits	**15**
2nd Semester		
CHEM 126	General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**15**
Second Year		
1st Semester		
BIOL 200	Concepts in Biology	4
CHEM 243	Organic Chemistry I	3
FRSC 201	Intro to Forensic Science	3
MATH 333	Probability and Statistics	3
Computing GER (p. 106)		3
	Term Credits	**16**
2nd Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
FRSC 307	Crime Scene Investigation &Lab	4
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 222	Analytical Chemistry	3
FRSC 359	Physical Methods of Forensic Analysis & Lab	4
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**14**
2nd Semester		
BIOL 340	Mammalian Physiology	4
CHEM 221	Analytical Chemical Methods	2
CHEM 473	Biochemistry	3
HIST 320	Law and Evidence	3

R120 356	Molecular Biology	3
	Term Credits	**15**
Fourth Year		
1st Semester		
BIOL 352	Genetics	3
CHEM 475	Biochemistry Lab I	2
Humanities and Social Science Senior Seminar GER (p. 112)		3
300 or 400 level Forensics Elective I		3
300 or 400 level Forensics Elective II		3
	Term Credits	**14**
2nd Semester		
FRSC 479	Forensic Biology & Lab	4
FRSC 480	Forensic Microscopy & Lab	4
Select one of the following:		3
FRSC 490	Co-op Work Experience	
FRSC 491	Research & Indep Study I	
FRSC 495	Senior Seminar	
Free Elective		4
	Term Credits	**15**
	Total Credits	**120**

B.S. in Forensic Science: Forensic Chemistry Option

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FYS SEM	First-Year Student Seminar	0
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
	Term Credits	**15**
2nd Semester		
CHEM 126	General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**15**
Second Year		
1st Semester		
CHEM 231	Physical Chemistry I	3
CHEM 243	Organic Chemistry I	3
FRSC 201	Intro to Forensic Science	3
MATH 211	Calculus III A	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**15**
2nd Semester		
BIOL 200	Concepts in Biology	4
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2

MATH 333	Probability and Statistics	3
300 or 400 level Forensics Elective I		3
	Term Credits	**15**
Third Year		
1st Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 222	Analytical Chemistry	3
FRSC 307	Crime Scene Investigation &Lab	4
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**14**
2nd Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 221	Analytical Chemical Methods	2
CHEM 473	Biochemistry	3
FRSC 359	Physical Methods of Forensic Analysis & Lab	4
HIST 320	Law and Evidence	3
	Term Credits	**16**
Fourth Year		
1st Semester		
CHEM 475	Biochemistry Lab I	2
FRSC 475	Forensic Chemistry & Lab	4
Computing GER (p. 106)		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
300 or 400 level Forensics Elective II		3
	Term Credits	**15**
2nd Semester		
CHEM 480	Instrumental Analysis	2
FRSC 480	Forensic Microscopy & Lab	4
Select one of the following:		3
FRSC 490	Co-op Work Experience	
FRSC 491	Research & Indep Study I	
FRSC 495	Senior Seminar	
Free Elective I		3
Free Elective II		3
	Term Credits	**15**
	Total Credits	**120**

B.S. in Forensic Science – Digital Forensics Option (120 credits)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FYS SEM	First-Year Student Seminar	0
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
	Term Credits	**15**
2nd Semester		
CHEM 126	General Chemistry II	3

CHEM 126A	Gen Chemistry Lab II	1
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**15**
Second Year		
1st Semester		
CS 100	Roadmap to Computing	3
FRSC 201	Intro to Forensic Science	3
CHEM 222	Analytical Chemistry	3
IT 120	Introduction to Network Technology	3
MATH 333	Probability and Statistics	3
	Term Credits	**15**
2nd Semester		
CS 113	Introduction to Computer Science	3
FRSC 307	Crime Scene Investigation &Lab	4
CHEM 221	Analytical Chemical Methods	2
IT 220	Wireless Networks	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**15**
Third Year		
1st Semester		
FRSC 359	Physical Methods of Forensic Analysis & Lab	4
IT 202	Internet Applications	3
IT 230	Computer and Network Security	3
History and Humanities GER 300+ level (p. 108)		3
300 or 400 level Forensics Elective I		3
	Term Credits	**16**
2nd Semester		
FRSC 480	Forensic Microscopy & Lab	4
HIST 320	Law and Evidence	3
IS 331	Database Design Management and Applications	3
300 or 400 level Forensics Elective II		3
	Term Credits	**13**
Fourth Year		
1st Semester		
Humanities and Social Science Senior Seminar GER (p. 112)		3
IT 330	Computer Forensic	3
IT 340	Introduction to System Administration	3
Free Elective I		3
Free Elective II		3
	Term Credits	**15**
2nd Semester		
IT 332	Digital Crime	3
IT 400	Information Technology and the Law	3
IT 430	Ethical Hacking for System Administrators	3
Select one of the following:		3
FRSC 490	Co-op Work Experience	
FRSC 491	Research & Indep Study I	
FRSC 495	Senior Seminar	

Free Elective III		4
	Term Credits	**16**
	Total Credits	**120**

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses"

Chemistry Minor (not for Chemical Engineering majors)

Code	Title	Credits
Select A1 or A2:		11
A1		
CHEM 231	Physical Chemistry I	
CHEM 235	Physical Chemistry II	
CHEM 243	Organic Chemistry I	
CHEM 235A	Physical Chemistry II Laboratory	
A2		
CHEM 243	Organic Chemistry I	
CHEM 244	Organic Chemistry II	
CHEM 244A	Organic Chemistry II Laboratory	
CHEM 473	Biochemistry	
Select two of the following:		5-6
CHEM 474	Biochemistry II	
CHEM 222	Analytical Chemistry	
CHEM 480	Instrumental Analysis	
CHEM 336	Quantum Chemistry	
CHEM 412	Inorganic Chemistry	
CHEM 491	Research and Independent Study I	
CHEM 360	Environmental Chemistry I	
CHEM 361	Environmental Chemistry II	
CHEM 244	Organic Chemistry II	
Total Credits		**16-17**

Environmental Science and Policy Minor

Code	Title	Credits
CHEM 360	Environmental Chemistry I [1]	3
or CHEM 361	Environmental Chemistry II	
EVSC 375	Environmental Biology	3
EPS 202	Society, Technology, and the Environment	3
Select six credits from the following:		6
EVSC 484	Environmental Analysis	
MATH 225	Survey of Probability and Statistics	
EVSC 416	Environmental Toxicology	
R460 206	Env Geology	
R460 207	Env Geology Lab	
EVSC 385	Environmental Microbiology	
CHEM 360	Environmental Chemistry I [1]	
or CHEM 361	Environmental Chemistry II	
R120 380	Field Ecology	
STS 362	Environmental Economics	
Total Credits		**15**

1. The first Environmental Chemistry Course counts against the core, the second can be used as an option course.

More **information on this minor** can be found on the Chemistry & Environmental Science website (https://chemistry.njit.edu/).

Forensic Science Minor

In order to complete a minor in forensic science, students must complete **18 credit hours** from the following courses comprising the forensic science core:

Code	Title	Credits
FRSC 201	Intro to Forensic Science	3
FRSC 307	Crime Scene Investigation &Lab	4
HIST 320	Law and Evidence	3
FRSC 359	Physical Methods of Forensic Analysis & Lab	4
FRSC 475	Forensic Chemistry & Lab	4
FRSC 480	Forensic Microscopy & Lab	4
FRSC 479	Forensic Biology & Lab	4
FRSC 498	Special Topics in Forensic Science	3

History

The history faculty at NJIT and Rutgers University-Newark comprise a federated department offering an integrated curriculum and a broad selection of degree programs covering major historical periods and regions. The history faculty at NJIT specialize in historical studies, on both the undergraduate and graduate levels, that appeal to students attending a science and technological university. These include courses on the history of technology, the history of medicine and health, environmental history, and the history of media and communication. NJIT's history faculty also administers a distinctive undergraduate pre-law curriculum in Law, Technology, and Culture. The Federated History Department also offers two graduate degrees, a Masters in History and a Masters in Teaching. In addition to instruction by nationally and internationally recognized scholars, the department offers outstanding resources and opportunities that include preparation for law-related careers; opportunities for original research and writing; internships with the New Jersey Historical Society, the Newark Museum and other cultural institutions; participation in teacher-certification programs; use of the extensive library holdings of the Rutgers University system; and active student organizations on the graduate and undergraduate levels.

NJIT History Faculty

A

Arcadi, Teal, University Lecturer

C

Çelik, Zeynep, Distinguished Professor (NJIT College of Architecture and Design)

D

Dent, Rosanna, Assistant Professor

E

Esperdy, Gabrielle, Professor

H

Hamilton, Louis, Professor

K

Kostopoulou, Elektra, University Lecturer

L

Lefkovitz, Alison L., Associate Professor

M

Maher, Neil M., Professor

P

Pemberton, Stephen, Associate Professor

S

Schweizer, Karl W., Professor

Rutgers-Newark History Faculty

A

Amzi-Erdogdular, Leyla, Assistant Professor

Asen, Daniel, Assistant Professor

C

Caplan, Karen, Associate Professor

Chang, Kornel, Associate Professor

Cooper, Melissa, Assistant Professor

Cowans, Jon, Associate Professor

D

Diner, Steven J., University Professor

E

Esquilin, Marta, Assistant Professor

F

Farney, Gary D., Associate Professor

Feldstein, Ruth, Professor

G

Giloi, Eva, Associate Professor

Goodman, James, Distinguished Professor

Green-Mercado, Mayte, Assistant Professor

K

Krasovic, Mark, Associate Professor

M

Monteiro, Lyra D., Assistant Professor

Murphy, Brian Phillips, Associate Professor

R

Riismandel, Kyle, Associate Teaching Professor

Rizzo, Mary, Assistant Professor

S

Satter, Beryl, Professor

Stewart-Winter, Timothy, Associate Professor

Strub, Whitney, Associate Professor

T

Tegegne, Habtamu, Assistant Professor

Truschke, Audrey, Assistant Professor

V

Varlik, Nükhet, Associate Professor

Programs

- History - B.A. (p. 384)
- Law, Technology and Culture - B.A. (p. 386)
- Law, Technology and Culture (Patent Law Concentration) - B.A. (p. 381)

Accelerated Programs (p. 102)

- History - B.A. /D.P.T. (p. 369) (http://catalog.njit.edu/undergraduate/contact-department/)
- History - B.A./J.D. (p. 371)
- History - B.A./M.D. (p. 378)
- History - B.A./ D.M.D., D.D.S., O.D. (p. 373)
- Law, Technology and Culture - B.A./J.D (p. 376).

Double Majors

- Biology & Law, Technology and Culture - B.A. (p. 398)
- Chemistry & Law, Technology and Culture - B.S. (p. 403)
- Forensic Science & Law, Technology & Culture - B.S (p. 405)
- Physics & Law, Technology and Culture - Astronomy Option - B.S. (p. 478)
- Physics & Law, Technology and Culture - Optical Science & Engineering Option - B.S. (p. 480)

- History Minor (p. 410)
- Legal Studies Minor (p. 410)

History Courses

HIST 2. History Elective. 3 credits, 3 contact hours (3;0;0).**
This designation is used primarily to designate a course transferred from another school, judged to be acceptable, but without a specific NJIT or Rutgers-Newark equivalent. This course satisfies the three credit 200 GER in History and Humanities.

HIST 213. The Twentieth-Century World. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENGL 101 with a grade C or better, and pre- or co-requisite ENGL 102 with a grade C or better. Uses case studies to provide an interdisciplinary view of the 20th-century world. Selected literary, philosophical, and artistic movements are discussed in the context of the major historical developments of the century. This course satisfies the three credit 200 GER in History and Humanities.

HIST 214. Tech & Cult in Amer History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 with a grade of C or better, ENGL 102 pre- or co-requisite with a grade of C or better. This course examines the relationship between technology and society throughout the history of the United States. We analyze the roles and impacts of major technological innovations within their cultural and historical contexts, seeking to understand how these contexts shaped and were shaped by these technologies. This course satisfies the three credit 200 GER in History and Humanities.

HIST 310. Co-op in Law, Technology, Culture and History I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENGL 102 and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Students gain work experience related to their major in Law, Technology and Culture. Work assignments are facilitated and approved by the co-op office. Requires mandatory participation in seminars and completion of a report. This course may not be used to satisfy either of the three credit 300 level GER in History and Humanities.

HIST 311. Co-op in Law, Technology, Culture and History II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENGL 102 and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Students gain work experience related to their major in Law, Technology and Culture. Work assignments are facilitated and approved by the co-op office. Requires mandatory participation in seminars and completion of a report. This course may not be used to satisfy either of the three credit 300 level GER in History and Humanities.

HIST 312. Prof Development in Law. 1 credit, 1 contact hour (1;0;0).
Prerequisite: Sophomore standing. This course is designed to enhance professional development for students who hope to attend law school or another graduate program. It will provide students with the skills necessary to apply to, be accepted into, and succeed in law school or other graduate program. It will meet workshop-style for three hours for five weeks. This course may not be used to satisfy either of the three credit 300 level GER in History and Humanities.

HIST 320. Law and Evidence. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade C or higher and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. This course considers the philosophical and technical question of what constitutes evidence in the US legal system. This course satisfies the three credit 300 GER in History and Humanities.

HIST 329. Dante: Hell, Heaven, and Medieval Florence. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines the work of Dante Alighieri in the cultural context (intellectual, religious, literary, social, political, and artistic) of his contemporary Florence. Students will read a range of primary source materials, including the "Divine Comedy." This is a digital history course and students will construct and analyze a geographic database. This course satisfies the three credit 300 GER in History and Humanities.

HIST 334. Environmental History of North America. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade C or higher and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. The history of interactions between humans and their natural environment on the North American Continent. Considers perceptions of, use of, and alteration of the environment. Traces the cultural, intellectual, economic, political and technological transformations from early colonial times to the late 20th century. Addresses the diverse environmentalisms that have emerged the last several decades. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 338. Environmental Justice and Climate Change in America. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade C or higher and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. The history of interactions between humans and their natural environment on the North American Continent. Considers perceptions of, use of, and alteration of the environment. Traces the cultural, intellectual, economic, political and technological transformations from early colonial times to the late 20th century. Addresses the diverse environmentalisms that have emerged the last several decades. Examines the history of environmental inequality within the United States, especially in poor and minority communities, as well as the rise of the environmental justice movement during the post-World War II period. Considers the numerous historical causes of environmental discrimination along with the strategies undertaken by local communities to alleviate such inequality. Topics include analysis of grassroots organizing, legal strategies, and policy implementation focused on fostering a more environmentally just society. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 341. The American Experience. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade C or higher and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. American history from the colonies to the 20th century, with concentration on several selected themes basic to an understanding of the changing cultural patterns and social values of American civilization. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 342. Civil Rights Revolution and Law. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. This course will examine what historians have been identifying as the civil rights revolution—the moment in the twentieth century when a host of interest groups began pursuing rights through the court system. We will begin by examining African Americans’ campaign to gain civil rights through the courts and how political action supported and sometimes even exceeded this process. We will then examine how African Americans’ success inspired or shored up the claims of other groups—including women, Chicanos, Asian Americans, Native Americans, LGBTQ people, disabled people, and others—to pursue their rights in courts as well. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 343. African-American History I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Introduction to African-American history from pre-colonial West Africa to emancipation in the mid-19th century. Topics include the African slave trade, the economics and politics of slavery, gender and culture in the slave community, and the free black experience in both the north and south. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 344. African-American History II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Introduction to African-American history from the mid-19th century to the present. Covers race relations and the civil rights movement, as well as migration, black social and political thought, gender roles, and class formation. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 345. Communication through the Ages. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Modes of communication, ancient and modern, in their social and cultural context, from cave paintings to computers. Topics include literacy and economic development in the West; the technological revolution in media beginning with Daguerre, Samuel Morse, and Alexander Graham Bell; the institutional development of mass media and popular culture; and contemporary trends in world communication and interaction. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 351. Ancient Greece and the Persian Empire. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. The political, institutional, and cultural developments of Ancient Greece and the Persian Empire from the Mycenaean period to the King's Peace (386 B.C.). This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 352. The Hellenistic States and the Roman Republic. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. The political and cultural developments of the Hellenistic states and their influence on the Republic of Rome to 30 B.C. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 361. The Founding of the American Nation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. North America in the colonial and revolutionary periods, with emphasis on patterns of cultural and institutional development from early settlement through the ratification of the Constitution. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 362. Sex, Gender, and the Law in American History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines how the US legal system has dealt with the problems of sex and gender. Surveys laws that dictated different roles for men and women as well as seemingly gender-neutral laws that affected men and women differently. Tracks the designation of sexual acts as legal or illegal and the ways that race, class, and nationality complicated these relationships. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 363. The United States as a World Power. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. American domestic and foreign policy in the 20th century. Topics include imperialism, the Progressive Era, the Depression, the New Deal, World Wars I and II, the Cold War, America and the world today. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 364. American Law in the World. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Concerns the history of American law as a product and catalyst of world politics by considering in global context the transformation of central doctrines of regulation, property rights, and civil liberties from the Declaration of Independence through the War on Terror. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 365. Science and Technology in the Global South. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. A comparative analysis of the relationship between expanding Western nations and selected regions of Africa, Asia, and South America, from 1500 to 1970. A case study approach illuminates key historical processes, with a special emphasis on economic development and cultural change in colonial settings. Topics include European perceptions of culturally different peoples, race relations in colonial societies, forms of rebellion and resistance to European rule, nationalist movements. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 366. Gender, Race and Identity in American History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Surveys the social construction of gender in America from the s17th century to the present. Examines the changing gender roles and relations that have characterized and structured the historical experiences of different racial and ethnic groups. In a multicultural framework, covers the impact that colonization, industrialization, slavery, immigration and migration, urbanization, war, and social movements have had on the ways that women and men think of themselves in terms of gender as well as their respective roles in families and larger social networks. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 367. International Law and Diplomacy in History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines the origins, evolution, and application of diplomacy and international law from the 15th century to the present. Topics include the rise of modern diplomacy in Renaissance Italy; the emergence of international law and professionalization of diplomacy in early modern Europe; the development of international law and diplomatic theory in the 18th and 19th centuries; the codification of international law; and adaptation of international law to transnationalism and globalism in the 20th century. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 369. Law and Society in History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Uses historical case studies to illustrate and evaluate various approaches to the study of law and society. Topics include criminality and the rise of incarceration as a legal penalty in the 19th century; the comparative law of slavery; and the evolution of American Indian law. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 370. Legal issues in the History of Media. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Investigates the development and impact of media law and policy in the United States. Examines how media law and policy affect media content, industry behavior, and consumer rights. Analyzes the values and ideas, as well as political and cultural contexts that have guided continuities and transformations in media law and policy. Topics include indecency and obscenity, copyright and intellectual property, legal protections for children, and media ownership regulation. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 372. Contemporary Europe. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. European society in the 20th century, Nationalism, imperialism, totalitarianism, movements toward European unity, and prominent cultural developments. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 373. The Rise of Modern Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines the development of modern science in the western world from the origins of the Scientific Revolution to 1900. Explores how science challenged the revealed universe of Christianity, changed the curriculum in schools and universities, and altered the world view of philosophers. This course covers the achievements of Copernicus, Galileo, Newton, Darwin, Einstein, and other leading scientific innovators, but it also weaves the expansion of scientific knowledge into the larger fabric of European intellectual history. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 374. Modern Russian Civilization. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Russia under the last tsars, the 1917 upheavals, the rise of the Soviet state to world power under Lenin, Stalin, and others, until the collapse of the communist dictatorship. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 375. Legal Issues in Environmental History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines the role of law in the formation of human relationships with the natural world. The course will focus on the management and regulation of the human use of natural resources in a variety of historical contexts, but particularly in the United States from colonial times to the present. Through readings and class discussion, students will explore a number of recurring themes, including the transformation from customary rules governing access to local resources to state enforced laws. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 377. Cities in History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines social, cultural and economic changes in urban areas. Regions and themes vary and may include urbanization in Europe, the rise of cities in Latin America, and urban change in contemporary America. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 378. Medicine and Health Law in Modern America. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines the legal and ethical aspects of medical and public health practice in the United States from 1900 to the present. Topics include the rights and responsibilities of physicians and patients, the roles of government in promoting health, the rise of health law and bioethics, the tensions between civil liberties and public health, as well as evolving notions of harm, liability, uncertainty, and proof as they relate to the history of medical and public health practice. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 379. History of Medicine. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Focuses on the evolving institutions, values, concepts, and techniques through which doctors attempted to control the impact of disease and preserve the health of Americans, beginning with the shaman and colonial physician through post-World War II changes in the system of medical care. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 380. History of Public Health. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Attempts to protect the health of human populations from the Black Death in medieval Europe to recent threats from epidemics and chemical and biological terrorism. Shifting patterns of disease and the emergence and growth of public health as a domain of expert knowledge and policy. Topics include epidemiology and statistical modes of inquiry; the tension between civil liberties and public health; the economics of health and disease; and the relationship between medicine and public health. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 381. Sci & Tech In Modern Medicine. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Examines how science and technology came to play critical roles in the rise of modern medicine. Readings, lectures, and discussions focus on the specific innovations in ideas, practices, and technologies that helped transform Western medicine in the 19th and 20th centuries. The course also considers how medicine and the biomedical sciences both inform and reflect attitudes about the human body in Western society. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 382. War and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. The evolution of warfare and the impact of war on political, economic, cultural, and social institutions, including the two World Wars and post-1945 conflicts. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 383. The Making of Modern Thought. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. The formation of contemporary images of human nature since the mid-19th century. Emphasis on Marx, Darwin, and Freud and their legacy to 20th century thought. Theories of the family, sexuality and the changing role of women in society are explored. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 384. Invention and Regulation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. This course examines how the law has affected technological development in the United States from its founding to today. We cover four broad technical categories: industrialization, transportation, communication, information technology. We analyze the invention of technology within issues of patent and copyright, funding and regulation of technology through legislation, and legal challenges to technology. Our goal is to understand change in law and technology in historical and cultural context. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 385. Technology and Society in European and World History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. An introduction to the social history of European and global tech-nology from the Middle Ages to the second Industrial Revolution of the late 19th century. Emphasis on such themes as the process of tech-nological innovation, the nature of technological systems, the diffusion of technology, the interaction of Western and non-Western technology, the changing relations of science and technology, and the role of technology in broader historical movements. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 386. Technology in American History. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Survey of the history of American technology emphasizing the social and economic environments of technological change. Topics include the transfer of technology in building canals and cities, the rise of the factory system, the emergence of the American system of manufacture, and the development of major technological systems such as the railroad, telegraph, electric light and power, and automobile production and use. Focus on the professionalization of engineering practice, the industrialization of invention, and the growing links between engineers and corporate capitalism in the 20th century. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 387. Computers, Innovators and Hist. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. This course traces the development of computer technology from its theoretical origins in the 19th century, through the transformation from analog to digital computers and the emergence of personal computing in the 20th century, up to the present. Topics include the place of computer technology in society, how computers & people shape each other, who & what was involved in innovating computers, the cultural context of such innovation, as well as how the uses and users of computers have evolved. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 388. Britain in the 20th Century. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Survey of British history from the death of Queen Victoria (1901) to that of Diana, Princess of Wales (1997); emphasis on Britain’s social, cultural and political transformation. Topics include causes and impact of the World Wars, the turn from Empire to Europe, rise and critique of the welfare state, and foreign relations. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 390. Historical Problems of the 20th Century through Film. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. A study of selected problems in the 20th century using film as a window into history. Such topics as the rise of Nazi Germany, America in the thirties, World War II and American society, the development of cities, and the emergence of the Third World will be considered. In any one semester only two topics will be selected for study. The material for the course will include documentary films, newsreels, TV news films, and theatrical feature films as well as selected readings. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 391. Industrial Revolution in World. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. This course covers the Industrial Revolution from its emergence in Britain in the 18th century to its expansion to America, Western Europe, and Japan. Topics include the practical need for new forms of power, links between invention, empire, the impact of technical advance on the labor force, colonialism and slavery, and 19th century socio-cultural change. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 395. Research Methods in Law and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher. Law threads through every aspect of society: it permits and prohibits human behaviors, it enables and invalidates official actions, and it protects and prosecutes citizens. This course explore the social complexity of law through original research. Students will learn how to trace the connections between law and society using interdisciplinary humanities and social science approaches. Readings span several theoretical, disciplinary, and interdisciplinary perspectives that include history, sociology, anthropology, political science, economics, psychology, and cultural studies. The readings will guide the student's original research on what law is and how it operates in relation to society. The course facilitates student understanding of the relationships between social, cultural, political, and economic forces on the one hand, and legal rules, practices, and outcomes, on the other. This course may be used to satisfy a three credit 300 level GER in History and Humanities.

HIST 401. Independent Study. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher in addition to junior or senior standing; and before registering, permission from one of the following: NJIT history department chairperson or history major or minor advisor. Pursuit of special interests in history not covered in a regular elective course. A history faculty member provides guidance and assigns readings and papers. Note: Normal grading applies.

HIST 402. Independent Study. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher in addition to junior or senior standing; and before registering, permission from one of the following: NJIT history department chairperson, or history major or minor advisor. Pursuit of special interests in history not covered in a regular elective course. A history faculty member provides guidance and assigns readings and papers.

HIST 489. Seminar - Readings. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher, an upper level History course (3 credits) and senior standing. Intended to combine study of specific topics, which vary each year, with attention to the methods for researching and writing history, these small classes for history majors in their senior year prepare students for the following semester's research project and culminate in a brief paper describing a proposed topic and the historical documents and sources to be used.

HIST 490. Seminar - Research. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and a course fulfilling the History and Humanities GER 200 level course with a grade of C or higher, an upper level history course, R510 315 or R510 316 Perspectives in History, and HSS 404 History Senior Seminar. This one-semester-long seminar allows students to apply the skills they learn in the History major to specific topics that vary semester by semester. In these small classes, students conduct research with attention to historical methods. With close guidance from instructors, students explore local archives, design a paper topic of their individual interest in conjunction with the professor, and write a research paper.

Rutgers-Newark Courses

R510 101. Western Civilization. 3 credits, 3 contact hours (3;0;0).

R510 102. History Of Western Civ. 3 credits, 3 contact hours (3;0;0).

R510 201. Hist Of West Civ. 3 credits, 3 contact hours (3;0;0).

R510 202. History Of West. Civ.. 3 credits, 3 contact hours (3;0;0).

R510 205. Hist Western Civ. 3 credits, 3 contact hours (3;0;0).

R510 207. Hist Of Latin Amer. 3 credits, 3 contact hours (3;0;0).

R510 208. History Of Latin America. 3 credits, 0 contact hours (0;0;0).

R510 209. History of the Caribbean. 3 credits, 3 contact hours (3;0;0).

R510 213. 20th Century World. 3 credits, 3 contact hours (3;0;0).

R510 226. ST:. 3 credits, 3 contact hours (3;0;0).

R510 227. ST:. 3 credits, 3 contact hours (3;0;0).

R510 236. Ancient World. 3 credits, 3 contact hours (3;0;0).

R510 240. Women in European History. 3 credits, 3 contact hours (3;0;0).

R510 255. Ancient Greece & Persian Empir. 3 credits, 3 contact hours (3;0;0).

R510 256. Roman Civilization. 3 credits, 3 contact hours (3;0;0).

R510 257. Golden Age Of Europe. 3 credits, 3 contact hours (3;0;0).

R510 258. Golden Age Of Europe. 3 credits, 3 contact hours (3;0;0).

R510 262. Hist Rus & Soviet Union. 3 credits, 3 contact hours (3;0;0).

R510 263. History Of Africa. 3 credits, 3 contact hours (3;0;0).

R510 264. History Of Africa. 3 credits, 3 contact hours (3;0;0).

R510 272. Peoples Republic China. 3 credits, 3 contact hours (3;0;0).

R510 280. South Asia up to 1750. 3 credits, 3 contact hours (3;0;0).

R510 281. South Asian History II. 3 credits, 3 contact hours (3;0;0).

R510 286. The Ancient Near Est. 3 credits, 3 contact hours (3;0;0).

R510 287. Hist Islamic Civ. 3 credits, 0 contact hours (0;0;0).

R510 288. Hist Of Islamic Civ.. 3 credits, 0 contact hours (0;0;0).

R510 289. Perspective in History. 3 credits, 3 contact hours (3;0;0).

R510 290. Perspectives in History. 3 credits, 3 contact hours (3;0;0).

R510 297. Far Eastern History. 3 credits, 0 contact hours (0;0;0).

R510 298. Far Eastern History. 3 credits, 0 contact hours (0;0;0).

R510 300. The Ottoman Empire. 3 credits, 3 contact hours (3;0;0).

R510 301. Film And History. 3 credits, 3 contact hours (3;0;0).

R510 302. History Of Democracy. 3 credits, 0 contact hours (0;0;0).

R510 305. Ancient Sport. 3 credits, 3 contact hours (3;0;0).

R510 306. Greek & Roman City. 3 credits, 3 contact hours (3;0;0).

R510 307. South Asia Up To 1750. 3 credits, 3 contact hours (3;0;0).

R510 308. South Asia Since 1750. 3 credits, 3 contact hours (3;0;0).

R510 311. Latin Amer & The Us. 3 credits, 3 contact hours (3;0;0).

R510 312. Democracy & Reb Mod Latin Amer. 3 credits, 3 contact hours (3;0;0).

R510 313. Cinema & Society 20th Century. 3 credits, 3 contact hours (3;0;0).

R510 314. Film and Colonialism. 3 credits, 3 contact hours (3;0;0).

R510 315. Perspectives in History. 3 credits, 3 contact hours (3;0;0).

R510 316. Perpectives in History. 3 credits, 3 contact hours (3;0;0).

R510 317. History Of The Caribbean. 3 credits, 3 contact hours (3;0;0).

R510 319. Classical World. 3 credits, 3 contact hours (3;0;0).

R510 320. Roman History. 3 credits, 3 contact hours (3;0;0).

R510 321. Military History. 3 credits, 3 contact hours (3;0;0).

Accelerated B.A. in History/D.P.T.

Accelerated B.A. in History/D.P.T.

Major Requirements

The accelerated B.A. in history requires 36 credits of history courses with a grade of C or higher. The history courses may include offerings at NJIT (HIST prefix) and Rutgers (510 and 512 prefixes). The accelerated history student must complete a minimum of 104 total undergraduate credits, inclusive of NJIT's General Education Requirements, prior to advancing to professional training in their fourth year. Each student's program of study is subject to approval by their academic advisor for the history major.

Required History Courses for Accelerated B.A./D.P.T.

Western Civilization

Code	Title	Credits
R510 201	Hist Of West Civ	3
R510 202	History Of West. Civ.	3

American History

Six credits in U.S. History courses (any level) 6

Global/Comparative History

Six credits in Asian, African, Latin American, World, or Comparative History courses (any level) 6

History of Medicine/Health

Select two of the following:[1]

Code	Title	Credits
HIST 378	Medicine and Health Law in Modern America	3
HIST 379	History of Medicine	3
HIST 380	History of Public Health	3
HIST 381	Sci & Tech In Modern Medicine	3

Historical Methodology & Research

Code	Title	Credits
R510 315	Perspectives in History	3
or R510 316	Perpectives in History	

Select one of the following one-semester Senior History Seminars[2][3]

Code	Title	Credits
R510 490	Seminar:Research	3
HIST 490	Seminar - Research	3

Free History Electives

Six credits in history (upper level)[4]

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[1] At least one of these courses must be taken in an honors section. Each history of medicine/health course can count either as an American History course or as a course in Global/Comparative History (as determined by the academic advisor).

[2] Successful completion of a R510 316 Perspectives in History and HSS 404 Humanities Senior Seminar - History are required prior to enrollment in HIST 490 Seminar Research or R510 490 Seminar: Research.

[3] All majors write a research paper that incorporates methods of historiography and research learned in the seminar. An honors level of scholarship is expected from students enrolled in the Albert Dorman Honors College.

[4] Must be HSS 404 Humanities Senior Seminar - History if upper-level HSS GER not otherwise satisfied.

6-Year Accelerated Program in History (B.A.) and Physical Therapy (DPT)

(104 credits at NJIT)

First Year		
1st Semester		**Credits**
R510 201	Hist Of West Civ	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 105	Elementary Probability and Statistics	3
BIOL 200	Concepts in Biology	4
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
	Term Credits	**17**
2nd Semester		
R510 202	History Of West. Civ.	3
MATH 111	Calculus I	4
CHEM 126	General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**18**
Summer		
US History Elective		3
Global/Comparative History Elective		3
	Term Credits	**6**
Second Year		
1st Semester		
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
PSY 210	Introduction to Psychology	3
History of Medicine Elective [1]		3
MATH 112	Calculus II	4
	Term Credits	**18**
2nd Semester		
R510 315	Perspectives in History	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
BIOL 340	Mammalian Physiology [4]	4
STS 221	Introduction to Sociology	3
	Term Credits	**14**
Third Year		
1st Semester		
HSS 404	Humanities Senior Seminar - History	3
History (Upper Level) Elective		3
BNFO 135 or CS 101 or CS 103	Programming for Bioinformatics or Computer Programming and Problem Solving or Computer Science with Business Problems	3
BIOL 321	Comp Vertebrate Anatomy [5]	4

History of Medicine Elective [1]		3
	Term Credits	**16**
2nd Semester		
HIST 490 or R510 490	Seminar - Research or Seminar:Research	3
History (Upper Level) Elective		3
US History elective		3
Global/Comparative History Elective		3
Free Elective		3
	Term Credits	**15**
	Total Credits	**104**

Transfer from Professional Program

Code	Title	Credits
Elective		4
Elective		3
Elective		3
Elective		3
Elective		3

[1] At least one of these courses must be taken in an honors section. Each history of medicine/health course can count either as an American History course or as a course in Global/Comparative History (as determined by the academic advisor).

[2] Student should take whichever course is needed to satisfy any remaining U.S. history or Global/Comparative requirement.

[3] At least one of these courses must be taken in an honors section. Each history of medicine/health course can count either as an American History course or as a course in Global/Comparative History (as determined by the academic advisor).

[4] Students in the B.A./D.P.T. program can take R120 141 Anatomy & Physiology and R120 142 Anatomy & Physiology (4 credits each) at Rutgers or its equivalent (121/122) at Essex County Community College in place of BIOL 340 Mammalian Physiology and BIOL 321 Comparative Vertebrate Anatomy.

[5] Students in the B.A./D.P.T. program can take R120 141 Anatomy & Physiology and R120 142 Anatomy & Physiology (4 credits each) at Rutgers or its equivalent (121/122) at Essex County Community College in place of BIOL 340 Mammalian Physiology and BIOL 321 Comparative Vertebrate Anatomy.

Accelerated B.A. in History/J.D.

Major Requirements

The major requires 36 credits of history courses with a grade of C or higher. These courses may include offerings at NJIT (HIST prefix) and Rutgers (510 and 512 prefixes). The accelerated B.A. in History/J.D. also requires a minimum of 120 total credits, including completion of the General Education Requirements (p. 105). Each student's program of study is subject to approval by an advisor or by the chairperson of the department. Specific requirements are as follows:

Code	Title	Credits
Western Civilization		
R510 201	Hist Of West Civ	3
R510 202	History Of West. Civ.	3
American History		
Six credits in U.S. History courses (any level)		6
Global/Comparative History		
Six credits in Asian, African, Latin American, World, or Comparative History courses (any level)		6
Historical Methodology & Research		
Select one of the following courses:		3
R510 315	Perspectives in History	
R510 316	Perpectives in History	

Select one of the following Seminars: [1, 2, 3]		3
HIST 490	Seminar - Research	
R510 490	Seminar:Research	
Senior Seminar in History		
HSS 404	Humanities Senior Seminar - History	3
History Electives		
Nine credits in history [4]		9
Total Credits		**36**

Minor Requirements

This accelerated B.A./J.D. degree includes a Legal Studies minor as a condition of admission to the J.D. program. The legal studies minor requires 15 credits of law-related courses.

Code	Title	Credits
Legal Studies Electives [5]		
Law and Business or Engineering Course		3
Law and History Course		3
Law and Humanities Course (Non-History)		3
Law and Social Science Course		3
Law-Related Course (Any Discipline)		3
Total Credits		**15**

Accelerated B.A. in History/J.D.

(120 credits minimum)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
Mathematics GER (p. 113)		3
Social Science GER (p. 114)		3
Natural Science GER (p. 113)		3
R510 201	Hist Of West Civ	3
	Term Credits	**15**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics	3
CS 100 or CS 103	Roadmap to Computing or Computer Science with Business Problems	3
R510 202	History Of West. Civ.	3
Natural Science with Laboratory GER (p. 113)		4
	Term Credits	**16**
Second Year		
1st Semester		
American History Elective		3
Global or Comparative History Elective		3
Legal Studies Elective (Law-Related Business or Engineering Course)		3
Legal Studies Elective (Law-Related History Course) [6]		3
Free Elective		3
Free Elective		1
	Term Credits	**16**
2nd Semester		
American History Elective		3

Global or Comparative History Elective		3
Legal Studies Elective (Law-Related Humanities Course, Non-History) [6]		3
Free Elective		3
Free Elective		3
Free Elective		1
	Term Credits	**16**
Third Year		
1st Semester		
R510 315 or R510 316	Perspectives in History or Perpectives in History	3
Legal Studies Elective (Law-Related Social Science Course)		3
History Elective		3
History Elective		3
Free Elective		3
	Term Credits	**15**
2nd Semester		
HSS 404	Humanities Senior Seminar - History	3
R510 490	Seminar:Research	3
Legal Studies Elective (Law-Related Course, Any Discipline)		3
History Elective		3
Free Elective		3
Free Elective		3
	Term Credits	**18**
	Total Credits	**96**

Code	Title	Credits
Transfer Credits from Professional Program		**24**
TOTAL CREDITS		**120**

1. Qualified juniors may enroll in HIST 490 Seminar - Research or R510 490 Seminar:Research with permission.
2. Successful completion of a Perspectives in History course and HSS 404 Humanities Senior Seminar - History are required prior to enrollment in HIST 490 Seminar - Research or R510 490 Seminar:Research.
3. All majors write a research paper that incorporates methods of historiography and research learned in the seminar. An honors level of scholarship is expected from students enrolled in the Albert Dorman Honors College.
4. At least six of the nine history elective credits must be taken at the 300 level or higher.
5. These courses must be approved by the Legal Studies minor advisor.
6. Course must satisfy the History and Humanities 300 GER (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/).

Accelerated B.A. in History/M.D., D.M.D., D.D.S., O.D.

Major Requirements

The accelerated B.A. in history requires 36 credits of history courses with a grade of C or higher. The history courses may include offerings at NJIT (HIST prefix) and Rutgers (510 and 512 prefixes). The accelerated history student must complete a minimum of 107 total undergraduate credits, inclusive of NJIT's General Education Requirements, prior to advancing to professional training in their fourth year. Each student's program of study is subject to approval by the academic advisor for the history major.

Required History Courses for Accelerated M.D., D.M.D., D.D.S., O.D.

Western Civilization

Code	Title	Credits
R510 201	Hist Of West Civ	3
R510 202	History Of West. Civ.	3

American History

Code	Title	Credits
Six credits in U.S. History courses (any level) 6		

Global/Comparative History

Code	Title	Credits
Six credits in Asian, African, Latin American, World, or Comparative History courses (any level) 6		

History of Medicine/Health

Select two of the following:[1] (p.)

Code	Title	Credits
HIST 378	Medicine and Health Law in Modern America	3
HIST 379	History of Medicine	3
HIST 380	History of Public Health	3
HIST 381	Sci & Tech In Modern Medicine	3

Historical Methodology & Research

Code	Title	Credits
R510 316	Perpectives in History	3
or R510 315	Perspectives in History	
HIST 490	Seminar - Research [2]	3
or R510 490	Seminar:Research	

Free History Electives

Code	Title	Credits
Six credits in history (upper level) [3]		

[1] (p.) At least one of these courses must be taken in an honors section. Each history of medicine/health course can count either as an American History course or as a course in Global/Comparative History (as determined by the academic advisor).

[2] Successful completion of a R510 316 Perspectives in History and HSS 404 Humanities Senior Seminar - History are required prior to enrollment in HIST 490 Seminar Research or R510 490 Seminar: Research. All majors write a research paper that incorporates methods of historiography and research learned in the seminar. An honors level of scholarship is expected from students enrolled in the Albert Dorman Honors College.

[3] Must be HSS 404 Humanities Senior Seminar - History if upper-level HSS GER not otherwise satisfied.

6-Year Accelerated Program in History (B.A.) and Medicine (M.D.) or Dentistry (D.M.D. or D.D.S.) or Optometry (O.D.)

(107 credits at NJIT)

First Year		
1st Semester		**Credits**
R510 201	Hist Of West Civ	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 105	Elementary Probability and Statistics	3
BIOL 200	Concepts in Biology	4
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
R510 202	History Of West. Civ.	3
MATH 111	Calculus I	4

BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 126	General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
	Term Credits	**18**
Summer		
U.S. History Elective		3
Global/Comparative History Elective		3
	Term Credits	**6**
Second Year		
1st Semester		
History of Medicine/Health Elective [1]		3
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
CHEM 243	Organic Chemistry I	3
STS 221	Introduction to Sociology	3
	Term Credits	**17**
2nd Semester		
History of Medicine/Health Elective [2]		3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
MATH 112	Calculus II	4
	Term Credits	**16**
Third Year		
1st Semester		
HSS 404	Humanities Senior Seminar - History	3
U.S. History Elective or Global/Comparative History Elective [3]		3
BNFO 135 or CS 101 or CS 103	Programming for Bioinformatics or Computer Programming and Problem Solving or Computer Science with Business Problems	3
CHEM 473 or R120 360	Biochemistry (recommended) or Biochemistry	3
R120 352	Genetics (recommended)	3
R510 315	Perspectives in History	3
	Term Credits	**18**
2nd Semester		
HIST 490 or R510 490	Seminar - Research or Seminar:Research	3
History (upper level) elective		3
History (upper level) elective		3
U.S. History Elective or Global/Comparative History Elective		3
PSY 210	Introduction to Psychology	3
	Term Credits	**15**
	Total Credits	**107**

Transfer from Professional Program

Code	Title	Credits
Elective		4
Elective		3

Elective	3
Elective	3

Accelerated B.A. in Law, Technology and Culture/JD

(120 credits)

Major Requirements

The Law, Technology and Culture (LTC) B.A. requires 45 credits of major courses with a grade of C or higher. These courses may include offerings at NJIT and Rutgers-Newark. The B.A. in LTC also requires a minimum of 120 total credits, including completion of the General Education Requirements (p. 105). Each student's program of study is subject to approval by an advisor or by the chairperson of the department.

The 45 credits of LTC major courses are taken from the following four categories:

(1) Nine credits of legal foundations core courses, which treat aspects of the law in relation to history, philosophy, business, and basic principles of jurisprudence and legal thought, writing, and research:

Code	Title	Credits
Legal Foundations Core Courses		
Select three of the following:		9
HIST 361	The Founding of the American Nation	
HIST 362	Sex, Gender, and the Law in American History	
HIST 364	American Law in the World	
HIST 369	Law and Society in History	
MGMT 290	Business Law I	
STS 300	Legal Reasoning, Writing, and Technology	
R790 304	Intro Law And Legal Res	
Total Credits		**9**

(2) Twelve credits of LTC core courses, which treat the history, policy, and practice of law in relation to engineering, environment, health, information technology, and media:

Code	Title	Credits
LTC Core Courses		
Select four of the following:		12
EVSC 335	Environmental Law	
HIST 320	Law and Evidence	
HIST 338	Environmental Justice and Climate Change in America	
HIST 370	Legal issues in the History of Media	
HIST 375	Legal Issues in Environmental History	
HIST 378	Medicine and Health Law in Modern America	
HIST 384	Invention and Regulation	
IE 447	Legal Aspects of Engineering	
IT 331	Privacy and Information Technology	
IT 332	Digital Crime	
IT 400	Information Technology and the Law	
R790 382	Environm Pol & Policy	
Total Credits		**12**

(3) Eighteen credits of law-related electives and other approved courses offered at NJIT and Rutgers-Newark that fit each student's special interests. Examples include:

Code	Title	Credits
Law-Related Electives [1]		
Select six of the following: [2]		18
HIST 373	The Rise of Modern Science	

IE 472	Product Liability Engineering
R202 201	Intro Criminal Justice
R512 265	Amer Legal Hist
R512 266	American Legal History II
R202 305	Case Process:Law & Courts
R512 379	Us Hist In The Court
R790 356	Sex Law & Public Pol
R790 367	Jurisprudence and Legal Theory
R790 381	Judicial Process
R790 387	International Law
R790 401 & R790 402	Amer Constitutl Dev and Amer Constitutl Dev
R790 409	Law & Public Policy (Writing Intensive)
R920 349	Law & Society
Total Credits	**18**

[1] Students who wish to pursue a specialty in law in relation to a specific scientific, technological, environmental, medical, or media field (such as health policy or intellectual property on the Internet), legal field (such as environmental law, criminal law, or international law), or interdisciplinary thematic field (such as gender studies) may count up to 9 credits of advisor-approved courses in that field toward the electives requirement for the major. For example, a student interested in environmental law might take HIST 334 Environmental History of North America and 6 credits of courses in environmental science and/or environmental policy for elective course credit in the major.

[2] Every course in this category must be approved by the LTC Advisor. Other law-related classes at NJIT and/or Rutgers that are not designated in this list may be used to satisfy the 18 credits of Law-Related Electives. The Rutgers Law School faculty occasionally offer classes open to undergraduates that can be used to satisfy these credits.

(4) Six credits of focused senior coursework: HSS 404 Humanities Senior Seminar - History, in which students prepare a project or write a thesis in a relevant field, and HIST 310 Co-op in Law, Technology, Culture and History I, which provides a hands-on, law-related experience as an intern in a law firm, non-profit or government agency, science- or technology-based corporation, or other relevant organization.

Code	Title	Credits
Law-Focused Senior Courses		
HIST 310	Co-op in Law, Technology, Culture and History I	3
HSS 404	Humanities Senior Seminar - History (Must Be Approved Law-Related HSS 404)	3
Total Credits		**6**

B. A. in Law, Technology and Culture

(120 credits)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 105	Elementary Probability and Statistics	3
R790 201	American Government	3
Natural Science GER (p. 113)		3
MGMT 290	Business Law I [1]	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
Social Science GER (p. 114)		3
ENGL 102	English Composition: Introduction to Writing for Research	3
Math GER non-statistics (p. 113)		3
Law-Related Elective		3
Computing GER (p. 106)		3
	Term Credits	**15**

Second Year		
1st Semester		
LTC Core Elective		3
LTC Core Elective		3
Law-Related Elective		3
History and Humanities GER 200 level (p. 106)		3
Natural Science GER (p. 113)		3
Natural Sciences Labratory GER (p. 113)		1
	Term Credits	**16**
2nd Semester		
Legal Foundations Elective [2]		3
Legal Foundations Elective [2]		3
LTC Core Elective		3
Free Elective		3
Free Elective		3
Free Elective [3]		1
	Term Credits	**16**
Third Year		
1st Semester		
LTC Core Elective		3
LTC Core Elective		3
Law-Related Elective		3
Free Elective		3
HSS 404	Humanities Senior Seminar - History [4]	3
HIST 310	Co-op in Law, Technology, Culture and History I	3
	Term Credits	**18**
2nd Semester		
Law-Related Elective		3
Law-Related Elective		3
Free Elective		3
Free Elective		3
Free Elective		3
Free Elective [3, 5]		1
	Term Credits	**16**
	Total Credits	**96**

Code	Title	Credits
Transfer Credits from Professional Program		**24**
TOTAL CREDITS		**120**

1 This course satisfies 3 credits of the Legal Foundations Electives.
2 Course must satisfy the History and Humanities GER 30 (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/)0 level (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/).
3 Student may replace 1-credit elective if he or she has taken a 4-credit course elsewhere.
4 HSS 404 Senior Seminar must be a law-related course.
5 HIST 312 is recommended.

Accelerated History - B.A./M.D.

Major Requirements

The accelerated B.A. in history requires 36 credits of history courses with a grade of C or higher. The history courses may include offerings at NJIT (HIST prefix) and Rutgers (510 and 512 prefixes). The accelerated history student must complete a minimum of 105 total undergraduate credits, inclusive of NJIT's General Education Requirements, prior to advancing to professional training in their fourth year. Each student's program of study is subject to approval by the academic advisor for the history major.

Required History Courses for Accelerated M.D.

Western Civilization

Code	Title	Credits
R510 201	Hist Of West Civ	3
R510 202	History Of West. Civ.	3

American History

Code	Title	Credits
Six credits in U.S. History courses (any level) 6		

Global/Comparative History

Code	Title	Credits
Six credits in Asian, African, Latin American, World, or Comparative History courses (any level) 6		

History of Medicine/Health

Select two of the following:[1] (p.)

Code	Title	Credits
HIST 378	Medicine and Health Law in Modern America	3
HIST 379	History of Medicine	3
HIST 380	History of Public Health	3
HIST 381	Sci & Tech In Modern Medicine	3

Historical Methodology & Research

Code	Title	Credits
R510 316	Perpectives in History	3
or R510 315	Perspectives in History	
HIST 490	Seminar - Research [2]	3
or R510 490	Seminar:Research	

Free History Electives

Code	Title	Credits
Six credits in history (upper level) [3]		

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[1] (p.) At least one of these courses must be taken in an honors section. Each history of medicine/health course can count either as an American History course or as a course in Global/Comparative History (as determined by the academic advisor).

[2] Successful completion of a R510 316 Perspectives in History and HSS 404 Humanities Senior Seminar - History are required prior to enrollment in HIST 490 Seminar Research or R510 490 Seminar: Research. All majors write a research paper that incorporates methods of historiography and research learned in the seminar. An honors level of scholarship is expected from students enrolled in the Albert Dorman Honors College.

[3] Must be HSS 404 Humanities Senior Seminar - History if upper-level HSS GER not otherwise satisfied.

6-Year Accelerated Program in History (B.A.) and Medicine (M.D.) or Dentistry (D.M.D. or D.D.S.) or Optometry (O.D.)

(107 credits at NJIT)

First Year		
1st Semester		**Credits**
R510 201	Hist Of West Civ	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 105	Elementary Probability and Statistics	3

BIOL 200	Concepts in Biology	4
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
MATH 111	Calculus I	4
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 126	General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
PSY 210	Introduction to Psychology	3
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**18**
Summer		
Global/Comparative History Elective		3
R510 202	History Of West. Civ.	3
	Term Credits	**6**
Second Year		
1st Semester		
History of Medicine/Health Elective [1]		3
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
CHEM 243	Organic Chemistry I	3
MATH 112	Calculus II	4
	Term Credits	**18**
2nd Semester		
R510 315	Perspectives in History	3
History of Medicine/Health Elective [2]		3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
U.S. History Elective		3
	Term Credits	**18**
Third Year		
1st Semester		
HSS 404	Humanities Senior Seminar - History	3
U.S. History Elective or Global/Comparative History Elective [3]		3
BNFO 135 or CS 101 or CS 103	Programming for Bioinformatics or Computer Programming and Problem Solving or Computer Science with Business Problems	3
CHEM 473 or R120 360	Biochemistry (recommended) or Biochemistry	3
R120 352	Genetics ((recommended))	3
	Term Credits	**15**
2nd Semester		
HIST 490 or R510 490	Seminar - Research or Seminar:Research	3
History (upper level) elective		3
History (upper level) elective		3

U.S. History Elective or Global/Comparative History Elective [3]		3
STS 221	Introduction to Sociology	3
	Term Credits	**15**
	Total Credits	**107**

Transfer from Professional Program

Code	Title	Credits
Elective		4
Elective		3
Elective		3
Elective		3

B.A in Law, Technology and Culture (Patent Law Concentration)

(120 credits)

Major Requirements

Students in the LTC patent law concentration follow the standard curriculum for the Law, Technology and Culture B.A. (p. 386) while focusing their science-based coursework around a specific natural science discipline (biology, chemistry, physics) or general science literacy.

The curricular options for the LTC B.A. Patent Law concentration are as follows:

Physics Option (24 minimum physics credits)

Students choosing the physics option must complete at least 24 credits of approved physics courses. Only physics courses for physics majors will be accepted.

Chemistry Option (30 minimum chemistry credits)

Students choosing the chemistry option must complete 30 credits of approved chemistry courses. Only chemistry courses for chemistry majors will be accepted.

Biology Option (32 minimum science credits)

Students choosing the biology option must complete 8 credits of approved chemistry or 8 credits of approved physics courses plus 24 credits of approved courses in biology, botany, microbiology, or molecular biology. The 8 semester hours in chemistry or physics must be obtained in two sequential courses, each course including a lab. Only biology courses for biology majors will be accepted.

General Science Option (40 minimum science credits)

Students choosing the general science option must complete 8 credits of approved chemistry or 8 credits of approved physics courses plus 32 credits of approved courses in chemistry, physics, biology, botany, microbiology, molecular biology, or engineering. The 8 semester hours of chemistry or 8 semester hours of physics must be obtained in two sequential courses, each course including a lab. Only courses for science or engineering majors will be accepted

These science curricular options meet the standards mandated by the U.S. Patent and Trademark Office.

Free electives are used to fulfill the minimum science credit hours for options that require more than the 24 science credit hours in the plan of study grid below.

B. A. in Law, Technology and Culture - Patent Law Concentration (120 Credits)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
MGMT 290	Business Law I	3
Natural Science GER (p. 113)		3
Computer Science GER (p. 106)		3

FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
Social Science GER (p. 114)		3
Mathematics GER Statistics (p. 113)		3
Natural Science with Lab GER (p. 113)		4
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Second Year		
1st Semester		
Legal Foundations Elective [1]		3
LTC Core Elective		3
Free Elective		3
Free Elective		3
Natural Science Elective		3
	Term Credits	**15**
2nd Semester		
Legal Foundations Elective [1]		3
LTC Core Elective		3
Law-Related Elective		3
Free Elective		3
Natural Science with Lab GER (p. 113)		4
	Term Credits	**16**
Third Year		
1st Semester		
LTC Core Elective		3
Law-Related Elective		3
Natural Science Elective (p. 113)		3
Free Elective		3
Free Elective [2]		1
Free Elective		3
	Term Credits	**16**
2nd Semester		
LTC Core Elective		3
Law-Related Elective		3
Natural Science Elective with Lab (p. 113)		4
Free Elective		3
Free Elective		3
	Term Credits	**16**
Fourth Year		
1st Semester		
HIST 310	Co-op in Law, Technology, Culture and History I	3
HSS 404	Humanities Senior Seminar - History [3]	3
HIST 312	Prof Development in Law	1
Law-Related Elective		3
Science Elective		3
	Term Credits	**13**
2nd Semester		
Law-Related Elective		3
Law-Related Elective		3
Free Elective		3

Free Elective		3
Term Credits		**12**
Total Credits		**120**

Code	Title	Credits
Legal Foundations Electives		
Select three of the following:		
HIST 361	The Founding of the American Nation	
HIST 362	Sex, Gender, and the Law in American History	
HIST 364	American Law in the World	
HIST 369	Law and Society in History	
MGMT 290	Business Law I	
STS 300	Legal Reasoning, Writing, and Technology	
R790 304	Intro Law And Legal Res	

Code	Title	Credits
LTC Core Electives		
Select four of the following:		
EVSC 335	Environmental Law	
HIST 370	Legal issues in the History of Media	
HIST 320	Law and Evidence	
HIST 338	Environmental Justice and Climate Change in America	
HIST 375	Legal Issues in Environmental History	
HIST 378	Medicine and Health Law in Modern America	
HIST 384	Invention and Regulation	
IE 447	Legal Aspects of Engineering	
IT 331	Privacy and Information Technology	
IT 332	Digital Crime	
IT 400	Information Technology and the Law	
R790 382	Environm Pol & Policy	

Code	Title	Credits
Law-Related Electives [4]		
Select six of the following: [5]		
HIST 373	The Rise of Modern Science	
IE 472	Product Liability Engineering	
R202 201	Intro Criminal Justice	
R512 265	Amer Legal Hist	
R512 266	American Legal History II	
R202 305	Case Process:Law & Courts	
R512 379	Us Hist In The Court	
R790 356	Sex Law & Public Pol	
R790 367	Jurisprudence and Legal Theory	
R790 381	Judicial Process	
R790 387	International Law	
R790 401 & R790 402	Amer Constitutl Dev and Amer Constitutl Dev	
R790 409	Law & Public Policy (Writing Intensive)	
R920 349	Law & Society	

1. Course must satisfy the History and Humanities 300 GER (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/).
2. Student may replace 1-credit elective if he or she has taken a 4-credit course elsewhere.
3. HSS 404 Senior Seminar must be a law-related course.

[4] Students who wish to pursue a specialty in law in relation to a specific scientific, technological, environmental, medical, or media field (such as health policy or intellectual property on the Internet), legal field (such as environmental law, criminal law, or international law), or interdisciplinary thematic field (such as gender studies) may count up to 9 credits of advisor-approved courses in that field toward the electives requirement for the major. For example, a student interested in environmental law might take HIST 334 Environmental History of North America and 6 credits of courses in environmental science and/or environmental policy for elective course credit in the major.

[5] Every course in this category must be approved by the LTC Advisor. Other law-related classes at NJIT and/or Rutgers that are not designated in this list may be used to satisfy the 18 credits of Law-Related Electives. The Rutgers Law School faculty occasionally offer classes open to undergraduates that can be used to satisfy these credits.

B.A. in History

Major Requirements

The major requires 36 credits of history courses with a grade of C or higher. These courses may include offerings at NJIT (HIST prefix) and Rutgers (510 and 512 prefixes). The B.A. in History also requires a minimum of 120 total credits, including completion of the General Education Requirements (p. 105). Each student's program of study is subject to approval by an advisor or by the chairperson of the department. Specific requirements are as follows:

Code	Title	Credits
Western Civilization		
R510 201	Hist Of West Civ	3
R510 202	History Of West. Civ.	3
American History		
Six credits in U.S. History courses (any level)		6
Global/Comparative History		
Six credits in Asian, African, Latin American, World, or Comparative History courses (any level)		6
Historical Methodology & Research		
Select one of the following courses:		3
R510 315	Perspectives in History	
R510 316	Perpectives in History	
Select one of the following Seminars: [1, 2, 3]		3
HIST 490	Seminar - Research	
R510 490	Seminar:Research	
Senior Seminar in History		
HSS 404	Humanities Senior Seminar - History	3
History Electives		
Nine credits in history [4]		9
Total Credits		**36**

[1] Qualified juniors may enroll in HIST 490 Seminar - Research or R510 490 Seminar:Research with permission.

[2] Successful completion of a Perspectives in History course and HSS 404 Humanities Senior Seminar - History are required prior to enrollment in HIST 490 Seminar - Research or R510 490 Seminar:Research.

[3] All majors write a research paper that incorporates methods of historiography and research learned in the seminar. An honors level of scholarship is expected from students enrolled in the Albert Dorman Honors College.

[4] At least six of the nine history elective credits must be taken at the 300 level or higher.

B.A. in History

(120 credits minimum)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
Mathematics GER (p. 113)		3
Social Sciences(lower-level) (p. 114)		3
Natural Science GER (p. 113)		3

R510 201	Hist Of West Civ	3
	Term Credits	**15**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 105	Elementary Probability and Statistics	3
CS 100 or CS 103	Roadmap to Computing or Computer Science with Business Problems	3
R510 202	History Of West. Civ.	3
Natural Sciences with lab (p. 113)		4
	Term Credits	**16**
Second Year		
1st Semester		
American History Elective		3
Global or Comparative History Elective		3
Free Elective (Minor Course Suggested)		3
Free Elective		3
Free Elective		3
Free Elective		1
	Term Credits	**16**
2nd Semester		
American History Elective		3
Global or Comparative History Elective		3
Free Elective(Minor Course Suggested)		3
Free Elective		3
Free Elective		3
Free Elective		1
	Term Credits	**16**
Third Year		
1st Semester		
R510 315 or R510 316	Perspectives in History or Perpectives in History	3
History Elective		3
Free Elective(Minor Course Suggested)		3
Free Elective		3
Free Elective		3
	Term Credits	**15**
2nd Semester		
HSS 404	Humanities Senior Seminar - History	3
History Upper Level Elective		3
Free Elective (Minor Course Suggested)		3
Free Elective		3
Free Elective		3
	Term Credits	**15**
Fourth Year		
1st Semester		
Free Elective (Minor Course Suggested)		3
R510 490 or HIST 490	Seminar:Research or Seminar - Research	3
Free Elective		3
Free Elective		3
Free Elective		3
	Term Credits	**15**

2nd Semester	
Free Elective (Minor Course suggested)	3
Free Elective	3
Free Elective	3
Free Elective	3
Term Credits	**12**
Total Credits	**120**

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.A. in Law, Technology and Culture

(120 credits)

Major Requirements

The Law, Technology and Culture (LTC) B.A. requires 45 credits of major courses with a grade of C or higher. These courses may include offerings at NJIT and Rutgers-Newark. The B.A. in LTC also requires a minimum of 120 total credits, including completion of the General Education Requirements (p. 105). Each student's program of study is subject to approval by an advisor or by the chairperson of the department.

The 45 credits of LTC major courses are taken from the following four categories:

(1) Nine credits of legal foundations core courses, which treat aspects of the law in relation to history, philosophy, business, and basic principles of jurisprudence and legal thought, writing, and research:

Code	Title	Credits
Legal Foundations Core Courses		
Select three of the following:		9
HIST 361	The Founding of the American Nation	
HIST 362	Sex, Gender, and the Law in American History	
HIST 364	American Law in the World	
HIST 369	Law and Society in History	
MGMT 290	Business Law I	
STS 300	Legal Reasoning, Writing, and Technology	
R790 304	Intro Law And Legal Res	
Total Credits		**9**

(2) Twelve credits of LTC core courses, which treat the history, policy, and practice of law in relation to engineering, environment, health, information technology, and media:

Code	Title	Credits
LTC Core Courses		
Select four of the following:		12
EVSC 335	Environmental Law	
HIST 320	Law and Evidence	
HIST 338	Environmental Justice and Climate Change in America	
HIST 370	Legal issues in the History of Media	
HIST 375	Legal Issues in Environmental History	
HIST 378	Medicine and Health Law in Modern America	
HIST 384	Invention and Regulation	
IE 447	Legal Aspects of Engineering	
IT 331	Privacy and Information Technology	
IT 332	Digital Crime	
IT 400	Information Technology and the Law	

R790 382	Environm Pol & Policy	
Total Credits		**12**

(3) Eighteen credits of law-related electives and other approved courses offered at NJIT and Rutgers-Newark that fit each student's special interests. Examples include:

Code	Title	Credits
Law-Related Electives [1]		
Select six of the following: [2]		18
HIST 373	The Rise of Modern Science	
IE 472	Product Liability Engineering	
R202 201	Intro Criminal Justice	
R512 265	Amer Legal Hist	
R512 266	American Legal History II	
R202 305	Case Process:Law & Courts	
R512 379	Us Hist In The Court	
R790 356	Sex Law & Public Pol	
R790 367	Jurisprudence and Legal Theory	
R790 381	Judicial Process	
R790 387	International Law	
R790 401 & R790 402	Amer Constitutl Dev and Amer Constitutl Dev	
R790 409	Law & Public Policy (Writing Intensive)	
R920 349	Law & Society	
Total Credits		**18**

1. Students who wish to pursue a specialty in law in relation to a specific scientific, technological, environmental, medical, or media field (such as health policy or intellectual property on the Internet), legal field (such as environmental law, criminal law, or international law), or interdisciplinary thematic field (such as gender studies) may count up to 9 credits of advisor-approved courses in that field toward the electives requirement for the major. For example, a student interested in environmental law might take HIST 334 Environmental History of North America and 6 credits of courses in environmental science and/or environmental policy for elective course credit in the major.
2. Every course in this category must be approved by the LTC Advisor. Other law-related classes at NJIT and/or Rutgers that are not designated in this list may be used to satisfy the 18 credits of Law-Related Electives. The Rutgers Law School faculty occasionally offer classes open to undergraduates that can be used to satisfy these credits.

(4) Six credits of focused senior coursework: HSS 404 Humanities Senior Seminar - History, in which students prepare a project or write a thesis in a relevant field, and HIST 310 Co-op in Law, Technology, Culture and History I, which provides a hands-on, law-related experience as an intern in a law firm, non-profit or government agency, science- or technology-based corporation, or other relevant organization.

Code	Title	Credits
Law-Focused Senior Courses		
HIST 310	Co-op in Law, Technology, Culture and History I	3
HSS 404	Humanities Senior Seminar - History (Must Be Approved Law-Related HSS 404)	3
Total Credits		**6**

B. A. in Law, Technology and Culture

(120 credits)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 105	Elementary Probability and Statistics	3
R790 201	American Government	3
Natural Science GER (p. 113)		3
MGMT 290	Business Law I	3

FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
Social Science GER (p. 114)		3
ENGL 102	English Composition: Introduction to Writing for Research	3
Math GER non-statistics (p. 113)		3
Law-Related Elective		3
Computing GER (p. 106)		3
	Term Credits	**15**
Second Year		
1st Semester		
Legal Foundations Elective		3
Law-Related Elective		3
History and Humanities GER 200 level (p. 106)		3
Natural Sciences Labratory GER (p. 113)		1
Natural Science GER (p. 113)		3
Free Elective		3
	Term Credits	**16**
2nd Semester		
Legal Foundations Elective [1]		3
LTC Core Elective [1]		3
LTC Core Elective		3
Free Elective		3
Free Elective		3
Free Elective [2]		1
	Term Credits	**16**
Third Year		
1st Semester		
LTC Core Elective		3
LTC Core Elective		3
Law-Related Elective		3
Free Elective		3
Free Elective		3
	Term Credits	**15**
2nd Semester		
Law-Related Elective		3
Free Elective		3
Free Elective		3
Free Elective		3
Free Elective		3
Free Elective [2, 3]		1
	Term Credits	**16**
Fourth Year		
1st Semester		
HIST 310	Co-op in Law, Technology, Culture and History I	3
HSS 404	Humanities Senior Seminar - History [4]	3
Free Elective		3
Free Elective		3
Free Elective		3
	Term Credits	**15**
2nd Semester		
Law-Related Elective		3

Free Elective		3
Free Elective		3
Free Elective		3
	Term Credits	**12**
	Total Credits	**120**

[1] Course must satisfy the History and Humanities GER 30 (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/)0 level (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/).

[2] Student may replace 1-credit elective if he or she has taken a 4-credit course elsewhere

[3] HIST 312 is recommended

[4] HSS 404 Senior Seminar must be a law-related course.

B.A. in Patent Law, Technology and Culture

Major Requirements

The patent law, technology, and culture major requires a minimum of 51 credits of LTC major courses with a grade of C or higher. These courses may include offerings at NJIT and Rutgers-Newark. The patent law B.A. also requires a minimum of 120 total credits, including completion of the General Education Requirements (p. 105). Each student's program of study is subject to approval by an advisor or by the chairperson of the department.

Students in the patent law curriculum program follow the standard curriculum for the Law, Technology and Culture B.A. (p. 386) while focusing their science-based coursework around a specific discipline (biology, chemistry, or physics). The curricular options for the Patent Law concentration are as follows:

Biology Options (B.A. or B.S.)

Students choosing the biology option must complete 8 credits of approved chemistry or physics courses and 24 credits of approved courses in biology, botany, microbiology, or molecular biology. The 8 semester hours in chemistry or physics must be obtained in two sequential courses, each course including a lab. Only biology courses for biology majors will be accepted. Subject to the approval of an advisor, students can earn a double-major B.A. in LTC and biology with 124 total credits. It is also possible to earn a double-major B.S. degree in LTC and Biology with 128 total credits.*

Chemistry Options (B.A. or B.S.)

Students choosing the chemistry option must complete 30 credits of approved chemistry courses. Only chemistry courses for chemistry majors will be accepted. Subject to the approval of an advisor, students can earn a double-major B.S. in LTC and chemistry with 125 total credits.*

Physics Options (B.A. or B.S.)

Students choosing the physics option must complete 24 credits of approved physics courses. Only physics courses for physics majors will be accepted. Subject to the approval of an advisor, students can earn a double-major B.S. in LTC and applied physics with 127 total credits. Students doing the B.S. in Applied Physics and LTC choose to study one of two concentrations: either Astronomy or Optical Science and Engineering.*

General Science Option (B.A.)

Students choosing the general science option must complete 8 credits of approved chemistry or physics courses and 32 credits of approved courses in chemistry, physics, biology, botany, microbiology, molecular biology, or engineering. The 8 semester hours of chemistry or 8 semester hours of physics must be obtained in two sequential courses, each course including a lab. Only courses for science or engineering majors will be accepted.*

*__Note__: The science courses in each Patent Law, Technology and Culture major are taken in place of:

- 7-8 credits of the Natural Sciences GUR electives
- up to 24 credits of Law-Related electives
- up to 24 credits of Free Electives to fulfill 24 credits of Free Electives (as mandated by the U.S. Patent and Trademark Office).

B.A. in Patent Law, Technology and Culture

(120 credits minimum)

First Year		
1st Semester		**Credits**
HUM 101	English Composition: Writing, Speaking, Thinking I	3
MATH 111	Calculus I	4
MGMT 290	Business Law I	3
Natural Science GER (p. 113)		3
Computer Science GER (p. 106)		3
FRSH SEM	First-Year Seminar	0
	Term Credits	**16**
2nd Semester		
Social Science GER (p. 114)		3
HUM 102	English Composition: Writing, Speaking, Thinking II	3
Mathematics GER (p. 113)		
Legal Foundations Elective		3
Natural Science Literacy with Lab GER (p. 113)		4
	Term Credits	**13**
Second Year		
1st Semester		
Legal Foundations Elective		3
LTC Core Elective		3
History and Humanities GER 200 level (p. 106)		3
Natural Science GER (p. 113)		3
Free Elective		3
	Term Credits	**15**
2nd Semester		
Law Technology and Culture Core Elective		3
Law Related Elective		3
Free Elective		3
Free Elective		3
Natural Science with Lab GER (p. 113) [1]		4
	Term Credits	**16**
Third Year		
1st Semester		
Law Technology and Culture Core Elective		3
Law Related Elective		3
Natural Science GER (p. 113) [1]		3
Free Elective		3
Free Elective		3
Free Elective [2]		1
	Term Credits	**16**
2nd Semester		
LTC Core Elective		3
Law Related Elective		3
Natural Science with Lab GER (p. 113) [1]		4
Free Elective		3
Free Elective		3
	Term Credits	**16**
Fourth Year		
1st Semester		
HIST 310	Co-op in Law, Technology, Culture and History I	3
HSS 404	Humanities Senior Seminar - History	3

MGMT 390 or HRM 301	Principles of Business or Organizational Behavior	3
HIST 312	Prof Development in Law	1
Free Elective		3
	Term Credits	**13**
2nd Semester		
Law Related Elective		3
Law Related Elective		3
Free Elective		3
Free Elective		3
	Term Credits	**12**
	Total Credits	**117**

* *Student may replace 1-credit elective if he or she has taken a 4-credit course elsewhere*

B.A. Double Major in Biology & Law, Technology and Culture

(124 credits minimum)

First Year		
1st Semester		**Credits**
BIOL 200	Concepts in Biology	4
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3
MATH 138	General Calculus I	3
HUM 101	English Composition: Writing, Speaking, Thinking I	3
BNFO 135	Programming for Bioinformatics	3
FRSH SEM	First-Year Seminar	0
	Term Credits	**16**
2nd Semester		
R120 201	Foundations Of Biology	3
R120 202	Foundations Of Biology Lab	1
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
CHEM 124	General Chemistry Laboratory	1
MATH 238	General Calculus II	3
HUM 102	English Composition: Writing, Speaking, Thinking II	3
Physical Education: GUR Elective		1
	Term Credits	**15**
Second Year		
1st Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 243	Organic Chemistry I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
HIST 213	The Twentieth-Century World	3
Physical Education: GUR Elective		1
	Term Credits	**15**
2nd Semester		
Biology Cluster Elective		3
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
PHYS 103	General Physics	3

PHYS 103A	General Physics Lab	1
Social Science: GUR Elective		3
	Term Credits	**15**
Third Year		
1st Semester		
Biology Functional Laboratory Elective		3
Biology Cluster Elective		3
Management: GUR Elective		3
IE 447	Legal Aspects of Engineering	3
Legal Foundations Elective		3
	Term Credits	**15**
2nd Semester		
Biology Laboratory Elective		3
Biology Elective		3
HIST 378	Medicine and Health Law in Modern America	3
Social Science: GUR Elective		3
Legal Foundations Elective		3
Free Elective		3
	Term Credits	**18**
Fourth Year		
1st Semester		
Biology Laboratory Elective		3
Biology Elective		3
HIST 310	Co-op in Law, Technology, Culture and History I	3
HSS 404	Humanities Senior Seminar - History ((LTC Section))	3
Legal Foundations Elective		3
	Term Credits	**15**
2nd Semester		
Biology Elective		3
HIST 375 or EVSC 335	Legal Issues in Environmental History or Environmental Law	3
IT 400 or IT 331 or IT 332	Information Technology and the Law or Privacy and Information Technology or Digital Crime	3
Free Elective		3
Free Elective		3
	Term Credits	**15**
	Total Credits	**124**

B.S. Double Major in Biology & Law, Technology and Culture

(128 credits minimum)

First Year		
1st Semester		**Credits**
BIOL 200	Concepts in Biology	4
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3
MATH 111	Calculus I	4
HUM 101	English Composition: Writing, Speaking, Thinking I	3
BNFO 135	Programming for Bioinformatics	3
FRSH SEM	First-Year Seminar	0
	Term Credits	**17**

2nd Semester		
R120 201	Foundations Of Biology	3
R120 202	Foundations Of Biology Lab	1
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
MATH 112	Calculus II	4
CHEM 124	General Chemistry Laboratory	1
HUM 102	English Composition: Writing, Speaking, Thinking II	3
Physical Education: GUR Elective		1
	Term Credits	**16**
Second Year		
1st Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 243	Organic Chemistry I	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
MATH 211	Calculus III A	3
BNFO 236	Programming for Bioinformatics II	3
	Term Credits	**17**
2nd Semester		
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
Math Elective		3-4
MGMT 290	Business Law I	3
Physical Education: GUR Elective		1
	Term Credits	**16-17**
Third Year		
1st Semester		
Biology Functional Laboratory Elective		4
Biology Cluster Elective		3
MATH 333	Probability and Statistics	3
HIST 213	The Twentieth-Century World	3
Legal Foundations Elective		3
	Term Credits	**16**
2nd Semester		
Biology Laboratory Elective		3
Biology Cluster Elective		4
HIST 378	Medicine and Health Law in Modern America	3
IE 447	Legal Aspects of Engineering	3
MGMT 390	Principles of Business	3
	Term Credits	**16**
Fourth Year		
1st Semester		
Biology Laboratory Elective		3
Biology Cluster Elective		3
HIST 310	Co-op in Law, Technology, Culture and History I	3
IT 400 or IT 331 or IT 332	Information Technology and the Law or Privacy and Information Technology or Digital Crime	3

Legal Foundations Elective		3
	Term Credits	**15**
2nd Semester		
Biology Elective		3
Biology Elective		3
Legal Foundations Elective		3
HSS 404	Humanities Senior Seminar - History ((LTC Section))	3
HIST 375 or EVSC 335	Legal Issues in Environmental History or Environmental Law	3
	Term Credits	**15**
	Total Credits	**128-129**

B.S. Double Major in Chemistry & Law, Technology and Culture

(125 credits minimum)

First Year		
1st Semester		**Credits**
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
CS 113 or BNFO 135	Introduction to Computer Science or Programming for Bioinformatics	3
HUM 101	English Composition: Writing, Speaking, Thinking I	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FRSH SEM	First-Year Seminar	0
	Term Credits	**18**
2nd Semester		
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
CHEM 124	General Chemistry Laboratory	1
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
HUM 102	English Composition: Writing, Speaking, Thinking II	3
Physical Education: GUR Elective		1
	Term Credits	**16**
Second Year		
1st Semester		
CHEM 221	Analytical Chemical Methods	2
CHEM 222	Analytical Chemistry	3
CHEM 243	Organic Chemistry I	3
MATH 211	Calculus III A	3
HIST 213	The Twentieth-Century World	3
Physical Education: GUR Elective		1
	Term Credits	**15**
2nd Semester		
CHEM 231	Physical Chemistry I	3
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
EPS 202	Society, Technology, and the Environment	3
MGMT 290	Business Law I	3

IT 400 or IT 331 or IT 332	Information Technology and the Law or Privacy and Information Technology or Digital Crime	3
	Term Credits	**17**
Third Year		
1st Semester		
CHEM 235	Physical Chemistry II	3
ECON 201	Economics	3
Legal Foundations Elective		3
IE 447	Legal Aspects of Engineering	3
HIST 375 or EVSC 335	Legal Issues in Environmental History or Environmental Law	3
	Term Credits	**15**
2nd Semester		
CHEM 340	Chemistry and Engineering of Materials	3
CHEM 336	Quantum Chemistry	3
CHEM 235A	Physical Chemistry II Laboratory	2
MATH 225	Survey of Probability and Statistics	1
Legal Foundations Elective		3
HIST 378	Medicine and Health Law in Modern America	3
	Term Credits	**15**
Fourth Year		
1st Semester		
CHEM 473	Biochemistry	3
CHEM 412 or R160 413	Inorganic Chemistry or Inorganic Chemistry	3
HIST 310	Co-op in Law, Technology, Culture and History I	3
Technical Elective		3
Technical Elective		3
	Term Credits	**15**
2nd Semester		
CHEM 480	Instrumental Analysis	2
HSS 404	Humanities Senior Seminar - History ((LTC Section))	3
Management: GUR Elective		3
Technical Elective		3
Technical Elective		3
	Term Credits	**14**
	Total Credits	**125**

B.S. Double Major in Physics & Law, Technology and Culture - Astronomy Option

(127 credits minimum)

First Year		
1st Semester		**Credits**
HUM 101	English Composition: Writing, Speaking, Thinking I	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
MATH 111	Calculus I	4
CS 113 or CS 115	Introduction to Computer Science or Introduction to Computer Science in C++	3
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3

FRSH SEM	First-Year Seminar	0
	Term Credits	**17**
2nd Semester		
PHYS 114	Introduction to Data Reduction with Applications	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
MATH 112	Calculus II	4
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
CHEM 124	General Chemistry Laboratory	1
Physical Education: GUR Elective		1
	Term Credits	**16**
Second Year		
1st Semester		
MATH 211	Calculus III A	3
MATH 225A	Survey of Probability and Statistics	1
PHYS 234	Physics III	3
PHYS 231A	Physics III Lab	1
HIST 213	The Twentieth-Century World	3
HUM 102	English Composition: Writing, Speaking, Thinking II	3
Physical Education: GUR Elective		1
	Term Credits	**15**
2nd Semester		
MATH 222	Differential Equations	4
MATH 328	Mathematical Methods for Scientists and Engineers	3
PHYS 335	Introductory Thermodynamics	3
Legal Foundations Elective		3
Legal Foundations Elective		3
	Term Credits	**16**
Third Year		
1st Semester		
PHYS 418	Fundamentals of Optical Imaging	3
PHYS 432	Electromagnetism I	3
PHYS 320	Astronomy and Astrophysics I	3
PHYS 430	Classical Mechanics I	3
Legal Foundations Elective		3
	Term Credits	**15**
2nd Semester		
PHYS 433	Electromagnetism II	3
PHYS 321	Astronomy and Astrophysics II	3
Math Elective		3
HSS 404	Humanities Senior Seminar - History ((LTC Section))	3
IT 400 or IT 331 or IT 332	Information Technology and the Law or Privacy and Information Technology or Digital Crime	3
HIST 310	Co-op in Law, Technology, Culture and History I	3
	Term Credits	**18**
Fourth Year		
1st Semester		
PHYS 420	Special Relativity	3
PHYS 442	Introduction to Quantum Mechanics	3
Elective (Math/Physics/Computer Science)		3

IE 447	Legal Aspects of Engineering	3
Management: GUR Elective		3
	Term Credits	**15**
2nd Semester		
PHYS 322	Observational Astronomy	3
PHYS 421	General Relativity	3
PHYS 450	Advanced Physics Lab	3
HIST 378	Medicine and Health Law in Modern America	3
HIST 375 or EVSC 335	Legal Issues in Environmental History or Environmental Law	3
	Term Credits	**15**
	Total Credits	**127**

B.S. Double Major in Physics & Law, Technology and Culture - Optical Science & Engineering Option

(127 credits minimum)

First Year		
1st Semester		**Credits**
HUM 101	English Composition: Writing, Speaking, Thinking I	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
MATH 111	Calculus I	4
CS 113 or CS 115	Introduction to Computer Science or Introduction to Computer Science in C++	3
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3
FRSH SEM	First-Year Seminar	0
	Term Credits	**17**
2nd Semester		
PHYS 114	Introduction to Data Reduction with Applications	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
MATH 112	Calculus II	4
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
CHEM 124	General Chemistry Laboratory	1
Physical Education: GUR Elective		1
	Term Credits	**16**
Second Year		
1st Semester		
MATH 211	Calculus III A	3
MATH 225A	Survey of Probability and Statistics	1
PHYS 234	Physics III	3
PHYS 231A	Physics III Lab	1
HUM 102	English Composition: Writing, Speaking, Thinking II	3
Legal Foundations Elective		3
Physical Education: GUR Elective		1
	Term Credits	**15**
2nd Semester		
MATH 222	Differential Equations	4
MATH 328	Mathematical Methods for Scientists and Engineers	3
PHYS 335	Introductory Thermodynamics	3

Legal Foundations Elective		3
HIST 213	The Twentieth-Century World	3
	Term Credits	**16**
Third Year		
1st Semester		
OPSE 301	Introduction to Optical Science and Engineering	3
PHYS 418	Fundamentals of Optical Imaging	3
PHYS 430	Classical Mechanics I	3
PHYS 432	Electromagnetism I	3
HIST 310	Co-op in Law, Technology, Culture and History I	3
	Term Credits	**15**
2nd Semester		
PHYS 433	Electromagnetism II	3
PHYS 446	Solid State Physics	3
OPSE 402	High Power Laser and Photonics Applications	3
Legal Foundations Elective		3
HIST 378	Medicine and Health Law in Modern America	3
Elective (Physics/OPSE)		3
	Term Credits	**18**
Fourth Year		
1st Semester		
PHYS 442	Introduction to Quantum Mechanics	3
IT 400 or IT 331 or IT 332	Information Technology and the Law or Privacy and Information Technology or Digital Crime	3
Management: GUR Elective		3
HIST 375 or EVSC 335	Legal Issues in Environmental History or Environmental Law	3
Elective (Physics/OPSE/EE)		3
	Term Credits	**15**
2nd Semester		
OPSE 610	Virtual Instrumentation	3
PHYS 450	Advanced Physics Lab	3
Elective (Physics/EE)		3
IE 447	Legal Aspects of Engineering	3
HSS 404	Humanities Senior Seminar - History ((LTC Section))	3
	Term Credits	**15**
	Total Credits	**127**

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Biology & Law, Technology & Culture BA

(120 credit minimum)

First Year		
1st Semester		**Credits**
BIOL 200	Concepts in Biology	4
CHEM 125 or CHEM 121	General Chemistry I [1] or Fundamentals of Chemical Principles I	3
CHEM 125A	General Chemistry Lab I	1
MATH 138	General Calculus I	3

ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 126A	Gen Chemistry Lab II	1
CHEM 126 or CHEM 122	General Chemistry II [1] or Fundamentals of Chemical Principles II	3
MATH 238	General Calculus II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 243	Organic Chemistry I	3
BNFO 135 or CS 101	Programming for Bioinformatics or Computer Programming and Problem Solving	3
MATH 105	Elementary Probability and Statistics	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
Biology Functional Laboratory Elective Cluster B		4
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
Social Science GER (p. 114)		3
Legal Foundations Elective [2]		3
	Term Credits	**15**
Third Year		
1st Semester		
Biology Laboratory Elective		4
Biology Cluster A or C Elective		3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
Legal Foundations Elective [2]		3
LTC Core Elective		3
	Term Credits	**17**
2nd Semester		
Biology Laboratory Elective [3]		3
Biology Cluster A or C Elective		3
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
Legal Foundations Elective [2]		3
Technical Elective [4]		4
	Term Credits	**17**
Fourth Year		
1st Semester		
Biology Elective		3
Biology Elective		3
Technical Elective [5]		3
HSS Senior Seminar GER (p. 112) [6]		3

LTC Core Elective		3
	Term Credits	**15**
2nd Semester		
HIST 310	Co-op in Law, Technology, Culture and History I	3
LTC Core Elective / Technical Elective [7]		3
LTC Core Elective / Technical Elective [7]		3
Biology Elective		3
	Term Credits	**12**
	Total Credits	**120**

Biology Credits: 38

Technical Electives

Any course in chemistry, math or physics beyond major requirements. Any course in environmental science, computer science or engineering. Additional biology courses can be used as technical electives.

Free Electives

Any course in any subject at any level.

Biology Electives

One course must be taken from each cluster.

Concept Cluster Ecology and Evolution

Code	Title	Credits
BIOL 222	Evolution	3
or R120 222	Evolution	
R120 280	Ecology	3
R120 370	Plant Ecology	3
BIOL 382	Animal Behavior	3

Concept Cluster Molecular and Cellular

Code	Title	Credits
BIOL 352	Genetics	3
or R120 352	Genetics	
R120 355	Cell Biology	3
R120 356	Molecular Biology	3
CHEM 473	Biochemistry	3
or R120 360	Biochemistry	

Concept Cluster Functional Organism (4 credits)

Code	Title	Credits
R120 211	Plant Kingdom	4
R120 230	Biology Of Seed Plants	4
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
BIOL 340	Mammalian Physiology	4
or R120 340	Mammalian Physiology	
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4

Laboratory/ Field Experience (7 credits, At least one 4-credit lab)

Code	Title	Credits
Four Credit Laboratories		
R120 211	Plant Kingdom	4
R120 227	Biol Invertebrates	4
R120 230	Biology Of Seed Plants	4
R120 311	Flora of New Jersey	4
R120 313	Mycology	4
BIOL 321	Comp Vertebrate Anatomy	4
R120 325 & R120 326	Animal Parasites and Parasitology Lab	4
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
BIOL 340	Mammalian Physiology	4
or R120 340	Mammalian Physiology	
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4
BIOL 347	Lab Approaches in Neuroscience	4
R120 404	Intro to Neuroanatomy	4
R120 405	Microanatomy of Cells	4
R120 430	Plant Growth & Development	4
BIOL 451	Cell Physiology and Imaging	4
R120 452	Molecular Biol Techniques	4
FRSC 307	Crime Scene Investigation &Lab	4
FRSC 480	Forensic Microscopy & Lab	4
CHEM 475 & CHEM 473	Biochemistry Lab I and Biochemistry	5
Three Credit Laboratories		
R120 328	Ornithology	3
R120 371	Field Study Plant Ecology	3
R120 380	Field Ecology	3
R120 381	Ecological History of North Am	3
BIOL 484	Evolution of Animal Behavior Laboratory	3
BIOL 475	Ecological Field Methods and Analysis	3
R120 486	Tropical Field Biology	2

Biology Electives

Code	Title	Credits
Any concept cluster or lab course or any of the following		
BIOL 315	Principles of Neurobiology	3
BIOL 320	Discovering Biological Research	3
BIOL 337	Collective Intel in Biol Syst	3
BIOL 338	Ecology of the Dining Hall	3
BIOL 441	Neurophysiology	3
BIOL 342	Developmental Biology (Embryology)	3
BIOL 423	Physiological Mechanisms	3
BIOL 424	Comparative Physiology	3
R120 346	Neurobiology	3
BIOL 350	Immunology	3
R120 365	Evolutions of Humans	3
BIOL 468	Disease Ecology & Evolution	3
BIOL 375	Conservation Biology	3

BIOL 383	Neural Basis of Behavior	3
BIOL 400	Biology in Science Fiction	3
R120 402	Biology of Cancer	3
R120 422	Biological Invasions	3
BIOL 440	Cell Biology of Disease: Cells gone Bad!	3
BIOL 445	Endocrinology	3
or R120 445	Endocrinology	
BIOL 447	Systems Neurobiology	3
BIOL 448	Neuropathophysiology: Nervous System Gone Bad!	3
BIOL 453	Applied Genetics & Genomics	3
R120 455	Molec Cell Biology	3
BIOL 462	Comparative Biomechanics	3
R120 472	Environmental Assessment	3
CHEM 474	Biochemistry II	3
BIOL 491 & BIOL 492	Research and Independent Study and Research and Independent Study	6
R120 493 & R120 494	Seminar In Biology and Seminar In Biol	2
BIOL 495	Honors Seminar in Biology	3
BIOL 498	Special Topics in Biology	3

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses"

Legal Foundations Electives (9 credits)

Code	Title	Credits
Choose three of the following: [2]		
HIST 361	The Founding of the American Nation	3
HIST 362	Sex, Gender, and the Law in American History	3
HIST 364	American Law in the World	3
HIST 369	Law and Society in History	3
MGMT 290	Business Law I	3
STS 300	Legal Reasoning, Writing, and Technology	3
R790 304	Intro Law And Legal Res	3

LTC Core Electives (12 credits)

Code	Title	Credits
Choose four of the following:		
EVSC 335	Environmental Law [8]	3
HIST 320	Law and Evidence	3
HIST 338	Environmental Justice and Climate Change in America	3
HIST 370	Legal issues in the History of Media	3
HIST 375	Legal Issues in Environmental History	3
HIST 378	Medicine and Health Law in Modern America	3
HIST 384	Invention and Regulation	3
IE 447	Legal Aspects of Engineering [8]	3
IT 331	Privacy and Information Technology [8]	3
IT 332	Digital Crime [8]	3
IT 400	Information Technology and the Law [8]	3
R790 382	Environm Pol & Policy	3

1 CHEM 121 and CHEM 122 require permission from academic advisor

2 At least two of the Legal Foundations Electives must also fulfill the History and Humanities 300+ GER (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/) requirement

3 Laboratory Elective - 3 or 4-credit laboratory

4 Technical Elective - Any course in BIOL, CHEM, CS, EVSC, IT, IS, PHYS, FRSC, MATH, MIS, MIT, and BME or any other engineering course qualifies, however **this technical elective must be four credits.**
5 Technical Elective - Any course in BIOL, CHEM, CS, EVSC, IT, IS, PHYS, FRSC, MATH, MIS, MIT, and BME or any other engineering course qualifies. **Taking a course that also counts as an LTC Core Elective is recommended.**
6 A law-related HSS Senior Seminar is required
7 At least 6 of the 12 credits of LTC Core Electives must be completed as Technical Electives. The qualifying LTC Core Electives are EVSC 335, IE 447, IT 331, IT 332, and IT 400.
8 This LTC Core elective course can also be used as a 3-credit Technical Elective.

Chemistry & Law, Technology and Culture - B.S.

(130 Credits)

First Year		
1st Semester		**Credits**
CHEM 125 or CHEM 121	General Chemistry I or Fundamentals of Chemical Principles I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I [1]	4
BNFO 135	Programming for Bioinformatics [2]	3
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
CHEM 126 or CHEM 122	General Chemistry II or Fundamentals of Chemical Principles II	3
CHEM 126A	Gen Chemistry Lab II	1
MATH 112	Calculus II	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**15**
Second Year		
1st Semester		
CHEM 222	Analytical Chemistry	3
CHEM 243	Organic Chemistry I	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
MATH 211	Calculus III A	3
	Term Credits	**13**
2nd Semester		
CHEM 221	Analytical Chemical Methods	2
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
History and Humanities GER 200 level (p. 108)		3
MATH 222	Differential Equations	4
	Term Credits	**14**
Third Year		
1st Semester		
CHEM 473	Biochemistry [3]	3
Technical Elective [3]		3
CHEM 231	Physical Chemistry I	3
EPS 202	Society, Technology, and the Environment [4]	3

EVSC 335	Environmental Law [5]	3
	Term Credits	**15**
2nd Semester		
CHEM 235	Physical Chemistry II	3
CHEM 480	Instrumental Analysis [3]	2
CHEM 412	Inorganic Chemistry [3]	3
Technical Elective [3]		3
STS 300	Legal Reasoning, Writing, and Technology [6, 7]	3
	Term Credits	**14**
Fourth Year		
1st Semester		
CHEM 235A	Physical Chemistry II Laboratory	2
CHEM 336	Quantum Chemistry [3]	3
CHEM 340	Chemistry of Materials [3, 8]	3
MATH 225	Survey of Probability and Statistics	1
Technical Elective [3]		3
R790 382	Environm Pol & Policy [3, 5]	3
	Term Credits	**15**
2nd Semester		
HIST 369	Law and Society in History [6, 7]	3
LTC Core Elective		3
LTC Core Elective		3
Technical Elective [3]		3
Technical Elective [3]		3
	Term Credits	**15**
Fifth Year		
1st Semester		
HSS Senior Seminar GER (p. 112) [8]		3
HIST 310	Co-op in Law, Technology, Culture and History I	3
MGMT 290	Business Law I [6]	3
Technical Elective [3]		3
Technical Elective [3]		3
	Term Credits	**15**
	Total Credits	**130**

1 Students who do not place initially into Math 111 must take the prerequisite(s) first and catch up to the math sequence as soon as possible.
2 CS 113 is also acceptable, but it has a pre-requisite of CS 100, adding 3 more credits unless AP or transfer credit is obtained.
3 33 credits of these courses must be taken at NJIT, Rutgers-Newark, or Essex County College by all students.
4 This course satisfies the Social Science GER.
5 This course satisfies 3 credits of the LTC Core Electives.
6 This courses satisfies 3 credits of the Legal Foundations Elective.
7 Course must satisfy the 300 History and Humanities GER (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/).
8 MTSE 301 can be substituted for Chem 340.
9 HSS Senior Seminar must be a law-related course.

Code	Title	Credits
Legal Foundations Electives		
HIST 361	The Founding of the American Nation	3
HIST 362	Sex, Gender, and the Law in American History	3
HIST 364	American Law in the World	3
HIST 369	Law and Society in History	3
MGMT 290	Business Law I	3

STS 300	Legal Reasoning, Writing, and Technology	3
R790 304	Intro Law And Legal Res	3

Code	Title	Credits
LTC Core Electives		
EVSC 335	Environmental Law	3
HIST 320	Law and Evidence	3
HIST 338	Environmental Justice and Climate Change in America	3
HIST 370	Legal issues in the History of Media	3
HIST 375	Legal Issues in Environmental History	3
HIST 378	Medicine and Health Law in Modern America	3
HIST 384	Invention and Regulation	3
IE 447	Legal Aspects of Engineering	3
IT 331	Privacy and Information Technology	3
IT 332	Digital Crime	3
IT 400	Information Technology and the Law	3
R790 382	Environm Pol & Policy	3

Forensic Science and Law, Technology & Culture - B.S.

B.S. in Forensic Science and LTC

This double major provides training in both forensic science and the law. Forensic science is the application of sciences to matters of law. The Bachelor of Science in Forensic Science requires foundational coursework in mathematics and the natural sciences. In addition, students complete the program’s forensic science core, which is designed to equip students with a background in forensic science core concepts, evidence collection, technical analysis, data interpretation, and professional regulatory practices. Students complete advanced coursework in analytical chemistry as well as upper-level courses in one of the program’s three options: digital forensics, forensic biology, or forensic chemistry. Students must complete the Forensic Science Assessment Test (FSAT) in order to be certified for graduation. In addition to this, students will have the traditional pre-law training required for LTC majors. Students will complete Legal Foundations electives, LTC Core electives, a coop, and a law-related senior seminar.

B.S. in Forensic Science and LTC: Forensic Biology Option (125 credits)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FYS SEM	First-Year Student Seminar	0
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
	Term Credits	**15**
2nd Semester		
CHEM 126	General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**15**
Second Year		
1st Semester		
BIOL 200	Concepts in Biology	4
CHEM 243	Organic Chemistry I	3
FRSC 201	Intro to Forensic Science	3

MATH 333	Probability and Statistics	3
	Term Credits	**13**
2nd Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
FRSC 307	Crime Scene Investigation &Lab	4
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 222	Analytical Chemistry	3
CHEM 221	Analytical Chemical Methods	2
FRSC 359	Physical Methods of Forensic Analysis & Lab	4
Legal Foundations Elective [1]		3
	Term Credits	**16**
2nd Semester		
BIOL 340	Mammalian Physiology	4
CHEM 473	Biochemistry	3
CHEM 475	Biochemistry Lab I	2
HIST 320	Law and Evidence [2]	3
	Term Credits	**12**
Fourth Year		
1st Semester		
BIOL 352	Genetics	3
HSS Senior Seminar GER (p. 112) [3]		3
Legal Foundations Elective		3
LTC Core Elective		3
	Term Credits	**12**
2nd Semester		
FRSC 479	Forensic Biology & Lab	4
FRSC 480	Forensic Microscopy & Lab	4
Select one of the following:		3
FRSC 490	Co-op Work Experience	
FRSC 491	Research & Indep Study I	
FRSC 495	Senior Seminar	
Legal Foundations Elective		3
	Term Credits	**14**
Fifth Year		
1st Semester		
HIST 310	Co-op in Law, Technology, Culture and History I	3
Computing GER (p. 106)		3
LTC Core Elective		3
LTC Core Elective		3
	Term Credits	**12**
	Total Credits	**125**

B.S. in Forensic Science and LTC: Forensic Chemistry Option (128 credits)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FYS SEM	First-Year Student Seminar	0
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
	Term Credits	**15**
2nd Semester		
CHEM 126	General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**15**
Second Year		
1st Semester		
CHEM 231	Physical Chemistry I	3
CHEM 243	Organic Chemistry I	3
FRSC 201	Intro to Forensic Science	3
MATH 211	Calculus III A	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**15**
2nd Semester		
BIOL 200	Concepts in Biology	4
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
MATH 333	Probability and Statistics	3
Legal Foundations Elective [1]		3
	Term Credits	**15**
Third Year		
1st Semester		
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 222	Analytical Chemistry	3
CHEM 221	Analytical Chemical Methods	2
FRSC 307	Crime Scene Investigation &Lab	4
HIST 320	Law and Evidence [2]	3
	Term Credits	**16**
2nd Semester		
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 221	Analytical Chemical Methods	2
CHEM 473	Biochemistry	3
CHEM 475	Biochemistry Lab I	2
FRSC 359	Physical Methods of Forensic Analysis & Lab	4
	Term Credits	**15**

Fourth Year		
1st Semester		
FRSC 475	Forensic Chemistry & Lab	4
Computing GER (p. 106)		3
HSS Senior Seminar GER (p. 112) [3]		3
Legal Foundations Elective		3
	Term Credits	**13**
2nd Semester		
CHEM 480	Instrumental Analysis	2
FRSC 480	Forensic Microscopy & Lab	4
Select one of the following:		3
FRSC 490	Co-op Work Experience	
FRSC 491	Research & Indep Study I	
FRSC 495	Senior Seminar	
LTC Core Elective		3
	Term Credits	**12**
Fifth Year		
1st Semester		
HIST 310	Co-op in Law, Technology, Culture and History I	3
Legal Foundation Elective		3
LTC Core Elective		3
LTC Core Elective		3
	Term Credits	**12**
	Total Credits	**128**

B.S. in Forensic Science and LTC– Digital Forensics Option (120 credits)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FYS SEM	First-Year Student Seminar	0
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
	Term Credits	**15**
2nd Semester		
CHEM 126	General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**15**
Second Year		
1st Semester		
CS 100	Roadmap to Computing	3
FRSC 201	Intro to Forensic Science	3
CHEM 221	Analytical Chemical Methods	2
CHEM 222	Analytical Chemistry	3
MATH 333	Probability and Statistics	3

IT 120	Introduction to Network Technology	3
	Term Credits	**17**
2nd Semester		
CS 113	Introduction to Computer Science	3
FRSC 307	Crime Scene Investigation &Lab	4
IT 220	Wireless Networks	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**13**
Third Year		
1st Semester		
FRSC 359	Physical Methods of Forensic Analysis & Lab	4
IT 202	Internet Applications	3
IT 230	Computer and Network Security	3
LTC Core Elective		3
Legal Foundations Elective [1]		3
	Term Credits	**16**
2nd Semester		
FRSC 480	Forensic Microscopy & Lab	4
HIST 320	Law and Evidence [2]	3
IS 331	Database Design Management and Applications	3
HIST 310	Co-op in Law, Technology, Culture and History I	3
	Term Credits	**13**
Fourth Year		
1st Semester		
HSS Senior Seminar GER (p. 112) [3]		3
IT 330	Computer Forensic	3
IT 340	Introduction to System Administration	3
Free Elective I		3
Legal Foundations Elective		3
	Term Credits	**15**
2nd Semester		
IT 332	Digital Crime	3
IT 400	Information Technology and the Law	3
IT 430	Ethical Hacking for System Administrators	3
Select one of the following:		3
FRSC 490	Co-op Work Experience	
FRSC 491	Research & Indep Study I	
FRSC 495	Senior Seminar	
Free Elective II [4]		1
Legal Foundations Elective		3
	Term Credits	**16**
	Total Credits	**120**

Legal Foundations Electives

Code	Title	Credits
HIST 361	The Founding of the American Nation	3
HIST 362	Sex, Gender, and the Law in American History	3
HIST 364	American Law in the World	3
HIST 369	Law and Society in History	3
MGMT 290	Business Law I	3

STS 300	Legal Reasoning, Writing, and Technology	3
R790 304	Intro Law And Legal Res	3

LTC Core Electives

Code	Title	Credits
EVSC 335	Environmental Law	3
HIST 320	Law and Evidence	3
HIST 338	Environmental Justice and Climate Change in America	3
HIST 370	Legal issues in the History of Media	3
HIST 375	Legal Issues in Environmental History	3
HIST 378	Medicine and Health Law in Modern America	3
HIST 384	Invention and Regulation	3
IE 447	Legal Aspects of Engineering	3
IT 331	Privacy and Information Technology	3
IT 332	Digital Crime	3
IT 400	Information Technology and the Law	3
R790 382	Environm Pol & Policy	3

[1] Course must satisfy the History and Humanities GER 30 (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/)0 level (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/).

[2] HIST 320 satisfies the History and Humanities GER 30 (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/)0 level (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/).

[3] Law-related HSS Senior Seminar required.

[4] HIST 312 recommended

Global Studies Minor

(15 credits)

Five courses with global content including four upper division courses approved by the minor coordinator.

History Minor

(15 credits)

Five history courses; at least three upper-division courses; at least four with a HIST, R510, R512, or HSS 404 designation; as approved by the minor coordinator.

Legal Studies Minor

(15 credits)

Five law-related upper division courses approved by the minor coordinator.

Humanities and Social Sciences

The Humanities and Social Sciences Department (http://humanities.njit.edu/) is dedicated through general education requirements, electives and various undergraduate and graduate programs of study including those culminating in bachelor's and master's degrees, to offering research opportunities, seminars and colloquia that investigate the artistic, cultural and social contexts informing contemporary society. The department’s instructional staff places special emphasis on teaching and research in the following areas: communication with particular regard to contemporary media, journalism and all forms of writing; the interplay of science, technology and society; the theatre; philosophy and professional ethics; literature; English as a second language; the study of cultural artifacts from around the globe; the visual arts, including film; and music.

NJIT Faculty
A

Ascarelli, Miriam F., University Lecturer

B
Brooks, Charles, Professor of Practice

C
Castronova, Louise, Senior University Lecturer

Chen, Kim, University Lecturer

Cohen, Maurie, Professor and Chair

Curley, Jonathan R., Senior University Lecturer

D
Deane, Johanna, University Lecturer

E
Edel, Gareth, University Lecturer

Egan, John A., University Lecturer

Esche, John N., University Lecturer

Estrada, Daniel J., University Lecturer

F
Fleischer, Doris Z., Senior University Lecturer

Funkhouser, Christopher T., Professor

G
Gorelick, Risa, University Lecturer

H

Holbrook, J. Britt, Assistant Professor

Hunt, Theresa A., University Lecturer

J
Johnson, Carol S., Associate Professor

K

Khichi, Narendra-Neel, University Lecturer

Kimmelman, Burt J., Professor

Klobucar, Philip Andrew, Associate Professor

L
Lipuma, James M., Senior University Lecturer

Longo, Bernadette C., Associate Professor

M
McRae, Calista A. Assistant Professor

O
O'Neill, Megan E., Assistant Professor

P
Paris, Jerome, Director

R
Rittenhouse, Michele R., Director

Rothenberg, David B., Distinguished Professor

Rutkoff, Rebekah, Assistant Professor

S

See, Adam, University Lecturer

Semizer, Yelda, Assistant Professor

Siemann, Catherine A., University Lecturer

Slovis, Jake, University Lecturer

Steffen, Nancy L., Associate Professor

T
Tyrol, Katherine, University Lecturer

Programs

- Communication and Media - B.A. (p. 428)
- Communication and Media - B.S. (p. 431)
- Cyberpsychology - B.S. (p. 433)
- Science, Technology and Society - B.S. (p. 434)
- Theatre Arts and Technology - B.A. (p. 429)

Double Majors (p. 102)

- Science, Technology and Society & Business and Information Systems - B.S. (p. 247)

- Communication Minor (p. 436)
- Electronic Creative Writing Minor (p. 436)
- Global Studies Minor (p. 437)
- Journalism Minor (p. 437)
- Literature Minor (p. 437)
- Philosophy and Applied Ethics Minor (p. 437)
- Science, Technology & Society Minor (p. 437)
- Technology, Gender and Diversity Minor (p. 438)
- Theatre Arts and Technology Minor (p. 438)

Humanities Courses

COM 200. Communicating in Organizations. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a co-requisite. Allows students to understand the need for writing in an information-based corporate culture. Students write intensively in a variety of forms for a variety of audiences. Attention is given to editing, graphic design, communications ethics, and desktop publishing. At the conclusion of the course, students prepare a portfolio of their work. This course satisfies the three credit 200 GER in History and Humanities.

COM 303. Video Narrative. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Introduces various multimedia resources and environments in order to develop new strategies for both reading and writing within a visually-based, screen-oriented culture. Students will study different historical and theoretical lineages in videography, and learn hands-on techniques and technologies to produce independent media works of their own. This course satisfies the three credit 300 GER in History and Humanities.

COM 310. Interpersonal Communication. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course surveys theory and research related to interpersonal communication. The course focuses on effectively managing personal and professional relationships. The course’s format consists of lectures, group discussions, experiential activities, and written assignments that require students’ active involvement. This course satisfies the three credit 300 GER in History and Humanities.

COM 312. Oral Presentations. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Instruction and practice in effective oral presentations. Students deliver a wide range of presentations adapted to the needs of a variety of audiences. Topics include voice and diction, presentation skills, the effective use of visual aids, reporting technical material and audience analysis. This course satisfies the three credit 300 GER in History and Humanities.

COM 313. Technical Writing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An advanced writing course. Combines current theory with actual practice to prepare students as technical writers. Analyze complex communication situations and design appropriate responses through tasks that involve problem solving, rhetorical theory, document design, oral presentations, writing teams, audience awareness, ethical considerations, and gender equity issues. This course satisfies the three credit 300 GER in History and Humanities.

COM 314. Theory of Rhetoric. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines theories of rhetoric from ancient to contemporary times. Special attention is paid to Aristotle, Peter Ramus, James Kinneavy, Walter Ong, and Jurgen Habermas. Focuses on the ways in which theories inform the practice of communication. In the course project, students design and conduct field research based on rhetorical theory. This course satisfies the three credit 300 GER in History and Humanities.

COM 315. Environmental Communication. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. COM 315 (Environmental Communication) concentrates on effective communication through a close study of contemporary writing and film about the environment. To refine and strengthen students' abilities as sharp observers and effective communicators, the course will examine rhetorical decisions made across a variety of genres—including recent journalism, personal essays, documentaries, and digital works—centered on issues surrounding the environmental crisis. This course satisfies the three credit 300 GER in History and Humanities.

COM 316. Creative Writing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Focuses on the complexities of creating literary texts. Analyzes student writing in genres such as fiction, creative non-fiction, poetry, and drama. Considers these genres from theoretical perspectives. Topics include character development, plot, dialogue; meter, rhyme, figurative language; audience analysis, ethos, and narrative theory. Students write, edit and critique their own work with the aim of publication. This course satisfies the three credit 300 GER in History and Humanities.

COM 317. Advanced Composition. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Involves composing in-depth, persuasive research essays designed to address the aims of discourse (expressive, referential, literary, and persuasive), using current media tools (text, graphics, audio, animation and video) and venues (print and electronic), in several iterations. This course satisfies the three credit 300 GER in History and Humanities.

COM 318. Communication Theory. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course will introduce students to communication theory and practice. The course begins with a review of contemporary communication theory. After covering five selected theories - semiotic, visual, cultural, social, and reception, students will be required to apply a selected theory to a computer-mediated case study. Students will also be required to perform a collaborative field study. Through the course, students will be expected to read critically, to research peer-reviewed sources thoroughly, to present effective oral briefings, and to write analytic reports. This course satisfies the three credit 300 GER in History and Humanities.

COM 319. Technical, Professional and Scientific Writing for Publication. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The purpose of this course is to acquaint students with samples from significant technical, professional and scientific writing, sharpen skills in identifying theses and the major supporting elements in these works, while making judgments on their contributions. In addition, students will be required to demonstrate their ability to do the necessary research to integrate related sources other than the assigned texts. This course satisfies the three credit 300 GER in History and Humanities.

COM 321. Technology & Tactics of Sound. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The course offers students an effective primer in the science of how sound has been measured and understood historically as a media format. This course satisfies the three credit 300 GER in History and Humanities.

COM 323. Mobile Media Making. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Through hands-on writing, interviewing, videography, and photography supervised by the instructor, students develop competencies in discovering, developing and using a variety of skills using their cell phone for information gathering, archiving, and presentation to present publishable narratives. Special focus on using cell phone based technologies to document, record, create and produce narratives in a variety of media. Particular emphasis is placed on the creative process, planning, revision and editing to a completed product. This course satisfies the three credit 300 GER in History and Humanities.

COM 324. Podcast Practicum. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with a grade of C or better. In recent years, the digital media/network communications practice known as podcasting has gained much attention and popularity. This primary objective of this course is to guide students through the practice of preparing, organizing, and producing a series of thematically orchestrated podcasts, specifically focusing on teaching students to use the hardware and software that enables them to compose, edit, and publish online podcasts on subjects corresponding to their own interests and research. As a practicum, the bulk of the course emphasizes, and is dedicated to, applying the multiple compositional processes and audio engineering necessary to complete the tasks involved with creating works in this particular media format.

COM 325. Special Topics in Communication. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course. This course satisfies the three credit 300 GER in History and Humanities.

COM 337. Photojournalism. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Through hands-on writing and photography supervised by the instructor, students develop competencies in discovering and creating an interdisciplinary viewpoint using a variety of writing methods and photographic viewpoints. Special focus on interpreting architecture and architectural detail, nature's conflict and place in urban and suburban environs, and the human interface with nature and man-made spaces. Particular emphasis is placed on the creative process and critical revision. This course satisfies the three credit 300 GER in History and Humanities.

COM 338. The Newsroom. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This is an advanced journalism course. Students will work closely with the instructor in order to write news and feature stories, commentaries and critiques, and will be encouraged to publish their work in The Vector and other publications. This course satisfies the three credit 300 GER in History and Humanities.

COM 339. Practical Journalism. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A descriptive and analytic survey of news systems. Assignments include practice in writing straight news items, sports writing, feature writing, science writing, interviewing, and editing with emphasis on understanding methods. The survey of printed and broadcast news systems includes the influence of technological, economic, legal, ethical, and historical factors. This course satisfies the three credit 300 GER in History and Humanities.

COM 341. Documentary Film and Media. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or better, and one 200-level Cultural History GER course with a grade of C or higher. This course investigates a broad genre of media we've come to call 'documentary.' It looks at the origins of documentary filmmaking, investigates a range of mostly contemporary works, and looks critically at the truth-promises and reality-expectations that surround documentary. The course engages with complex questions of aesthetics, ethics, propaganda, and performance while simultaneously interrogating our own responses.

COM 342. Media and the Body. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or better, and one 200-level Cultural Literacy GER course with a grade of C or higher. This course is grounded in forms of audio-visual media — especially moving images — that represent and impact human bodies, those of both its subjects and its spectators. But at the same time, our field of inquiry will be broadened by thinking through the ways that the body is itself a mediating force. Medium, by definition, refers to something that's "in a middle position" or "facilitates transmission" — a reminder that the study of media is, at heart, the study of states of between-ness, and can help us think through embodiment and representation in essential ways. The course probes the creative and theoretical possibilities that emerge when we move our bodies — as thinkers, readers, writers, media-makers and spectators — into the foreground.

COM 350. Digital Video Production. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Instruction in the creation and editing of non-linear digital video; emphasis on team production of a short film; individual editing skills with Final Cut Pro editing software; development and editing of a variety of graphic formats and digital images; formulation of a script treatment; and development of a storyboard. Topics covered include: digital multi-media production; web-casting; interactive television; data-casting; CD and DVD production. This course satisfies the three credit 300 GER in History and Humanities.

COM 351. Documentary Studies. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course will allow students to study the methods by which documentary work is conducted and to complete a documentary project of their own. The course will connect the qualitative methods of the social sciences and the humanistic concerns of the arts by allowing students to study documentary subjects as captured by non-fiction, photography, film, tape recorder, and the World Wide Web. Special emphasis will be placed on narrative and metaphor. This course satisfies the three credit 300 GER in History and Humanities.

COM 353. Composing Documents for Print. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Explores information structuring via print and digital media; how computer technology has influenced the ways in which information is presented in modern culture. Focuses on the optimal ways to prepare and present information for technical and commercial use. Important concepts such as visual literacy and effective design are discussed and addressed. This course satisfies the three credit 300 GER in History and Humanities.

COM 354. Composing Documents for the Web. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Seminar and laboratory-based course designed for BA/BS majors; open to others with appropriate backgrounds and interests and permission of instructor. Follow up of COM 353, explores information structuring via digital media, and how computer technology has influenced the ways in which information is presented in contemporary culture. Through guided interactive research, presents information for technical, commercial, and artistic use. Projects involve use of HTML editors, NJIT networks, and graphical and animation software. This course satisfies the three credit 300 GER in History and Humanities.

COM 355. Cybertext. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Through theoretical readings and electronic research, students explore and compare information structuring in print and digital media, particularly how digital technology influences the dynamics of text. Interactivity, visual communication and developments in the realm of cybernetics are addressed in the course. Materials presented in creative, technical and commercial areas were studied. This course satisfies the three credit 300 GER in History and Humanities.

COM 369. Digital Poetry. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An investigation of activities taken up by poets who integrate computer technology in their works. Students discuss and evaluate virtues of the dynamics presented in an array of titles that include algorithmic programming, graphical artistry, videography, holography, hypermedia, and sonic design in order to build an understanding of the combined values of these disparate forms of expression. This course satisfies the three credit 300 GER in History and Humanities.

COM 390. Electronic Writing Workshop. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A practice-oriented workshop for creative expression in a variety of electronic formats with the specific goal of facilitating individual writing projects for screen and performance. Topics in literary theory will be combined with current criticism in electronic writing, media and screen studies to produce new cultural works in a variety of digital sub-genres, including soundscapes, hypertext poetry, animation, code poems, interactive games, digital video and wiki poems. This course satisfies the three credit 300 GER in History and Humanities.

COM 490. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments are facilitated and approved by the co-op office. Requires mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

COM 491. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments are facilitated and approved by the co-op office. Requires mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

COM 496. Senior Project-Communication and Media. 2 credits, 4 contact hours (0;0;4).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Intended for Communication and Media majors only. For professional and technical communication majors only. Provides students with a capstone experience. Offers PTC students the opportunity to enhance their understanding of communication through their integration of skills and knowledge gained in prior courses. The resultant research thesis or field project, of substantial length and originality, represents the culmination of the undergraduate disciplinary experience. Utilizing both a seminar and workshop approach, entails intense and sustained collaboration between student and instructor, and cooperation among students.

ENGL 090. General Skills in the English Language. 5 credits, 5 contact hours (5;0;0).
Prerequisites: None. Intended for students whose native language is not English and who need practice in speaking, listening, reading, and writing in English prior to enrolling in ENGL 096. Extensive activities to develop grammar and expand vocabulary. Frequent speaking practice in small groups and oral presentations. Practice in understanding and taking notes on academic lectures. Small class size and weekly individual tutoring sessions ensure students receive individualized attention.

ENGL 096. Reading, Writing, Critical Thinking. 6 credits, 6 contact hours (6;0;0).
Prerequisites: None, unless placement test result requires ENGL 090. The first course of the two-semester composition sequence ENGL 096 - ENGL 100. Intended for students for whom English is a second language. Emphasizes reading strategies, building vocabulary, grammar, developing a thesis, organizing an essay, editing and writing different kinds of expository essays. Frequent oral presentations. Weekly writing labs are held in conjunction with the course work.

ENGL 099. Reading, Writing, Language. 3 credits, 3 contact hours (3;0;0).
Prerequisites: None. Focuses on developing the reading and writing skills necessary for success in a college curriculum, including structuring and organizing effective sentences and paragraphs; preparing summaries; expanding vocabulary; developing grammatical fluency; formulating a thesis, and other steps toward writing expository essays. Students develop skills in evaluating, editing, and proofreading their writing. Intensive work in developing college-level reading skills. Gives attention to specific needs of students whose native language is not English as well as of native speakers of English. Small class size ensures students receive individualized attention.

ENGL 100. English Composition: Introduction to Academic Reading and Writing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Entrance is determined by placement test or completion of ENGL 096 with a grade of C or higher. Intended for students whose first language is not English but who have advanced level English language skills. Emphasizes writing college-level text-based essays, reading strategies, and advanced critical thinking. Special attention to strengthening skills in analysis and argumentation. Advanced vocabulary and grammar. Extensive practice in editing (proofreading) and revision skills. Frequent oral presentations. Some attention to rhetorical analysis and basic documentation. Small class size and weekly individual tutoring sessions ensure students receive individualized attention. Passing this course with a grade of C or higher satisfies the ENGL 101 General Education Requirement (GER).

ENGL 101. English Composition: Introduction to Academic Writing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Entrance is determined by placement-test score or completion of ENGL 099 with a grade of C or higher. This course provides an introduction to college-level writing, particularly the rhetorical dimensions of composition, including purpose, audience, occasion, and genre. The course also focuses on the writing process, asking students to brainstorm topics, to write drafts, and to revise their writing based on reflection and peer feedback. Activities in the course involve reading challenging articles, essays, and prose and considering paintings, films, and other visual compositions. Additionally, students work to analyze claims, to formulate independent arguments, and to communicate ideas through clear, well-organized writing.

ENGL 102. English Composition: Introduction to Writing for Research. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 100 with a grade of C or higher or ENGL 101 with a grade of C or higher. This course builds on the skills students learned and practiced in ENGL 101 and provides an introduction to writing using both primary and secondary sources. Emphasis is on developing research questions, finding and citing sources, conducting primary research, and synthesizing elements of research into persuasive arguments. Students also complete this course knowing how to correctly document and attribute sources.

HSS 404. Humanities, History and Social Sciences Senior Seminar. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. Restrictions: Registration requires senior standing. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students are required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HSS 405. Humanities Senior Seminar - Philosophy. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. Restrictions: Registration requires senior standing. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students will be required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HSS 406. Humanities Senior Seminar - English. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. Restrictions: Registration requires senior standing. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students will be required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HSS 407. Humanities Senior Seminar - Theater. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. Restrictions: Registration requires senior standing. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students will be required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HSS 408. Humanities Senior Seminar - Science, Technology, and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. Restrictions: Registration requires senior standing. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students will be required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HSS 409. Humanities Senior Seminar - Social Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students will be required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HSS 410. Humanities and Social Sciences Senior Seminar. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and 6 credits at the 300-level History and Humanities GER with a grade of C or higher; 3 credits at the 300-level may be taken concurrently as a co-requisite. Restrictions: Registration requires senior standing. The capstone seminars allow students the opportunity to work closely with an instructor in a specific area of the instructor's expertise. Students are required to bring together interests and skills developed in previous courses. Students make in-depth oral and written presentations. A list of capstone seminars is published each semester in the course registration bulletin.

HUM 2. Humanities Elective. 3 credits, 3 contact hours (3;0;0).**

HUM 211. The Pre-Modern World. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101 and HUM 102 with a grade of C or higher; HUM 102 may be taken concurrently as a co-requisite. Case studies focus on differing forms of material culture, belief systems, aesthetic norms, and artistic productions to develop an understanding of ancient and medieval world views. This course satisfies the three credit 200 GER in History and Humanities.

HUM 212. The Modern World. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 101 and HUM 102 with a grade of C or higher; HUM 102 may be taken concurrently as a co-requisite. Uses case studies to examine such key processes as the expansion of global trade and the formation of a global economy, European perceptions of non-Western cultures, and the roots and legacy of imperialism. This course satisfies the three credit 200 GER in History and Humanities.

HUM 232. Introduction to Film. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 with a C or higher. Corequisites: ENGL 102 with a C or higher, ENGL 102 may be taken concurrently as a co-requisite. An introduction to film studies, this course focuses on close verbal and visual analysis, and on critical writing. Students will consider a number of culturally and aesthetically significant films; make claims about how a film's content and form connect; and find and present evidence for such claims, becoming familiar with essential cinematographic techniques. Students will carefully consider their own writing at a slow pace, thereby refining their ability to communicate persuasively in a variety of settings.

LIT 230. Introduction to Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with a C or higher; ENGL 102 may be taken concurrently as a co-requisite. An introduction to literary studies, this course focuses on close reading and critical writing. Students will investigate and reflect on standard literary genres; make claims about how the content and form of each connect; find and present evidence for such claims. Students will carefully consider their own writing at a slow pace to understand, ultimately, how a literary text operates as a work of art, as well as to learn how to communicate powerfully and persuasively in a variety of settings. This course satisfies the three credit 200 GER in History and Humanities.

LIT 320. American Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A survey of major works of American literature. Provides a foundation for understanding the currents of American thought and experiences. Special emphasis is paid to American literature within a global context. This course satisfies the three credit 300 GER in History and Humanities.

LIT 321. British Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A survey of the major works of British literature. Provides a foundation for understanding the currents of British thought and experience. Special emphasis is paid to British literature within a global context. This course satisfies the three credit 300 GER in History and Humanities.

LIT 330. World Literature I: North America, Latin America and the Caribbean, Australia and Oceania. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Enhances understanding of other cultures and of past and contemporary global interactions. This course satisfies the three credit 300 GER in History and Humanities.

LIT 331. World Literature II: Africa and the Middle East, Asia, and Europe. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Enhances the under-standing of other cultures and of past and contemporary global interactions. This course satisfies the three credit 300 GER in History and Humanities.

LIT 340. Contemporary Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Focuses on the study of literary works published within the last ten years. Considers how contemporary issues and problems are addressed in a variety of literary works. This course satisfies the three credit 300 GER in History and Humanities.

LIT 350. Fiction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Explores the short story and the novel from varied countries and eras. Emphasis is given to narrative methods, representative themes, and global perspectives. This course satisfies the three credit 300 GER in History and Humanities.

LIT 352. 20th Century European Fiction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines themes ranging from war and occupation, revolution, Fascism, and Communism to individual liberation and self-discovery, existentialism, absurdism, and feminism. This course satisfies the three credit 300 GER in History and Humanities.

LIT 355. Poetry. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Explores the problems, devices, and techniques of poetry's sound, rhythm, meter; diction and tone; connotation, metaphor, and symbol? as a means of demystifying the reading of poems. Emphasis is given to the place and purpose of poetry in a technological society. This course satisfies the three credit 300 GER in History and Humanities.

LIT 361. 20th Century American Drama. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines the development of 20th century American drama with emphasis on the ways, often experimental, in which the playwrights reflect the spirit of the times. This course satisfies the three credit 300 GER in History and Humanities.

LIT 364. Modern Continental and British Drama. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An examination of some of the dramas from the late nineteenth and twentieth centuries with the purpose of gaining some understanding of how dramatists, in both subject matter and technique, reflect the spirit of the times. Representative playwrights include Ibsen, Shaw, Wilde, Strindberg, Synge, Chekhov, O'Casey, Pirandello, Anouilh, Brecht, Ionesco, and Pinter. This course satisfies the three credit 300 GER in History and Humanities.

LIT 365. Non-Fiction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines the ways that writers examine cultural issues through the use of literary non-fiction. Emphasis is placed on autobiographical, persuasive, and narrative techniques. This course satisfies the three credit 300 GER in History and Humanities.

LIT 370. Literature and Diversity. 3 credits, 3 contact hours (3;0;0).

LIT 372. African-American Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Allows students to explore themes and styles particular to literary works by and about African-Americans. This course satisfies the three credit 300 GER in History and Humanities.

LIT 374. Women and Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Allows students to explore literature by and about women from around the world. Special attention is paid to autobiographical narratives. This course satisfies the three credit 300 GER in History and Humanities.

LIT 376. Latin America through Art and Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course explores Latin American cultures through literature, film, music, and other art forms. It examines how twentieth and twenty-first century writers and artists responded to major social and political changes. Special attention is given to involvement of the United States in Latin America, immigration narratives, and issues involving individual and group identity. Knowledge of Spanish is not required; the course is taught in English. This course satisfies the three credit 300 GER in History and Humanities.

LIT 378. Literature and Nature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Literature as it reveals and interprets the natural world. Examines the ways that nature has been used in fiction, drama, poetry, and non-fiction. Students learn to describe the natural world in their writing. Co-listed as STS 378. This course satisfies the three credit 300 GER in History and Humanities.

LIT 380. Historical Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Sources of fiction and drama are often based on historical personalities and actual incidents. Examines a number of such works. Original historical material is compared with the literary work it inspired, thus providing insights into the nature of the creative process and the purposes of the historian and the creative writer. This course satisfies the three credit 300 GER in History and Humanities.

LIT 382. The Comic Tradition in English and American Literature. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Presents great comic works from the 14th century to the present. Students study verse narratives, plays, novels, and essays. Emphasis is given to the classical roots and international connections of the comic tradition in English, the relationship between form and function in comedy, and elucidation of comedy's social and philosophical ends. This course satisfies the three credit 300 GER in History and Humanities.

LIT 386. Science Fiction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Explores the distinctive characteristics of science fiction as a literary genre and its function as a social criticism. Special attention is given to the ways in which cultural gender coding surfaces in the text. Films and videos are used. This course satisfies the three credit 300 GER in History and Humanities.

LIT 388. The Russian Novel and Short Story. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Focuses on Russian fiction of the 19th and 20th centuries. Approaches material both as evidence of artistic vision and as social documents of Russian history. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 310. Logic. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Logic. Teaches students how to reason critically, identify issues, construct and evaluate arguments. Improves students’ ability to communicate effectively, both orally and in writing. Examines topics such as meaning and definition; explanations and arguments; informal logic and fallacies; and formal logic, including modern symbolic logic, truth tables, formal fallacies, proofs, and quantification. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 331. Problems in Philosophy. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An examination of problems of a social, ethical, esthetic, religious, and scientific nature, and a study of the related principles and methods of philosophy. Readings are chosen from a wide range of periods and schools from the Greeks to the present, with some application of philosophical analysis to individual and societal problems. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 333. Moral Philosophy. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A critical discussion of the history and fundamental elements of ethical thought. Examines topics such as the basic ethical theories, the nature of right and wrong, the significance of moral choice, the structure of the moral life, and the place of reason in ethics. Readings from both classical and modern philosophers. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 334. Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A philosophical examination of the nature of engineering practice and applied technology. Considers such questions as: How do the societal functions of engineers and the practical application of technologies relate to basic moral and intellectual values? What moral obligations are implied by the uses of technology? What are the ethical duties of engineers in the practice of their careers? How are technological practice and engineering related to questions about knowledge and reality? This course satisfies the three credit 300 GER in History and Humanities.

PHIL 335. Ethical Issues in Business. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with a grade of C or higher; ENGL 102 may be taken concurrently as a corequisite. An examination of the ethical problems and moral foundations of business from the perspective of moral philosophy. Among the questions explored are: What are the rights of employees and employers in the workplace? Do corporations and managers have an obligation to society at large? What is the relationship between personal and business morality? Is there a moral justification for the free market?.

PHIL 337. World Religions. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An introduction to five world religions which make strong claims to be in some sense universal: Hinduism, Judaism, Buddhism, Christianity, and Islam, with special attention to their impact on contemporary politics, gender, economics, and culture. Study of selected scriptures, major customs, representative figures, and one or two works of art from each religious tradition. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 350. Representative Philosophies. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The ideas of a few great thinkers, from a variety of historical periods. Shows at first-hand how these philosophers accelerated intellectual progress and how their work may contribute to the solution of modern problems. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 351. Biomedical Ethics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An examination of the ethical problems and moral foundations of medicine. Among the issues explored are the changing nature of the doctor/patient relationship, increased patient autonomy, advance directives, the rationing of care, doctor-assisted suicide, and "the right to die." This course satisfies the three credit 300 GER in History and Humanities.

PHIL 355. The Philosophy Of Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An investigation into the foundations and implications of modern science, with special emphasis on the influence of philosophy on scientific thought, and on philosophic questions. This course satisfies the three credit 300 GER in History and Humanities.

PHIL 380. Philosophy of Language. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines tradition, formation and change in the ways that language shapes thought. Special attention is paid to the relationships between language and religion, as well as language and science. This course satisfies the three credit 300 GER in History and Humanities.

PSY 2. Psychology Elective. 3 credits, 3 contact hours (3;0;0).**

PSY 201. Orientation to Psychology as a Behavioral Science. 3 credits, 3 contact hours (3;0;0).
This course will serve as an orientation to psychology in general and cyberpsychology in particular. Students will examine theories and research related to career and professional development. Topics include the utility of career development theory, the nature of the world of work, evaluation of career information, and the role of empirical research in career development theory and practice. Students will also use self-assessments of interests, goals, and strengths as they relate to career and vocational opportunities.

PSY 210. Introduction to Psychology. 3 credits, 3 contact hours (3;0;0).
Introduction to the study of human behavior. Topics include motivation, perception, learning, cognitive development, personality and emotion, individual difference, and biological basis of behavior, as well as methodology in psychological research. This course can be used to satisfy either the three credit 200 GER in History and Humanities or the three credit GER in Social Sciences, but not both.

PSY 215. Biology of Behavior. 3 credits, 3 contact hours (3;0;0).
Pre or Corequisite: PSY 210. This course provides a general introduction to the underlying biological principles and mechanisms that give rise to complex human behaviors. Topics include neurons, neural communication, brain structure and function, processing in sensory systems, cognitive neuroscience, and neural and hormonal influences on health and emotion. This course focuses on emerging methods and approaches to an integrated understanding of complex behavior, with an emphasis on applications for STEM professional practice.

PSY 3. Psychology Elective. 3 credits, 3 contact hours (3;0;0).**

PSY 321. Social Psychology. 3 credits, 3 contact hours (3;0;0).
Pre or Corequisites: PSY 210. Social psychology is the study of how individuals affect and are affected by other people and by their social and physical environments. Social psychology helps us to understand and explain how our thoughts, feelings, and behaviors are influenced by the actual, imagined, and implied presence of others. Social psychology is the recognition that human responses are influenced by social situations, in addition to, the products of our individual personalities. Social psychologists study interpersonal and group dynamics and social challenges, such as prejudice, implicit bias, bullying, criminal activity and substance abuse. They research social interactions and the factors that influence them, such as group behavior, attitudes, public perceptions and leadership. This course will provide students an introduction and overview of research and theory in social psychology. This course does not satisfy the three credit 300 GER in History and Humanities.

PSY 333. Principles of Psychometrics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PSY 210. Corequisites: STS 307A. This course exposes students to the scientific methods by which psychologists strive to conceptualize, operationalize, and measure human behavior in such areas as skills, aptitudes, attitudes, values, personality, and intelligence. The course emphasizes an epistemological approach to psychometric theories in order to develop a critical language as well as to define the limitations of psychological measurement. Topics include reliability, validity, scale development, and applications of psychometric assessment in applied, clinical, and research contexts.

PSY 339. Psychology of Diversity. 3 credits, 3 contact hours (3;0;0).
Pre or Corequisites: PSY 210. This course will provide a comprehensive introduction to psychological theories and research related to identity, group dynamics, and diversity. This course explores the relationship between psychology and identity, including group and identity formation, stereotyping, prejudice, stigma, intergroup contact, and multiculturalism. Students will examine diversity as constituted through intersections of social categories such as race, gender, ethnicity, nationality, age, language, citizenship, religion, class, sexual orientation, physical ability, etc. with an emphasis on structural agency, power, and privilege. This course does not satisfy the three credit 300 GER in History and Humanities.

PSY 358. Moral Psychology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An introduction to moral philosophy with emphasis on the biological and psychological mechanisms underlying moral thought, judgment and action. Topics covered include altruism and egoism; utilitarianism, deontology and virtue ethics; the situationist critique of character; and agency and responsibility. Readings draw from classical and contemporary philosophers as well as from current empirical psychology. This course satisfies the three credit 300 GER in History and Humanities.

PSY 359. Foundations of Cyberpsychology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Introduction to the study of the effects of the Internet and cyberspace on the psychology of individuals and groups. Some topics covered include online identity, online relationships, personality types in cyberspace, transference to computers, addiction to computers and the Internet, regressive behavior in cyberspace, and online gender-switching. This course satisfies the three credit 300 GER in History and Humanities.

PSY 361. Found of Cyberpsychology II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PSY 359. Pre or Corequisites: PSY 210. This course applies the behavioral and psychological sciences to study of the effects of the internet and contemporary information and communication technologies (ICTs) on individuals and groups. Topics include artificial intelligence, robotics, big data and machine learning, artificial and virtual realities, telepsychology, health applications of ICTs, distance learning and professional development, online assessment and evaluation, online research, and data analytics.

PSY 389. Psychopathology. 3 credits, 3 contact hours (3;0;0).
Pre or Corequisites: PSY 210. This course addresses psychopathology from multiple frames including biological, developmental, cultural, and interactional. Students will study psychopathology from an individual descriptive, symptom logic perspective, as well as from a contextual, systemic perspective including developmental hallmarks, familial patterns, and sociocultural contributors. Readings about traditional diagnostic approaches and alternative approaches to assessment will be examined. Students will critically examine assessment, diagnosis, treatment, and evaluation of success.

PSY 490. Co-op Work Experience. 3 credits, 3 contact hours (3;0;0).
Restrictions: Senior standing and departmental approval. Students gain major-related work experience and reinforcement of their academic program. Work assignments are facilitated and approved by the co-op office. Requires mandatory participation in seminars and completion of a report. Note: Normal grading applies to this co-op experience.

PSY 491. Research and Independent Study. 3 credits, 3 contact hours (3;0;0).
Restrictions: Senior standing and departmental approval. Research in forensic science. Each student works under the supervision of a forensic science or associated faculty member. A research paper or poster are required.

PSY 495. Senior Seminar. 3 credits, 3 contact hours (3;0;0).
Restrictions: Senior standing and departmental approval. Offers cyberpsychology students the opportunity to enhance their understanding of professional practice through their integration of skills and knowledge gained in prior courses. The resultant research paper and presentation represents the culmination of the undergraduate disciplinary experience. Guest speakers will be invited to present on topics relevant to their area of expertise within the field of the behavioral and psychological sciences.

STS 2. Science Tech and Society Elect. 3 credits, 3 contact hours (3;0;0).**

STS 201. Understanding Technological Society. 3 credits, 3 contact hours (3;0;0).
A problem-centered and task-oriented course that integrates social science theory and practice into the leading public issues of a technological society. Students learn critical thinking through hands-on assignments. The course emphasizes student understanding of social institutions that directly affect technological development and professional careers. This course can be used to satisfy either the three credit 200 GER in History and Humanities or the three credit GER in Social Sciences, but not both.

STS 205. Intro to Research Methods. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENGL 102 with a grade of C or higher. This course is intended to give second year undergraduate students an understanding of what research is, what it is used for, how it is conducted, and how it is reported. It provides an overview of applying the scientific method to real-life research, including ethical concerns, qualitative and quantitative methods (and how and when they should be used), and how to critically evaluate published research findings. This course can be used to satisfy either the three credit 200 GER in History and Humanities or the three credit GER in Social Sciences, but not both.

STS 221. Introduction to Sociology. 3 credits, 3 contact hours (3;0;0).
An examination of modern society and culture, analyzing the forces for stability and change. Topics covered include the individual and society (socialization, conformity, alienation, and class structure), social institutions (religion, law, education, family, and state), social processes (conflicts and harmony, cohesion and dissolution, power, authority, and revolution), urbanization, industrialization, and technological change. This course can be used to satisfy either the three credit 200 GER in History and Humanities or the three credit GER in Social Sciences, but not both.

STS 230. Introduction to Anthropology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with a grade of C or higher. Corequisites: ENGL 102 may be taken concurrently as a co-requisite. This course is an introduction to the discipline of Anthropology, to include the subfields of Cultural Anthropology. Physical Anthropology, Archeology, and Linguistic Anthropology. Anthropology is the study of the human species with the subfields united in their focus on culture. Physical (or Biological) Anthropology studies the evolution of the species that has resulted in its capacity for having culture. Archeology studies the preserved artifacts from past human societies to discover the cultures of prehistoric times. Linguistic Anthropology studies the development and use of languages, and how language is related to other aspects of culture. Cultural Anthropology studies the systems of culture in contemporary social groups, analyzing their similarities and difference. This course satisfies the three credit GER in Social Sciences.

STS 257. Technology, Society and Culture: An American View. 3 credits, 3 contact hours (3;0;0).
This course will examine several key cases in the way technology fits into society. The politics, sociology, and ethics of technological development will be investigated. Topics include several significant advances of the twentieth century: nuclear warfare, fast food, the simplicity movement, and futuristic enhancement. What do all these things have to do with one another? This course satisfies the three credit 200 GER in History and Humanities.

STS 258. Technology, Society and Culture: A Global View. 3 credits, 3 contact hours (3;0;0).
This course will investigate the issues and problems inherent in the globalization of technology and culture at the beginning of this new millennium. Countries and economies are becoming more entwined in each other’s identities and economies, and cultural diversity is both threatened and proliferating at one and the same time. How much can the world's markets continue to grow and connect? How does the spread of information change what we know about one another? Should we be afraid of progress? Does the world understand the United States? Do we understand the world? How can "Growth" or "development" be sustained? How can we guide its change? This course satisfies the three credit 200 GER in History and Humanities.

STS 300. Legal Reasoning, Writing, and Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Integrates the process of legal research and fundamentals of legal writing with analysis of law. Focuses upon legal reasoning through analysis of fact and upon the logic of law in judicial opinions, statutory construction, and constitutional interpretation as contemporary issues are analyzed. This course satisfies the three credit 300 GER in History and Humanities.

STS 301. Independent Study. 1 credit, 3 contact hours (0;0;3).
Prerequisites: Junior standing in the STS program and written approval of the program director. Consists of self-paced study on an individual or small group basis in a specific area integral to a student's STS concentration but not available on a regular course basis. This course does not satisfy the three credit 300 GER in History and Humanities.

STS 302. Independent Study. 2 credits, 3 contact hours (3;0;0).
Prerequisites: Junior standing in the STS program and written approval of the program director. See STS 301. This course does not satisfy the three credit 300 GER in History and Humanities.

STS 303. Independent Study. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Junior standing in the STS program and written approval of the program director. See STS 301. This course satisfies the three credit 300 GER in History and Humanities.

STS 304. Qualitative Research Methods in the Social and Behavioral Sciences. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Develop skills for collecting and evaluating social scientific data using qualitative research methods including content analysis, case study techniques, participant observation, ethnographies, interviews, survey design, and focus groups. The course also highlights essential issues pertaining to recruitment of research respondents and ethical fieldwork practices. This course satisfies the three credit 300 GER in History and Humanities.

STS 304A. Qualitative Research Methods Lab. 1 credit, 2 contact hours (0;2;0).
Corequisite: STS 304. This course is the laboratory component of STS 304 and must be taken concurrently.

STS 306. American Mosaic: Understanding Cultural Diversity. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An examination of multiculturalism in the United States. The course provides students with a methodological framework for understanding cultural diversity in the United States and around the world. This course satisfies the three credit 300 GER in History and Humanities.

STS 307. Quantitative Research Methods in the Social and Behavioral Sciences. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Focuses on quantitative research methods in the field of science, technology and society including basic statistical techniques for empirical data analysis. The course provides instruction in hypothesis testing, data collection, selection of appropriate instruments and techniques, experimental design, and quantitative modeling using statistical software. This course satisfies the three credit 300 GER in History and Humanities.

STS 307A. Quantitative Research Methods Lab. 1 credit, 2 contact hours (0;2;0).
Corequisite: STS 307. This course is the laboratory component of STS 307 and must be taken concurrently.

STS 308. Globalization. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course will investigate the issues and problems inherent in the globalization of technology, economics, and culture in this new century. Introduces the important public issues that technology brings to the modern world, such as global trade, new energy technologies, and climate change. Emphasizes the close connections between science and technology, social institutions, and cultural values. Also analyzes today's "global village", the changing relations in culture and trade between East and West, North and South. This course satisfies the three credit 300 GER in History and Humanities.

STS 309. Advocacy and the Law. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Offers opportunities to explore the retrieval and use of legal and law-related materials while developing skills in oral advocacy and in writing persuasive legal documents, such as motion memoranda and briefs. Includes learning to listen to participants in the legal process as well as developing effective styles and forms of speech in the classroom. This course satisfies the three credit 300 GER in History and Humanities.

STS 310. Technology and Human Values. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines the interactions between science, technology and human values. Specifically, explores psychological, moral, and philosophical consequences of, and humanistic responses to, technological change. Readings, essays, fiction, and research articles treat such topics as the philosophical foundations of modern science, scientism, technicism; the impact of technology on images of man found in modern literature; and the moral implications of various kinds of recent technology. This course satisfies the three credit 300 GER in History and Humanities.

STS 311. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op Office. Mandatory participation in seminars and completion of a -report. Note: Normal grading applies to this COOP Experience.

STS 312. Technology and Policy in Contemporary America. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. A study of technology and politics in recent America. Focuses on the role of the federal government in shaping technology, especially through funding technological innovations and applications. Topics will include the origins of technology policy in World War II, the influence of the Cold War, the science and technology policy advisory system, and political and cultural influences on technology policy. This course satisfies the three credit 300 GER in History and Humanities.

STS 315. Sports, Technology and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course addresses philosophical and sociological issues surrounding sports, especially questions that arise with advances in technology. For instance: How do advances in technology affect sports? Should sports limit technology, or should they adapt and change with advances in technology? Should performance-enhancing drugs be allowed in sports? What about other forms of technological enhancement? How should we judge sports performance, and how could technology help? Can technology make sports safer? How do various media affect sports? This course satisfies the three credit 300 GER in History and Humanities.

STS 316. Mass Communications, Technology and Culture. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Uses the tools of the humanities and social sciences to study the interplay between technology and mass culture. Focuses on motion pictures, electronic music, and television as both technologies and as forms of art. Devotes special attention to the portrayal of science and technology in the media. This course satisfies the three credit 300 GER in History and Humanities.

STS 318. Educational Media Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IT 201. Educational Media Design employs the instructional principles of constructivist pedagogy as the process used to develop a solution to develop courseware for K-12 audience. The course builds on the participatory design model of software engineering in order to develop integrated learning environments that support visual and verbal literacy; enables student to be able to plan, organize, and systematically develop instructional materials. This course implements instructional design theory and pedagogy in order to create an actual application for a computer-based environment. Same as IT 380. This course does not satisfy the three credit 300 GER in History and Humanities.

STS 325. ST:. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An in-depth examination of a current STS issue. A new topic is addressed each time the course is offered. This course satisfies the three credit 300 GER in History and Humanities.

STS 342. Gender, Technology and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course uses an interdisciplinary and intersectional approach to analyze how gender identities are constructed and contested in the world today, with special emphasis on gender issues in the high-tech workplace. Course topics include: essentialist and social constructionist theories of gender identity; transgender identities; the interrelationship between sexism, homophobia and racism; the historical contributions of women and underrepresented minorities in science, technology, architecture and design; issues facing women in technologically-developing countries; and communication in the workplace between people of different cultures and identities. Course materials include case studies and autobiographical narratives, films, novels, and short stories as well as historical and sociological research work. This course satisfies the three credit 300 GER in History and Humanities.

STS 344. Communications Policy. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Study of communication environments and developing communications technologies as central elements of evolving political and social systems. Analysis of philosophical, military, economic, and technical premises for communications policy and the process of regulation. This course satisfies the three credit 300 GER in History and Humanities.

STS 346. Pragmatism and Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines the relationship between the American philosophy of pragmatism and the role of technology in the contemporary world. How do philosophical ideas affect the development of technology and science? How has pragmatism shaped the current view of the meaning and value of technological progress? Readings from both the traditional authors of American pragmatism--Peirce, James, and Dewey--and contemporary texts. This course satisfies the three credit 300 GER in History and Humanities.

STS 347. Music and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one Cultural Literacy GER 200 level course with a grade of C or higher. This course is an overview of the role music has played in society, from ancient to present times, and considers various types: Western, Eastern, folk, world, classical, jazz, rock, and electronic. The course enables students to develop an informed and critical appreciation of the vast array of music available today and its importance in political and social discourse and influence. Also covered is the role that technology has played in transforming how we experience and create music, from the development of the earliest musical instruments to the Internet. Students will have extensive opportunities to listen to and write about music. This course satisfies the three credit 300-level GER in Cultural Literacy.

STS 349. Electronic Music in Practice. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Students will learn the basics of notebook computer-based music composition and production. Emphasis will be on composition and making of music, learning the aesthetics necessary to get the most out of your machine. Course will require extensive work on your own laptop computer. Computer requirements: A PC or Macintosh system running Ableton Live. This course satisfies the three credit 300 GER in History and Humanities.

STS 350. Computers and Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Examines the societal diffusion of computing and the role of computers in processes of social change. Special consideration is given to how computers have contributed to the emergence of new work routines, social practices, and mobility patterns. This course satisfies the three credit 300 GER in History and Humanities.

STS 351. Minds and Machines. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An introduction to the philosophy of mind and cognitive science. Topics covered include the computational theory of mind; artificial intelligence; connectionism; embodied theory of mind; and dynamical theories of mind. Readings from recent and contemporary philosophy, psychology and computer science. This course satisfies the three credit 300 GER in History and Humanities.

STS 352. Race and Ethnicity. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Explores the concepts of race and ethnicity in both national and international arenas. Scientific, sociological, political, and global implications are addressed. Upon completion of this course, students will be able to competently address the impact of race on micro and macro levels, from both individual and policy perspectives. Special topics are negotiated with students at the start of each class. Such topics can include immigration, affirmative action, educational curricula, institutional racism, or the impact of multiculturalism on families. Emphasis is on the interaction between race and technology. This course satisfies the three credit 300 GER in History and Humanities.

STS 360. Ethics and the Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An examination of contemporary environmental problems from the perspective of ethics or moral philosophy. An analysis of the ethical presuppositions and value principles underlying environmental policy. The study of ethical theories and their application to the environmental crisis. This course satisfies the three credit 300 GER in History and Humanities.

STS 362. Environmental Economics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher, and ECON 201 with a grade of C or higher. Presents a detailed overview of the relationship between political economy and the environment. Draws on diverse case studies including global warming, harvesting of minerals on the ocean's floor, destruction of old growth forests, and contamination of the nation's water, air, and soils. Explores the economic remedies to the fast-changing relationship between society and nature. This course does not satisfy the three credit 300 GER in History and Humanities.

STS 363. Introduction to Sustainability Studies. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The course introduces students to sustainability studies, examines the roots of the concept, and explores its roles as feature of international politics. Particular attention is devoted to the economically, advanced nations and the challenges of planning for a more sustainable future. The course also considers how the sustainability agenda is likely to evolve in an era of climate change and biophysical constraints. This course satisfies the three credit 300 GER in History and Humanities.

STS 364. Sustainability Policy and Practice. 3 credits, 3 contact hours (3;0;0).
Prerequisites: STS 201, EPS 202 and STS 363, each with a grade of C or better. Formulation of effective sustainability policies requires appreciation of the linkages between conceptual understanding and empirical practice. The course highlights the macroeconomic drivers of contemporary sustainability challenges. Topics discussed include efficiency improvements, economic relocalization, green consumerism, and efforts to build a green economy.

STS 365. Animal Intelligence and Ethics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This course offers a detailed look into contemporary debates in Animal Ethics and the Philosophy of Animal Minds. These debates are inherently multi-disciplinary, ranging from questions in evolutionary biology, ethology, cognitive science, developmental psychology, and artificial intelligence. This course investigates and demythologizes the concept of “human nature” by drawing cognitive and moral similarities between species. This course satisfies the three credit 300 GER in History and Humanities.

STS 375. AI and the Human Mind. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. What does it mean for a machine to know? What does this say about the possibility of human knowledge? In this course, we will explore what artificial intelligence (or, AI) is, how it works, how the field has developed, how the specific technical implementations of AI influence and are influenced by sociocultural factors, what barriers exist to AI research, what threats AI development may pose, and what AI can tell us about ourselves. This is not a programming course, and although some attention will be paid to AI technologies and algorithms, no coding will be involved. This course is appropriate for students at any level of previous AI experience. This course satisfies the three credit 300 GER in History and Humanities.

STS 376. Cyborg Society. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher and one 200-level Social Science or Cultural Literacy GER course with a grade of C or higher. A cyborg, short for cybernetic organism, is a human being with technological enhancement or augmentation that improves the human body beyond its natural state. This course looks at ourselves as cyborgs and human enhancements from prosthetic, biological, nano-technological, informational, and computational technologies. Cyborg theory requires us to reevaluate the boundaries of the self such as differences between humans and machines, humans and animals, male and female. Topics include cyborg theory's impact on politics, gender, race and ethnicity, space travel, war, the prescience of science fiction, and the exponential growth of future cyborg technology. This course can be used to satisfy either the three credit 300 GER in History and Humanities or the three credit GER in Social Sciences, but not both.

STS 378. Literature and Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Literature reveals and interprets the natural world. Students examine the ways that nature has been used in non-fiction and fiction. Students also learn the challenge of describing the natural world in their own words. Representative writers include Percy Shelley, Henry David Thoreau, Octavio Paz, Denise Levertov, Gary Snyder, Joyce Carol Oates, and Annie Dillard. Co-listed as LIT 378. This course satisfies the three credit 300 GER in History and Humanities.

STS 380. Policy Issues in the Coastal Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. An examination of coastal environments from the standpoint of the scientist, the engineer, and the resource manager. Topics include beach and shoreline characteristics, technological innovations to address coastal erosion problems, and current debates in coastal policy and resource management. Case studies are used to illustrate coastal management practices and the scientific, technical, and social constraint to policy formulation. This course satisfies the three credit 300 GER in History and Humanities.

STS 382. Geographical Perspectives on the Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisites: HUM 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Designed to introduce students to the field of geography. Focuses on the natural processes that sculpt the physical and biological terrain, and the environmental interrelationships between human societies and nature. Combining physical, human and environmental perspectives on the earth's surface, explores, in depth, topics such as famine, societal response to natural and technological hazards, and water issues in the United States. This course satisfies the three credit 300 GER in History and Humanities.

STS 401. Independent Study. 1 credit, 3 contact hours (0;0;3).

STS 403. Independent Study. 3 credits, 3 contact hours (0;0;3).
This course satisfies the three credit 300 GER in History and Humanities.

STS 411. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: STS 311 or its equivalent with a grade of C or better, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience. Mandatory participation in seminars and completion of requirements that include a report and/or project. Note: Normal grading applies to this COOP Experience.

STS 490. Project and Seminar I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: senior standing in the STS program. Each student undertakes a comprehensive study of an issue in science technology and human affairs. The solution requires application of knowledge and skills acquired in course work, self-study, and library research as well as consultation with persons in the academic community, industry, and government. The completed study is submitted as a detailed written report. The seminar meets weekly. Speakers from education, government, and industry address themselves in topics of current interest to STS students.

STS 491. Project & Seminar II. 2 credits, 4 contact hours (0;0;4).
Prerequisite: STS 490. A continuation of STS 490.

STS 492. Technology and the Future of Work. 2 credits, 3 contact hours (2;0;1).
Prerequisites: Senior status and permission of the program director. The course examines and evaluates our digital society, computerization, automation, artificial intelligence, and emerging technologies and explores how they are changing the nature of work, the societal understanding of work and the workplace, and the anticipated impacts on individuals, communities, culture, economics, and society. The course introduces ideas and theories and evaluates the relationship between technology, automation, society, and work.

THTR 1. Theatre Elective Lowe Div. 3 credits, 3 contact hours (3;0;0).**

THTR 101. Living Theatre. 3 credits, 3 contact hours (3;0;0).
An introduction to the basic elements of theater through an examination of the roles of the playwright, director, designer, and actor. Attend select current plays and professional productions.

THTR 102. Acting Fundamentals. 3 credits, 3 contact hours (3;0;0).
Developing acting skills in a studio environment. Work with improvisation comedy and drama, scene study based on known contemporary and classical plays, and basic theater exercises that develop physical skills for character development and performance endurance. Emphasis on vocal skills using presentation exercises and theatrical audition techniques will be developed through the class.

THTR 2. Theatre Elective Lower Div. 3 credits, 3 contact hours (3;0;0).**

THTR 208. Movement for Theatre. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a corequisite. Introduces skill-oriented movement exercises through an exploration of the physical nature of acting and character work. Movement is basic to actor training. The movement exercises used in this course will explore not only the physical age of the characters from plays chosen in class, but also work with the character social movements based on the cultural history of the times the plays were written or the historical period they represent. This course satisfies the three credit 200 GER in History and Humanities.

THTR 209. Voice and Speech for Theatre I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a corequisite. The objective of the course is for students to learn to use voice as a vocal instrument. Beginning with breath control, students learn how to project the voice, the use of resonators, and the placement of the voice in space. This is an essential training for the actor or public speaker. Exercises will be generated from plays from around the world. The character work from these plays will include the study of dialects, sustainability, phonetics, and culturally specific vocals. This course satisfies the three credit 200 GER in History and Humanities.

THTR 210. Voice & Speech for Theater II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a co-requisite Working with plays, poetry, and narratives, students learn to analyze texts vocally and to explore the relationship between physical and vocal expression. This course satisfies the three credit 200 GER in History and Humanities.

THTR 212. From Page to Stage. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a co-requisite. The course is an introduction to understanding the relationship between the literary nature of plays and how they are produced for the stage. Attendance to current professional productions and on-campus productions will be used as a launching point for class papers, discussions, and exercises. This course satisfies the three credit 200 GER in History and Humanities.

THTR 213. Directing I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken as a corequisite. Students will learn major directoral techniques in the production of short plays and other workshop scenarios. There is an emphasis on the process of synthesizing theatrical elements of direction in order to oversee and orchestrate the mounting of a theater production. The goal of the course is for students to learn what directors do to ensure the quality and completeness of theater production by collaborating with a team of individuals involved in stagecraft, costume design, props, lighting design, acting, set design, stage combat, and sound design for the production. This course satisfies the three credit 200 GER in History and Humanities.

THTR 215. Acting II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a corequisite. Advanced scene study, audition techniques, and ensemble techniques are explored. Interpretation of scenes from selected dramas for stage performance, evaluation of practiced techniques in character portrayal through dialogue and action. Participation in a performance workshop is stressed. This course satisfies the three credit 200 GER in History and Humanities.

THTR 216. Improvisational Theatre Short Form. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a corequisite. THTR 216 introduces the techniques of short-form improvisational performance through in-class practical exercises that promote spontaneity and creative space work. Students work with game structure and short narratives leading to public performances so the student gains insights only the live setting can impart. This course satisfies the three credit 200 GER in History and Humanities.

THTR 217. Improvisational Theatre Long Form. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 101 and ENGL 102 with grades of C or higher; ENGL 102 may be taken concurrently as a corequisite. This course includes exercises that promote long-form interactive narrative and story development skills. In addition to exploring storytelling this technique is used in other media such as, music, movement, and film. The students will perform multiple times getting feedback only a live show can give. This course satisfies the three credit 200 GER in History and Humanities.

THTR 220. Instr Ensemble Performance I. 1 credit, 3 contact hours (0;3;0).
Prerequisite: permission of course coordinator and conductor. This course involves membership in an instrumental music group led by a professional conductor. The group will meet once a week to rehearse concert pieces. Students must play an instrument with a significant level of accomplishment in order to register for this course. There will be continuous assessment of individual performance by the conductor and a final concert in a campus venue. This is one of three performance courses. Musicians may join one or more of these ensembles, wind, string, jazz, etc. In order to register for this course, contact instructor for permission. This course does not satisfy the three credit 300 GER in History and Humanities.

THTR 221. Instr Ensemble Performance II. 1 credit, 3 contact hours (0;0;3).
Prerequisite: permission of course coordinator and conductor. This course involves membership in an instrumental music group led by a professional conductor. The group will meet once a week to rehearse concert pieces. Students must play an instrument with a significant level of accomplishment in order to register for this course. There will be continuous assessment of individual performance by the conductor and a final concert in a campus venue. This is one of three performance courses. Musicians may join one or more of these ensembles, wind, string, jazz, etc. In order to register for this course, contact instructor for permission. This course does not satisfy the three credit 300 GER in History and Humanities.

THTR 222. Instr Ensemble Performance III. 1 credit, 3 contact hours (0;0;3).
Prerequisite: permission of course coordinator and conductor. This course involves membership in an instrumental music group led by a professional conductor. The group will meet once a week to rehearse concert pieces. Students must play an instrument with a significant level of accomplishment in order to register for this course. There will be continuous assessment of individual performance by the conductor and a final concert in a campus venue. This is one of three performance courses. Musicians may join one or more of these ensembles, wind, string, jazz, etc. In order to register for this course, contact instructor for permission. This course does not satisfy the three credit 300 GER in History and Humanities.

THTR 261. Performance I. 3 credits, 3 contact hours (3;0;0).
Departmental approval required. A lecture/workshop that combines class with a play production. An in-depth study of the author of the play and contemporaries of his/her time will be made throughout the semester. A different style or genre of theater is studied each term the course is offered based on the chosen mainstage production. This course satisfies the three credit 200 GER in History and Humanities.

THTR 262. Performance II. 3 credits, 3 contact hours (3;0;0).
Departmental approval required. A study will be made of the chosen playwright, contemporaries of the writer, and an in-depth study of costume design, music of period, and set design of the play chosen for production. A production team will coordinate the main stage production. This course satisfies the three credit 200 GER in History and Humanities.

THTR 310. Theatre History I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Study of Euro-American theater history from Greece and Rome through early post-Renaissance Europe. The course covers the dramatic literature of the times and how the socioeconomic influences reflect the theatrical style, community interaction, and the technical uses of stage devices. This course satisfies the three credit 300 GER in History and Humanities.

THTR 315. Theatre History II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Study of Euro-American theatre history from post-Renaissance Europe to present. Dramatic literature will be related to the historical events that reflect theatrical style, political movements, and technical advancements in society. This course satisfies the three credit 300 GER in History and Humanities.

THTR 344. American Musical Theater. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Course covers the development of American Musical Theatre decade by decade, starting with the turn of the 20th century until the present day. Examples of music and lyrics are demonstrated in class and students attend contemporary and revival Broadway musicals. This course satisfies the three credit 300 GER in History and Humanities.

THTR 360. Drama. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Follows the development of play structure from folkloric origins to contemporary theater. Emphasis is on text, history of text development, and the changing purpose of theatrical presentations. This course satisfies the three credit 300 GER in History and Humanities.

THTR 362. Non-Western Drama. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Explores classical and contemporary theater and drama in China, Japan, India, Africa, and the Middle East. This course satisfies the three credit 300 GER in History and Humanities.

THTR 363. Ethnic and Minority Drama. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Using contemporary dramas as social, historical, and cultural artifacts, examines the experience of Latinos, Asian Americans, Native Americans, and African Americans. This course satisfies the three credit 300 GER in History and Humanities.

THTR 364. Technology in Performance. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. Interdisciplinary course in a theatre area (e.g., acting, improvisation, writing, design, audio, lighting, etc.) to work with another department or program using an enhanced technology component (e.g., CGI, motion capture, electronic circuitry, media, etc.) to explore and develop alternative ways of presenting performances in a live setting. This course satisfies the three credit 300 GER in History and Humanities.

THTR 365. Principles of Playwriting. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The course objective is to write and rewrite three short plays during the semester. These new plays will have a first reading and a staged reading in the classroom, followed by analytical discussions about playwriting and the craft's applied techniques. Students will attend two professional plays and write subsequently one experience paper and one research paper; attend both campus shows for discussion and in-class improvisational playwriting exercises. The original plays developed in class will be submitted by the student for playwriting competitions at the end of the semester. This course satisfies the three credit 300 GER in History and Humanities.

THTR 384. Musical Theater Adaptations. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The content of this course is primarily literary. It examines the original texts that are used for theatrical adaptations in contemporary Broadway and Off-Broadway musicals. The origin stories are drawn from literature, graphic novels, and cultural folk stories. Students will attend selected musicals. This course satisfies the three credit 300 GER in History and Humanities.

THTR 396. Internship-Theater. 3 credits, 3 contact hours (0;0;3).
Open to junior or senior Theater majors or minors or Communication majors with Theater Specialization. Permission of division director or faculty advisor in conjunction with the instructor directing the course. The internship is with a professional performing or media arts organization. The student is expected to work with the host company for professional experience.

THTR 411. Special Topics in Theatre. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This specialty course will feature a different aspect of theater each semester depending on the area of expertise of the instructor. Some examples: The course could cover playwriting, advanced playwriting, film writing, and musical theater techniques, advanced theater directing, auditioning skills, advanced acting or acting: history and practice.

THTR 414. Directing II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: THTR 213 or departmental approval. Assistant directing main stage production with faculty director or other independent directing project. Intense study of directing style through practice and research.

THTR 465. Performance II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: THTR 261 or THTR 262 and ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. This is an advanced study of one playwright's work leading to a performance of one of his/her plays. A study will be made of the chosen playwright, contemporaries of the writer, and an in depth study of costume design, music of period, and set design of the play chosen for production.

THTR 480. Independent Theatre Practicum. 2 credits, 4 contact hours (0;0;4).
Prerequisites: ENGL 102 with a grade of C or higher, and one History and Humanities GER 200 level course with a grade of C or higher. The core of this course is a supervised and assigned independent involvement in a main stage production, which is pre-approved by an instructor. The student will take a leadership role and participate in pre-production activities all the way through to the conclusion of production of the show. An ongoing journal of activities is required to be submitted at the end of the production process. The production work will be in one of the following areas: performance, dramaturge, stage management, design, props, public relations or other areas related directly to the designated main stage production.

THTR 483. Independent Study in Theater I. 3 credits, 3 contact hours (0;0;3).
By arrangement only through a theater faculty advisor, the student will take on a specialized creative theater project for the semester. This would cover a specific aspect of theatrical production development and cumulate in one of the following depending on the nature of the assignment: a journal or portfolio of completed production work, an original play or screenplay script, or research document.

THTR 484. Independent Study in Theater II. 3 credits, 3 contact hours (0;0;3).
This course is for junior and seniors only by arrangement through a theater faculty advisor. The student will take on a more advanced specialized creative theater project for the semester. As this would cover a specific aspect of theatrical production development, the student will be expected to take on a leadership role in the chosen area of study. Documentation of the project development and completion is required.

B.A. in Communication and Media

First Year		
1st Semester		**Credits**
Select one of the following:		3
CS 103	Computer Science with Business Problems	
CS 104	Computer Programming and Graphics Problems	
CS 113	Introduction to Computer Science	
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 101	Foundations of Mathematics for the Liberal Arts	3
Natural Science GER (p. 113)		3
Natural Sciences Lab:GER Elective		1
Social Sciences GER (p. 114)		3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
History and Humanities GER 200 level (p. 106)		3
MATH 105	Elementary Probability and Statistics	3
ENGL 102	English Composition: Introduction to Writing for Research	3
Natural Science GER (p. 113)		3
Free Elective 1		3
	Term Credits	**15**
Second Year		
1st Semester		
COM 303	Video Narrative [1]	3
COM 353	Composing Documents for Print	3
Technology Elective		3
Free Elective 2		3
Free Elective 3		3
	Term Credits	**15**
2nd Semester		
HIST 345	Communication through the Ages	3
COM 354	Composing Documents for the Web	3
COM 339	Practical Journalism	3
Technology Elective		3
Track Option Elective 1		3
	Term Credits	**15**
Third Year		
1st Semester		
COM 355	Cybertext	3
History and Humanities GER 300+ level (p. 108)		3
Track Option Elective 2		3
Track Option Elective 3		3
Free Elective 4		3
	Term Credits	**15**
2nd Semester		
STS 349	Electronic Music in Practice	3
COM 312	Oral Presentations	3

History and Humanities GER 300+ level (p. 108)		3
Track Option Elective 4		3
Free Elective 5		3
	Term Credits	**15**
Fourth Year		
1st Semester		
COM 318	Communication Theory	3
COM 490	Co-op Work Experience I	3
Track Option Elective 5		3
Track Option Elective 6		3
Free Elective 6		3
	Term Credits	**15**
2nd Semester		
COM 491	Co-op Work Experience II	3
COM 496	Senior Project-Communication and Media	2
Humanities and Social Science Senior Seminar GER (p. 112)		3
Free Elective 7		3
Free Elective 8		3
	Term Credits	**14**
	Total Credits	**120**

1 Communication and media core courses

Technology Electives

See the advisor for appropriate courses.

Communication and Media Track Options

- Digital Expression
- Journalism
- Literature
- Media Arts
- Professional and Technical Communication
- Theatre Arts

All concentrations require courses (twenty-four credits) and should be selected in consultation with the program director from a variety of NJIT and Rutgers-Newark course offerings.

Please consult the Department of Humanities and Social Sciences website for specific course listing. http://humanities.njit.edu/

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.A. in Theatre Arts and Technology

(120 credits)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 101	Foundations of Mathematics for the Liberal Arts	3
Natural Science GER (p. 113)		3
Natural Science GER Laboratory (p. 113)		1
FYS SEM	First-Year Student Seminar	0
Select one of the following: [1]		3

CS 100	Roadmap to Computing	
CS 101	Computer Programming and Problem Solving	
CS 103	Computer Science with Business Problems	
CS 104	Computer Programming and Graphics Problems	
CS 115	Introduction to Computer Science in C++	
	Term Credits	**13**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
PHYS 202 or PHYS 203	Introductory Astronomy and Cosmology or The Earth in Space	3
MATH 105	Elementary Probability and Statistics	3
THTR 101 or THTR 212	Living Theatre or From Page to Stage	3
THTR 102	Acting Fundamentals	3
	Term Credits	**15**
Second Year		
1st Semester		
Select one of the following GER:		3
MGMT 390	Principles of Business	
or Social Science Elective		
History and Humanities GER 200 level (p. 106)		3
Select one of the following:		3
R088 259	Production I	
R088 260	Production II	
R088 467	Production III	
Free Elective		3
Free Elective		3
	Term Credits	**15**
2nd Semester		
History and Humanities GER 300+ level (p. 108)		3
R088 103	Theater Tech I	3
THTR 315	Theatre History II	3
Free Elective		3
Free Elective		3
	Term Credits	**15**
Third Year		
1st Semester		
THTR 310	Theatre History I	3
Theatre Requirement Elective		3
Theatre Requirement Elective		3
Theatre Elective		3
Free Elective		3
	Term Credits	**15**
2nd Semester		
THTR 365	Principles of Playwriting	3
History and Humanities GER 300+ level (p. 108)		3
Theatre Requirement Elective		3
Theatre Elective		3
Theatre Elective		3
	Term Credits	**15**

Fourth Year		
1st Semester		
HSS 407	Humanities Senior Seminar - Theater	3
THTR 411	Special Topics in Theatre	3
THTR 480	Independent Theatre Practicum	2
Theatre Requirement Elective		3
Theatre Elective		3
Free Elective		3
	Term Credits	**17**
2nd Semester		
Theatre Requirement Elective		3
Theatre Requirement Elective		3
Theatre Elective		3
Free Elective		3
Free Elective		3
	Term Credits	**15**
	Total Credits	**120**

[1] CS 103 or CS 104 are the course preferences.

Code	Title	Credits
Theatre Electives		
Courses from additional major that apply directly to technology or additional 15 theatre courses can count toward these electives.		15
Free Electives		
Courses from additional major or minors can count toward these electives		24
Theatre Requirement Electives		
Additional credits decided in consultation with the Theatre Arts and Technology Academic Program Advisor in order to lead to a coherent set of courses constituting a specific area of study.		21

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Communication and Media

(120 credit minimum)

First Year		
1st Semester		**Credits**
Select one of the following:		3
CS 103	Computer Science with Business Problems	
CS 104	Computer Programming and Graphics Problems	
CS 113	Introduction to Computer Science	
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 101	Foundations of Mathematics for the Liberal Arts	3
Natural Science GER (p. 113)		3
Natural Sciences Lab:GER Elective		1
Social Sciences GER (p. 114)		3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
History and Humanities GER 200 level (p. 106)		3
MATH 105	Elementary Probability and Statistics	3
ENGL 102	English Composition: Introduction to Writing for Research	3

Natural Science GER (p. 113)		3
Free Elective 1		3
	Term Credits	**15**
Second Year		
1st Semester		
COM 303	Video Narrative [1]	3
COM 353	Composing Documents for Print	3
Technology Elective		3
Free Elective 2		3
Free Elective 3		3
	Term Credits	**15**
2nd Semester		
HIST 345	Communication through the Ages	3
COM 354	Composing Documents for the Web	3
COM 339	Practical Journalism	3
Technology Elective		3
Track Option Elective 1		3
	Term Credits	**15**
Third Year		
1st Semester		
COM 355	Cybertext	3
History and Humanities GER 300+ level (p. 108)		3
Track Option Elective 2		3
Track Option Elective 3		3
Free Elective 4		3
	Term Credits	**15**
2nd Semester		
STS 349	Electronic Music in Practice	3
COM 312	Oral Presentations	3
History and Humanities GER 300+ level (p. 108)		3
Track Option Elective 4		3
Free Elective 5		3
	Term Credits	**15**
Fourth Year		
1st Semester		
COM 318	Communication Theory	3
COM 490	Co-op Work Experience I	3
Track Option Elective 5		3
Track Option Elective 6		3
Free Elective 6		3
	Term Credits	**15**
2nd Semester		
COM 491	Co-op Work Experience II	3
COM 496	Senior Project-Communication and Media	2
Humanities and Social Science Senior Seminar GER (p. 112)		3
Free Elective 7		3
Free Elective 8		3
	Term Credits	**14**
	Total Credits	**120**

[1] Communication and media core courses

Technology Electives

See the advisor for appropriate courses.

Communication and Media Track Options

- Digital Expression
- Journalism
- Literature
- Media Arts
- Professional and Technical Communication
- Theatre Arts

All concentrations require courses (twenty-four credits) and should be selected in consultation with the program director from a variety of NJIT and Rutgers-Newark course offerings.

Please consult the Department of Humanities and Social Sciences website for specific course listing. http://humanities.njit.edu/. (http://humanities.njit.edu/)

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Cyberpsychology

(120 credit minimum)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 101	Foundations of Mathematics for the Liberal Arts	3
PSY 201	Orientation to Psychology as a Behavioral Science	3
PSY 210	Introduction to Psychology	3
FYS SEM	First-Year Student Seminar	0
Natural Science GER (p. 113)		3
Natural Science GER Laboratory (p. 113)		1
	Term Credits	**16**
2nd Semester		
MATH 105	Elementary Probability and Statistics	3
ENGL 102	English Composition: Introduction to Writing for Research	3
PSY 215	Biology of Behavior	3
Computer Science GER (p. 106)		3
Natural Science GER (p. 113)		3
	Term Credits	**15**
Second Year		
1st Semester		
IS 247	Designing the User Experience	3
PSY 321	Social Psychology	3
PSY 359	Foundations of Cyberpsychology	3
Free Elective I		3
	Term Credits	**12**
2nd Semester		
PSY 339	Psychology of Diversity	3
IS 350	Computers, Society and Ethics (IS 350 Replaces STS 350)	3
PSY 361	Found of Cyberpsychology II	3

Free Elective II		3
Free Elective III		3
	Term Credits	**15**
Third Year		
1st Semester		
IS 333	Social Network Analysis	3
STS 375	AI and the Human Mind	3
STS 304	Qualitative Research Methods in the Social and Behavioral Sciences	3
STS 304A	Qualitative Research Methods Lab	1
Free Elective IV		3
Free Elective V		3
	Term Credits	**16**
2nd Semester		
IS 375	Discovering User Needs for UX	3
PSY 333	Principles of Psychometrics	3
STS 307	Quantitative Research Methods in the Social and Behavioral Sciences	3
STS 307A	Quantitative Research Methods Lab	1
STS 351	Minds and Machines	3
Free Elective VI		3
	Term Credits	**16**
Fourth Year		
1st Semester		
IS 448	Usability & Measuring UX	3
PSY 389	Psychopathology	3
Free Elective VII		3
Free Elective VIII		3
Free Elective IX		3
	Term Credits	**15**
2nd Semester		
Humanities and Social Science Senior Seminar GER (p. 112)		3
PSY 49X Capstone in Psychology		3
Free Elective X		3
Free Elective XI		3
Free Elective XII		3
	Term Credits	**15**
	Total Credits	**120**

B.S. in Science, Technology and Society

(120 credit minimum)

First Year		
1st Semester		**Credits**
MATH 101	Foundations of Mathematics for the Liberal Arts	3
ENGL 101	English Composition: Introduction to Academic Writing	3
Natural Science GER (p. 113)		3
Natural Science GER Laboratory (p. 113)		1
STS 201	Understanding Technological Society	3
Computing GER (p. 106)		3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
MATH 105	Elementary Probability and Statistics	3

ENGL 102	English Composition: Introduction to Writing for Research	3
Natural Science GER (p. 113)		3
ECON 201	Economics	3
Select one from the following:		3
EPS 202	Society, Technology, and the Environment	
PSY 210	Introduction to Psychology	
STS 221	Introduction to Sociology	
	Term Credits	**15**
Second Year		
1st Semester		
STS 304	Qualitative Research Methods in the Social and Behavioral Sciences	3
Select one of the following:		3
EPS 202	Society, Technology, and the Environment	
PSY 210	Introduction to Psychology	
STS 221	Introduction to Sociology	
Free Elective 1		3
Free Elective 2		3
Free Elective 3		3
	Term Credits	**15**
2nd Semester		
STS 310	Technology and Human Values	3
STS 300-Level Track Course 1		3
Free Elective 4		3
Free Elective 5		3
Free Elective 6		3
	Term Credits	**15**
Third Year		
1st Semester		
STS 307	Quantitative Research Methods in the Social and Behavioral Sciences	3
STS 300-Level Track Course 2		3
History and Humanities GER 300+ level (p. 108)		3
Free Elective 7		3
Free Elective 8		3
	Term Credits	**15**
2nd Semester		
STS 308	Globalization	3
STS 300-Level Track Course 3		3
History and Humanities GER 300+ level (p. 108)		3
Free Elective 9		3
Free Elective 10		3
	Term Credits	**15**
Fourth Year		
1st Semester		
STS 490	Project and Seminar I	3
STS 300-Level Track Course 4		3
Free Elective 11		3
Free Elective 12		3
Free Elective 13		3
	Term Credits	**15**
2nd Semester		
STS 491	Project & Seminar II	2
STS 300-Level Elective 1		3

STS 300-Level Elective 2		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
Free Elective 14		3
	Term Credits	**14**
	Total Credits	**120**

Electives

Code	Title	Credits
Major Option		
Select appropriate electives in consultation with an advisor [1]		18
Free Electives		
Students select appropriate electives in consultation with an advisor.		

1 Usually the Director of the STS Program. Courses may be selected from different disciplines but must comprise a coherent program of study within an option.

Refer to the **General Education Requirements** for further information on electives.

Specializations

- Mind, Behavior, and Society
- Environmental and Sustainability Studies
- Race and Gender in Science in Technology
- Politics, History, and Ethics in Science and Technology
- Music, Literature, and Culture in a Technological Society

Co-op

Co-op courses replace electives with the approval of an advisor. In science, technology and society, STS 311 Co-op Work Experience I and STS 411 Co-op Work Experience II are taken for degree credit.

Communication Minor

Five courses in Language and Communication approved by the minor coordinator.

More information on this minor can be found on the Department of Humanities and Social Sciences (http://humanities.njit.edu/academics/undergraduate/communication/pc-minor.php) website.

Electronic Creative Writing Minor

Code	Title	Credits
Select five of the following: [1]		15
COM 303	Video Narrative	
COM 325	Special Topics in Communication	
COM 350	Digital Video Production	
COM 351	Documentary Studies	
COM 337	Photojournalism	
COM 369	Digital Poetry	
COM 390	Electronic Writing Workshop	
COM 355	Cybertext	
COM 317	Advanced Composition	
COM 354	Composing Documents for the Web	
STS 347	Music and Society	
STS 349	Electronic Music in Practice	
Total Credits		**15**

[1] Appropriate Communications, Media, or Art courses at Rutgers-Newark may also be applied to the minor. Other upper-division humanities electives may be approved by faculty coordinator.

Global Studies Minor

(15 credits)

Five courses with global content including four upper division courses approved by the minor coordinator.

Journalism Minor

(15 credits)

Code	Title	Credits
COM 339	Practical Journalism	3
Four courses in journalism or related fields chosen in consultation with the minor adviser		12
Equivalent Rutgers-Newark courses may be taken with department approval		
Total Credits		**15**

Literature Minor

(15 credits)

Five upper division literature courses approved by the minor coordinator.

Philosophy Applied Ethics Minor

(15 credits)

Five upper division courses in Philosophy and STS chosen with approval of minor coordinator.

Psychology Minor (not for STS majors)

Code	Title	Credits
Complete ALL of the following:		3
PSY 215	Biology of Behavior	
Choose ONE of the following (with corequisite lab):		4
STS 304	Qualitative Research Methods in the Social and Behavioral Sciences	
STS 304A	Qualitative Research Methods Lab	
STS 307	Quantitative Research Methods in the Social and Behavioral Sciences	
STS 307A	Quantitative Research Methods Lab	
Choose THREE of the following:		9
PSY 321	Social Psychology	
PSY 333	Principles of Psychometrics	
PSY 339	Psychology of Diversity	
PSY 358	Moral Psychology	
PSY 359	Foundations of Cyberpsychology	
PSY 361	Found of Cyberpsychology II	
PSY 389	Psychopathology	
STS 375	AI and the Human Mind	
Total Credits		**16**

Science, Technology & Society Minor

(15 credits)

Five upper division STS courses or substitutes approved by the minor coordinator.

More **information on this minor** can be found on the Department of Humanities and Social Sciences (http://humanities.njit.edu/academics/undergraduate/) website.

Technology, Gender and Diversity Minor

(15 credits)

Five upper division courses in relevant fields chosen with approval of minor coordinator.

Theatre Arts and Technology Minor

(15 credits)

Five upper division courses in drama approved by the minor coordinator.

Mathematical Sciences

NJIT's nationally recognized Department of Mathematical Sciences offers a B.S. degree in mathematical sciences with concentrations in applied mathematics, applied statistics, computational mathematics, mathematical biology, and mathematics of finance and actuarial science; a B.S. in data science (statistics concentration); an M.S. in applied mathematics; an M.S. in applied statistics; and a Ph.D. in mathematical sciences with tracks in applied mathematics and applied probability and statistics. A seven-year accelerated B.S./M.D. program in mathematical sciences is also offered as well as several double major B.S. programs. In addition to its own degree programs, the department serves the university by providing courses in mathematics required for programs in various technological and scientific disciplines. The diverse research interests of department faculty include mathematical biology, mathematical fluid dynamics, linear and nonlinear waves, electromagnetics, optics, acoustics, applied statistics, and numerical analysis. This work is supported by substantial funding from sources such as the NSF, NIH, ONR, AFOSR, NASA, DOE, Simons Foundation, and the Council for International Exchange of Scholars (Fulbright Foundation).

NJIT Faculty

A
Afkhami, Shahriar, Professor

Ahluwalia, Daljit Singh, Professor Emeritus

Andrushkiw, Roman, Professor Emeritus

Askham, Travis, Assistant Professor

B
Bechtold, John K., Professor

Blackmore, Denis L., Professor

Booty, Michael R., Professor

Bose, Amitabha K., Professor

Boubendir, Yassine, Professor

Bukiet, Bruce G., Professor

C
Choi, Wooyoung, Professor

Cummings, Linda J., Professor

D
Dhar, Sunil K., Professor

Diekman, Casey O., Associate Professor

F
Frederick, Christina, Assistant Professor

G

Garfield, Ralph, Associate Professor Emeritus

Goodman, Roy H., Associate Professor

Guo, Wenge, Associate Professor

H

Hamfeldt, Brittany, Associate Professor

Horntrop, David J., Associate Professor

Horwitz, Kenneth A., University Lecturer

J

Jiang, Shidong, Professor

K

Kappraff, Jay M., Associate Professor Emeritus

Kim, Chulmin , Senior University Lecturer

Kondic, Lou, Distinguished Professor

L

Loh, Ji Meng, Associate Professor

Luke, Jonathan H. C., Professor

Lushi, Enkeleida, Assistant Professor

M

MacLaurin, James, Assistant Professor

Mahmood, Sirag, University Lecturer

Matveev, Victor V., Professor

Michalopoulou, Zoi-Heleni, Professor

Milojevic, Petronije, Professor

Muratov, Cyrill B., Professor

N

Natarajan, Padma, Senior University Lecturer

O

Oza, Anand, Assistant Professor

P

Petropoulos, Peter G., Associate Professor

Plastock, Roy A., Associate Professor

Pole, Andrew, Senior University Lecturer

Porus, Jonathan J., Math Tutoring Center Director

Potocki-Dul, Magdallena M., University Lecturer

R

Rana Concepcion Priyanka , University Lecturer

Ratnaswamy, Jey, Senior University Lecturer

Ro, Je Huyn, University Lecturer

S

Schmidt, Donivyn, University Lecturer

Shang, Zuofeng, Associate Professor

Shirokoff, David, Associate Professor

Siegel, Michael S., Professor

Stickler, David, Professor Emeritus

Subramanian, Sundarraman, Associate Professor

T
Tavantzis, John, Professor Emeritus

Turc, Catalin C., Associate Professor

V
Voronka, Roman W., Professor Emeritus

W
Wang, Antai, Associate Professor

Ward, Peter, University Lecturer

Y
Young, Yuan-Nan, Professor

Z
Zaleski, Joseph, University Lecturer

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Mathematical Sciences Courses

MATH 101. Foundations of Mathematics for the Liberal Arts. 3 credits, 3 contact hours (3;0;0).
Intended for students in degree programs offered by HSS and History. This course reviews principles of algebra and the foundations of mathematics. Degree credit awarded for degrees offered by HUM and HIST.

MATH 102. Modern Pre-calculus. 6 credits, 6 contact hours (6;0;0).
This course is an intensive non-traditional approach to pre-calculus employing curriculum innovations for the preparation of students for college calculus. The course infuses calculus techniques into the pre-calculus curriculum. The format includes both regular class and workshop environments with a focus on student problem solving. Course meets on Saturdays in the fall and spring terms and M, T, W, R in the summer, second session. This course is only available to high school students.

MATH 105. Elementary Probability and Statistics. 3 credits, 3 contact hours (3;0;0).
Consider notions of probability. Topics include the binomial and normal distributions, expected value, and variance. The notions of sampling, hypothesis testing, and confidence intervals are applied to elementary situations.

MATH 107. University Mathematics A. 3 credits, 3 contact hours (3;0;0).
Linear functions, equations, inequalities, systems of linear equations, quadratic equations elementary functions, graphing functions.

MATH 108. University Mathematics B. 4 credits, 5 contact hours (4;0;1).
Intended for students whose major requires MATH 111. Linear functions, equations, inequalities, systems of linear equations, quadratic equations, polynomials, rational expressions, expressions involving radicals, partial fraction decomposition, conic sections, graphing functions.

MATH 110. University Mathematics B II - Trigonometry. 4 credits, 5 contact hours (4;0;1).
Intended for students whose major requires MATH 111. Prerequisite: MATH 108 or placement by performance on standardized entrance examinations. Trigonometric functions and identities, laws of sines and cosines, logarithmic equations, systems of nonlinear equations, polar coordinates.

MATH 111. Calculus I. 4 credits, 5 contact hours (4;0;1).
Prerequisites: MATH 110 with a grade of C or better or placement by performance on standardized entrance examinations. Topics include limits, differentiation, applications of differentiation, and integration.

MATH 112. Calculus II. 4 credits, 5 contact hours (4;0;1).
Prerequisite: MATH 111 with a grade of C or better. Topics include integration, applications of integration, series, exponential and logarithmic functions, transcendental functions, polar coordinates, and conic sections.

MATH 113. Finite Mathematics and Calculus I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: (Intended for Architecture students.) MATH 107 with a grade of C or better, or MATH 110 with a grade of C or better, or NJIT placement. An introduction to differential and integral calculus. Applications include area, volumes, curve lengths, surface area, centroids, and moments. Focus is on application throughout the course.

MATH 120. Basic Concepts in Statistics. 1 credit, 1 contact hour (1;0;0).
The course offers an introduction to the basic concepts in statistics. Topics include the role of statistics, data summary, normal distribution, elements of probability, and computation of mean and variance. This course will also include an introduction to statistical estimation and inference.

MATH 135. Calculus for Business. 3 credits, 3 contact hours (3;0;0).
Intended for students with major offered by SOM. Prerequisite: MATH 107 with a grade of C or better or MATH 110 with a grade of C or better or NJIT placement. An introduction to mathematics of business, principles of differential and integral calculus, and optimization.

MATH 138. General Calculus I. 3 credits, 3 contact hours (3;0;0).
Intended for students who are not in Science or in Engineering. Prerequisite: MATH 107 with a grade of C or better, or MATH 110 with a grade of C or better or NJIT placement. An introduction to differential and integral calculus of a single variable.

MATH 161. Calculus I for Computing. 4 credits, 5 contact hours (4;0;1).
Prerequisites: MATH 110 with a grade of C or placement by performance on standardized entrance examinations. Corequisite: CS 100. A calculus course with the same core content as MATH 111 but with an emphasis on building foundations for computing rather than differential equations.
The course is characterized by an emphasis on symbolic computing over numerical computing. Topics include limits, differentiation, applications of differentiation, and integration. Student can not receive credit for both MATH 161 and MATH 111.

MATH 211. Calculus III A. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. Topics include vectors, curvature, partial derivatives, multiple integrals, line integrals, and Green's theorem. Students who are considering a major in Mathematical Sciences or who are undecided about their major should take MATH 213.

MATH 213. Calculus III B. 4 credits, 4 contact hours (4;0;0).
Prerequisite: MATH 112 with a grade of C or better. Topics include vectors, curvature, partial derivatives, multiple integrals, line integrals, and Green's, divergence, and Stokes' theorems.

MATH 222. Differential Equations. 4 credits, 4 contact hours (4;0;0).
Prerequisite: MATH 112 with a grade of C or better. Methods for solving ordinary differential equations are studied together with physical applications, Laplace transforms, numerical solutions, and series solutions.

MATH 225. Survey of Probability and Statistics. 1 credit, 1 contact hour (1;0;0).
Prerequisite: MATH 112 with a grade of C or better. Topics include descriptive statistics, elements of probability, random variables and distributions; mean and variance; introduction to estimation and inference. This course satisfies the Mathematics GUR in probability and statistics. However, degree credit will not be granted for both MATH 225 and any other upper level course in probability and/or statistics.

MATH 225A. Survey of Probability and Statistics. 1 credit, 1 contact hour (1;0;0).
Prerequisite: MATH 112 with a grade of C or better. Restriction: For Chemical Engineering students only. Topics include descriptive statistics, elements of probability, random variables and distributions; mean and variance; introduction to estimation and inference. This course satisfies the Mathematics GUR in probability and statistics. However, degree credit will not be granted for both MATH 225 and any other upper level course in probability and/or statistics.

MATH 226. Discrete Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. An introduction to discrete mathematics. An introduction to discrete mathematics. Topics include elementary set theory, logic, combinatorics, relations, and selections from graphs and trees and algebraic systems.

MATH 227. Mathematical Modeling. 3 credits, 4 contact hours (3;1;0).
Prerequisites: MATH 112 with a grade of C or better and CS 115 with a grade of C or better or CS 113 with a grade of C or better or CS 100 with a grade of C or better or CS 101 with a grade of C or better. An introduction to the theory and practice of mathematical modeling. Techniques include scaling and dimension, fitting of data, linear and exponential models, elementary dynamical systems, probability, optimization, Markov chain modeling. Models are drawn from applications including biology, physics, economics, finance, and chemistry.

MATH 238. General Calculus II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 138 with a grade of C or better or MATH 111 with a grade of C or better. A continuation of MATH 138. Topics include applications of integral calculus and an introduction to ordinary differential equations.

MATH 244. Introduction to Probability Theory. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. Topics include basic probability theory in discrete and continuous sample space, conditional probability and independence, Bayes' theorem and event trees, random variables and their distributions, joint distribution and notion of dependence, expected values and variance, moment generating functions, useful parametric families of distributions including binomial, geometric, hypergeometric, negative binomial, exponential, gamma, normal and their applications, simple case of central limit theorem and its uses.

MATH 279. Statistics and Probability for Engineers. 2 credits, 2 contact hours (2;0;0).
Prerequisite: MATH 112 with a grade of C or better. This course introduces methods of summarizing and analyzing engineering data and the importance of observing processes over time such as control charts. Descriptive statistics, plots and diagrams are then used to summarize the data. Elements of probability and random variables with their distributions along with mean and variance are taught. All this knowledge is then used as a platform towards covering how to do basic estimation and inference, including confidence intervals and hypothesis testing based on a single sample. Students taking this course cannot receive degree credit for MATH 225, MATH 244, or MATH 333.

MATH 305. Statistics for Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 111 with a grade of C or better or MATH 138 with a grade of C or better. (Intended for students in Engineering Technology) An introduction to the modern concepts of statistics needed by engineering technologists. Topics include organization of data, descriptive statistics, discrete and continuous probability distributions, sampling distribution and designs, estimation -- one and two populations, tests of hypotheses.

MATH 309. Mathematical Analysis for Technology. 4 credits, 4 contact hours (4;0;0).
Prerequisite: MATH 112 with a grade of C or better or MATH 238 with a grade of C or better. Emphasis on partial derivatives; vector calculus, and multiple integrals.

MATH 310. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Completion of the sophomore year, departmental approval, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

MATH 322. Differential Equations for Applications. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better or MATH 238 with a grade C or better. An applied science study using differential equations as the vehicle for comprehension of the unknown. Introduction to first-order differential equations and their applications to motion, cooling and electromechanical systems followed by higher order differential equations and their solutions. Study of methods of undetermined coefficients, variation of parameters, and many series and numerical methods. Includes Laplace transforms, matrix methods, and eigenvalue problems.

MATH 326. Discrete Analysis for Computer Engineers. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. An introduction to mathematical logic, Boolean algebra, and Karnaugh maps. Other topics include functions, equivalence relations and partially ordered sets, counting, graph theory and finite state machines. The emphasis is on computation but proofs will be addressed. Students cannot receive credit for both MATH 226 and MATH 326.

MATH 328. Mathematical Methods for Scientists and Engineers. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 with a grade of C or better, or MATH 213 with a grade of C or better. Corequisite: MATH 222. The course exposes students to concepts of mathematics encountered throughout the physical science and engineering disciplines. Topics include matrix algebra, vector analysis, complex numbers, and boundary value problems in partial differential equations.

MATH 331. Introduction to Partial Differential Equations. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 or MATH 213 and MATH 222 all with a grade of C or better. Partial differential equations in science and engineering. Topics include initial- and boundary-value problems for parabolic, hyperbolic, and elliptic second-order equations. Emphasis is placed on separation of variables, special functions, transform methods, and numerical techniques.

MATH 332. Introduction to Functions of a Complex Variable. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 or MATH 213 and MATH 222 all with a grade of C or better. Functions of a complex variable: Cauchy-Riemann equations, Cauchy-Goursat theorem, integration, series, residues, poles, geometrical aspects. Emphasis on techniques.

MATH 333. Probability and Statistics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. Descriptive statistics and statistical inference. Topics include discrete and continuous distributions of random variables, statistical inference for the mean and variance of populations, and graphical analysis of data.

MATH 334. Operations Research. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 244 with a grade of C or better or MATH 333 with a grade of C or better. Considers mathematical methods found especially in contemporary fields such as operations research and reliability engineering. Topics include linear programming, graph theory, finite mathematics, differential equations, matrices, and determinants.

MATH 335. Vector Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better. Algebra and calculus of vectors. Topics include the theorems of Gauss, Green, and Stokes, and curvilinear coordinates.

MATH 336. Applied Abstract Algebra. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. Classical algebra from a modern and constructive viewpoint. Emphasis is on the development of algorithmic and computational skills. Topics include rings, fields, and groups and their applications to science and engineering.

MATH 337. Linear Algebra. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. Matrices, determinants, systems of linear equations, vector spaces, linear transformations, eigenvalues, eigenvectors, and related topics.

MATH 340. Applied Numerical Methods. 3 credits, 4 contact hours (3;1;0).
Prerequisites: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better, and CS 100 with a grade of C or better or CS 101 with a grade of C or better or CS 113 with a grade of C or better or CS 115 with a grade of C or better. Introduction to numerical methods with emphasis on mathematical models. Implements and investigates numerical techniques for the solution of linear and nonlinear systems of equations, eigenvalue problems, interpolation and approximation, techniques of optimization, Monte Carlo methods, and applications to ordinary differential equations and integration.

MATH 341. Statistical Methods II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 244 with a grade of C or better or MATH 333 with a grade of C or better. Covers applications of classical statistical inference. Topics include transformation of variables, moment generating technique for distribution of variables, introduction to sampling distributions, point and interval estimation, maximum likelihood estimators, basic statistical hypotheses and tests of parametric hypotheses about means of normal populations, chi-square tests of homogeneity, independence, goodness-of-fit.

MATH 344. Regression Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 333 with a grade of C or better or MATH 341 with a grade of C or better. An introduction to statistical data analysis using regression techniques. Topics include least squares estimation, hypothesis testing, prediction, regression diagnostics, residual analysis, variance stabilizing transformations, regression using indicator variables, variable selection, and model building.

MATH 345. Multivariate Distributions. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 244 with a grade of C or better or MATH 333 with a grade of C or better. Topics include discrete and continuous multivariate distributions and their moments, multivariate distributions including multivariate normal and multinominal distributions, order statistics, conditional probability and the use of conditioning, discrete time Markov chains and their examples, discrete time branching processes, homogeneous and nonhomogeneous Poisson processes.

MATH 346. Mathematics of Finance I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112 with a grade of C or better. The main topics include basic problems in interest, annuities, certain amortization and sinking funds, bonds and related securities.

MATH 347. Mathematics of Finance II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 346 and MATH 244 or MATH 333 all with a grade of C or better. This course introduces mathematical models of bond and stock prices, which lead to arbitrage pricing of options and other derivative securities, and portfolio management. These areas of mathematical finance have a great impact on the way financial markets function. Topics include risk-free, and risky assets, portfolio management, futures, and options.

MATH 356. Loss Models. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 341 with a grade of C or better. This course will introduce a variety of frequency, severity, and aggregate models that are useful for actuarial applications. This will include analyzing data from applications, determining a suitable model, providing measures of confidence for decisions based on the model, and estimating losses.

MATH 371. Physiology And Medicine. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 222 with a grade of C or better. Mathematical models of organs and organ systems: the heart and circulation, gas exchange in the lungs, electrical properties of excitable membranes, neuro-biological clocks, the renal countercurrent mechanism, muscle mechanics. The biology is introduced with each topic. Emphasis is on quantitative problem solving, model building, and numerical simulation.

MATH 372. Population Biology. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 222 with a grade of C or better. Introduction to the mathematics of populations: Malthus' model of geometric population growth, Euler's renewal equations, age structure in human populations, predator satiation, chaos, mathematical models of inheritance, and the theory of epidemics. The ability to weave back and forth between physical concepts and mathematical notation is emphasized as well as the relationships between random and non-random models of similar phenomena.

MATH 373. Introduction to Mathematical Biology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better and MATH 222 with a grade of C or better. This course provides an introduction to the use of mathematical techniques applied to problems in biology. Discrete and continuous models of biological phenomena will be discussed. Biological topics discussed range from the subcellular molecular systems and cellular behavior to physiological problems, population biology and developmental biology. Techniques of phase plane analysis for differential equations are introduced in the course. No prior background in biology is necessary.

MATH 388. Introduction to Chaos Theory. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better. An elementary treatment of chaos theory and its applications concentrating on discrete dynamical systems. Uses theory and applications illustrated by computer experiments to develop such topics as bifurcation, attractors, the logistic map, period-doubling routes to chaos, symbolic dynamics, Sarkovskii's theorem, fractals, and Julia and Mandelbrot sets for complex dynamics.

MATH 391. Numerical Linear Algebra. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 337 with a grade of C or better and CS 113 with a grade of C or better or CS 115 with a grade of C or better or CS 101 with a grade of C or better or CS 100 with a grade of C or better. This course provides an introduction to computational linear algebra. Topics include direct solution of linear systems, iterative methods for linear systems, fast Fourier transforms, least squares problems, singular value decomposition and eigenvalue/eigenvector problems.

MATH 401. Undergraduate Research Seminar. 1 credit, 1 contact hour (0;0;1).
Research seminar intended for students who participate in year-long research projects. Methodologies and techniques needed for summer research projects are discussed. Presentations of current research topics are made by various faculty.

MATH 410. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: MATH 310 with a grade of C or better, departmental approval, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience. Mandatory participation in seminars and completion of requirements that include a report and/or project. Note: Normal grading applies to this COOP Experience.

MATH 430. Analytical and Computational Neuroscience. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better, and MATH 222 with a grade of C or better, and CS 100 with a grade of C or better or CS 113 with a grade of C or better or CS 115 with a grade of C or better or MATH 340 with a grade of C or better. A mathematical and computational introduction to the biophysical mechanisms that underlie physiological functions of single neurons and synapses. Topics include voltage-dependent channel gating mechanisms, the Hodgkin-Huxley model for membrane excitability, repetitive and burst firing, nerve impulse propagation in axons and dendrites, single- and multi-compartmental modeling, synaptic transmission, calcium handling dynamics and calcium dependent currents and processes.

MATH 431. Systems Computational Neuroscience. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 430 with a grade of C or better or departmental approval. This course provides a mathematical and computational introduction to operations of neuronal systems and networks. Topics covered include central pattern generators, neuroethology of sensory systems, sensory-motor transformations, models of various brain regions, models of visual processes, large networks modeling, models of learning and memory, neural coding and mathematics of neural networks.

MATH 432. Mathematics of Financial Derivatives I (Capstone I). 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222 with a grade of C or better and MATH 346 with a grade of C or better. Mathematical analysis of models encountered in the area of financial derivatives. Topics include modeling and analysis of futures markets, determination of future prices, hedging strategies, swaps, option markets, stock options and their trading strategies.

MATH 433. Mathematics of Financial Derivatives II (Capstone II). 3 credits, 3 contact hours (3;0;0).
Corequisite: MATH 340 with a grade of C or better. MATH 432 with a grade of C or better. Mathematical analysis of models encountered in the area of financial derivatives with emphasis on numerical methods. Topics include: Binomial Trees, Black Scholes Models, Finite Difference Methods.

MATH 440. Advanced Applied Numerical Methods. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 331 with a grade of C or better and MATH 340 with a grade of C or better. A survey of numerical methods for solving ordinary and partial differential equations. Includes initial-value and boundary-value problems for ordinary differential equations and for elliptic, hyperbolic, and parabolic partial differential equations.

MATH 441. Actuarial Mathematics I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 346 with a grade of C or better. Topics include the economics of insurance, individual risk models for a short term, survival distributions and life tables, life insurance per year, life annuities, and net premiums.

MATH 442. Actuarial Mathematics II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 441 with a grade of C or better. Topics include net premium reserves, insurance models including expenses, nonforfeiture benefits, and dividends.

MATH 444. Applied Sampling Methods and Quality Control. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 333 with a grade of C or better, or MATH 244 with a grade of C or better and MATH 341 with a grade of C or better. An introduction to sample survey and statistical quality control. Topics include sampling from a finite population and different sampling techniques, more detailed study of random sampling and stratification, control charts and acceptance sampling plans in statistical quality control.

MATH 445. Introduction to Experimental Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 333 with a grade of C or better, or MATH 244 with a grade of C or better and MATH 341 with a grade of C or better. Basic concepts and principles of designs are covered. Topics include randomized blocks, Latin squares, factorial designs.

MATH 446. Topics in Applied Statistics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 341 with a grade of C or better or MATH 333 with a grade of C or better. Topics may include biostatistics, environmental statistics, statistical consulting.

MATH 447. Applied Time Series Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 341 with a grade of C or better or MATH 333 with a grade of C or better. An introduction to applied univariate time series analysis. Topics include regression techniques for modeling trends, smoothing techniques (moving average smoothing, exponential smoothing), autocorrelation, partial auto-correlation, moving average, and autoregressive representation of series, Box-Jenkins models, forecasting, model selection, estimation, and diagnostic checking, Fourier analysis, and spectral theory for stationary processes.

MATH 448. Stochastic Simulation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 340 and either MATH 244 or MATH 333 with a grade of C or better. An introduction in the use of computer simulation to study stochastic models. Topics include the generation of samples of continuous and discrete random variables and processes with applications to stochastic models, statistical analysis of the results, and variance reduction techniques.

MATH 450. Methods Of Applied Math. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 331 with a grade of C or better, MATH 337 with a grade of C or better, and MATH 340 with a grade of C or better. Combines mathematical modeling with physical and computational experiments conducted in the Undergraduate Mathematics Computing Laboratory.

MATH 451. Methods Appl Math II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 450 with a grade of C or better. Small teams of students conduct research projects under the guidance of faculty members who perform applied research.

MATH 453. High-Performance Numerical Computing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 340 with a grade of C or better and MATH 391 with a grade of C or better. The course covers state-of-the-art numerical algorithms for solving large-scale problems accurately and efficiently. Topics include iterative methods for linear systems and eigenvalue computations, introduction to parallel program and parallel numerical algorithms and spectral methods. An instructor-selected advanced topic will be included in the course.

MATH 461. Introduction to Statistical Computing with SAS and R. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 341 with a grade of C or better or MATH 344 with a grade of C or better or MATH 447 with a grade of C or better. In this course, SAS and R statistical software will be studied from a programming language perspective. It will emphasize SAS and R data steps including getting data into SAS and R environments, working and combining data using control flows, merge and subsets. SAS and R mathematical, statistical, and data functions are discussed, as well as learning to write SAS Macro and generate high resolution graphics using SAS/Graph. The concentration is on SAS and R programming issues rather than on statistical procedures or functions; however, several SAS and R statistical procedures or functions are discussed and illustrated. Finally, interactive statistical software JMP and Minitab are briefly introduced.

MATH 462. Statistics and Statistical Learning (Capstone I). 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 461, MATH 478 with a grade of C or better. This is the first semester of a two-semester undergraduate-level statistical learning capstone course. The course provides an opportunity for students to synthesize knowledge gained during their undergraduate study by applying modern statistical tools to solve real-world projects. In this first semester course, the following basic statistical learning objects will be reviewed: statistical decision theory, linear/logistic regression, discriminant analysis, principle component analysis, high-dimensional data analysis, nearest neighbor methods, multiclass classification. The course will also select important papers on the above topics for students to read and present. Capstone research topics will be selected approaching the end of the semester.

MATH 463. Statistics and Statistical Learning (Capstone II). 3 credits, 3 contact hours (1;2;0).
Prerequisites: MATH 462 with a grade of C or better. This course is the continuation of MATH 462. In this course, the following basic statistical learning objects will be reviewed: variable/model selection, support vector machine, tree-based methods, cluster analysis. Students will work in teams on real-world projects which will require extensive use of statistical software. Each group will produce a written report and give an oral presentation of their findings. present their work in a research talk. Successful completion of this course will equip students with the modern statistical learning, teamwork, and presentation skills necessary to conduct advanced research or enter the professional world.

MATH 473. Intermediate Differential Equations. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222 with a grade of C or better and MATH 337 with a grade of C or better. Topics in the qualitative behavior of solutions of ordinary differential equations with applications to engineering problems. Includes phase plane analysis, stability, dynamical systems, and chaos.

MATH 477. Stochastic Processes. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 244 with a grade of C or better or MATH 333 with a grade of C or better and MATH 337 with a grade of C or better. This course introduces the theory and applications of random processes needed in various disciplines such as mathematical biology, finance, and engineering. Topics include discrete and continuous Markov chains, Poisson processes, as well as topics selected from Brownian motion, renewal theory, and simulation.

MATH 478. Stat Methods in Data Sci. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 333 with a grade of C or better or MATH 341 with a grade of C or better. This course introduces to students concepts in statistical methods used in data science, including data collection, data visualization and data analysis. Emphasis is on model building and statistical concepts related to data analysis methods. The course provides the basic foundational tools on which to pursue statistics, data analysis and data science in greater depth. Topics include sampling and experimental design, understanding the aims of a study, principles of data analysis, linear and logistic regression, resampling methods, and statistical learning methods. Students will use the R statistical software.

MATH 480. Introductory Mathematical Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better. Builds on principles taught in basic calculus courses. Topics discussed include continuity, differentiation, integration, and the limit process of sequences and series.

MATH 481. Advanced Calculus. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 480 with a grade of C or better. Systematic development of partial differentiation, multiple and improper integrals, transformations, inverse and implicit function theorems, and integrals over curves and surfaces.

MATH 491. Independent Study in Mathematics. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Senior standing and departmental approval. Each student works under the direct supervision of a member of the Department of Mathematical Sciences. The work consists primarily of a project applying the student's mathematical skills to an engineering- or science-oriented project.

MATH 492. Independent Study II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Senior standing and departmental approval. Each student works under the direct supervision of a member of the Department of Mathematical Sciences. The work consists primarily of a project applying the student's mathematical skills to an engineering- or science-oriented project.

MATH 495. Topics in Applied Mathematics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 331 with a grade of C or better, MATH 332 with a grade of C or better, and MATH 340 with a grade of C or better, or departmental approval. A survey of selected areas of applied mathematics. Case histories of problems in applied mathematics from an industrial background.

MATH E. Math Stack Engineers. 3 credits, 3 contact hours (3;0;0).

MATH NE. Math Stack For Non-Engineers. 3 credits, 3 contact hours (3;0;0).

Rutgers-Newark Courses

R960 211. Statistics I. 3 credits, 3 contact hours (3;0;0).

R960 212. Statistics II. 3 credits, 3 contact hours (3;0;0).

R960 238. Found Modern Math. 3 credits, 3 contact hours (3;0;0).

R960 463. Regression Methods. 3 credits, 3 contact hours (3;0;0).

Accelerated Bachelor of Science in Mathematical Sciences for M.D., D.M.D., D.D.S., O.D

7 Year Accelerated B.S. in Mathematical Sciences for M.D., D.D.S., D.M.D., or O.D.

(120 credits minimum)

First Year		
1st Semester		**Credits**
MATH 111	Calculus I	4
CHEM 125	General Chemistry I	3

CHEM 125A	General Chemistry Lab I	1
BIOL 200	Concepts in Biology	4
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**19**
2nd Semester		
MATH 112	Calculus II	4
CHEM 126	General Chemistry II	3
CHEM 126A	Gen Chemistry Lab II	1
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**19**
Summer		
MATH 213	Calculus III B	4
CHEM 243	Organic Chemistry I	3
	Term Credits	**7**
Second Year		
1st Semester		
MATH 222	Differential Equations	4
MATH 337	Linear Algebra	3
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
CS 100	Roadmap to Computing	3
	Term Credits	**19**
2nd Semester		
MATH 331	Introduction to Partial Differential Equations	3
MATH 340	Applied Numerical Methods	3
MATH 333	Probability and Statistics	3
CHEM 473	Biochemistry	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**15**
Third Year		
1st Semester		
MATH 371	Physiology And Medicine	3
MATH 430	Analytical and Computational Neuroscience	3
MATH 450	Methods Of Applied Math	3
History and Humanities GER 300+ level (p. 108)		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
MATH 332	Introduction to Functions of a Complex Variable	3
MATH 451	Methods Appl Math II	3
Math 300+	Elective	3
Social Science GER (p. 114)		3

Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**109**

Code	Title	Credits
Transfer from Professional Program		
Technical Elective		3
Technical Elective		3
Technical Elective		3
Technical Elective		2
Total Credits		**11**

Code	Title	Credits
Total Credits		**120**

Applied Mathematics Concentration

B.S. in Mathematical Sciences, Applied Mathematics Concentration

(120 credits)

First Year		
1st Semester		**Credits**
MATH 111	Calculus I	4
CS 100	Roadmap to Computing	3
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
MATH 112	Calculus II	4
Social Science GER (p. 114)		3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
MATH 213	Calculus III B	4
MATH 227	Mathematical Modeling	3
Select one of the following:		3
MATH 244	Introduction to Probability Theory	
MATH 333	Probability and Statistics	
PHYS 234	Physics III	3
Free Elective		3
	Term Credits	**16**
2nd Semester		
MATH 222	Differential Equations	4
MATH 337	Linear Algebra	3
MATH 340	Applied Numerical Methods	3
Technical Elective		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**

Third Year		
1st Semester		
MATH 332	Introduction to Functions of a Complex Variable	3
MATH 473	Intermediate Differential Equations	3
MATH 480	Introductory Mathematical Analysis	3
Technical Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
MATH 331	Introduction to Partial Differential Equations	3
MATH 481	Advanced Calculus	3
Math 300+ Elective		3
Technical Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
MATH 450	Methods Of Applied Math	3
Select one of the following		3
MATH 391	Numerical Linear Algebra	
MATH 440	Advanced Applied Numerical Methods	
MATH 448	Stochastic Simulation	
Technical Elective		3
Free Elective		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
2nd Semester		
Math 400+ Elective		3
MATH 451	Methods Appl Math II	3
Technical Elective		3
Technical Elective		3
Free Elective		3
	Term Credits	**15**
	Total Credits	**120**

[1] or approved course at Rutgers-Newark.

General Education Requirements and Electives

All students are required to satisfy the General Education Requirements (GER). All GER courses and additional mathematics, technical, and free electives are to be selected in consultation with a faculty advisor in the Department of Mathematical Sciences. Refer to the General Education Requirements (p. 105) section of this catalog for further information on electives.

Co-op Courses

In Mathematical Sciences, the co-op courses, MATH 310 Co-op Work Experience I and MATH 410 Co-op Work Experience II, bear degree credit and count as technical or free electives, subject to approval by a faculty advisor in the Department of Mathematical Sciences.

Electives

All electives should be selected after consultation with a Mathematical Sciences faculty advisor. Any mathematics course numbered 331 or above may be used as a mathematics, technical, or free elective. Any NJIT course at or above the 100 level may be used as a technical or free elective; except a technical elective is a course that has a significant mathematical and/or scientific content. All elective courses are to be chosen in consultation with a faculty advisor in the Department of Mathematical Sciences

Applied Mathematics Minor

Code	Title	Credits
MATH 222	Differential Equations	4
MATH 244	Introduction to Probability Theory	3
or MATH 333	Probability and Statistics	
MATH 337	Linear Algebra	3
Two courses approved by the minor coordinator		6-8
Total Credits		**16-18**

More **information on this minor** can be found on the Mathematical Sciences website.

Applied Statistics and Data Analysis Concentration

B.S. in Mathematical Sciences, Applied Statistics and Data Analysis Concentration

(120 credits)

First Year		
1st Semester		**Credits**
MATH 111	Calculus I	4
CS 100	Roadmap to Computing	3
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
MATH 112	Calculus II	4
CS 113	Introduction to Computer Science	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
MATH 213	Calculus III B	4
MATH 227	Mathematical Modeling	3
MATH 244	Introduction to Probability Theory	3
CS 114	Introduction to Computer Science II	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
MATH 222	Differential Equations	4
MATH 341	Statistical Methods II	3
MATH 337	Linear Algebra	3
CS 280	Programming Language Concepts	3
Social Science GER (p. 114)		3
	Term Credits	**16**
Third Year		
1st Semester		
MATH 340	Applied Numerical Methods	3
MATH 344	Regression Analysis	3
MATH 391	Numerical Linear Algebra	3

CS 331	Database System Design & Mgmt	3
Technical Elective		3
	Term Credits	**15**
2nd Semester		
MATH 345	Multivariate Distributions	3
MATH 478	Stat Methods in Data Sci	3
Technical Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
MATH 480	Introductory Mathematical Analysis	3
MATH 448	Stochastic Simulation	3
Technical Elective		3
400+ elective (with advisor's approval)		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
MATH 447	Applied Time Series Analysis	3
MATH 477	Stochastic Processes	3
Technical Elective		3
Free Elective		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**120**

General Education Requirements and Electives

All students are required to satisfy the General Education Requirements (GER). All GER courses and additional mathematics, technical, and free electives are to be selected in consultation with a faculty advisor in the Department of Mathematical Sciences. Refer to the General Education Requirements (p. 105) section of this catalog for further information on electives.

Co-op Courses

In Mathematical Sciences, the co-op courses, MATH 310 Co-op Work Experience I and MATH 410 Co-op Work Experience II, bear degree credit and count as technical or free electives, subject to approval by a faculty advisor in the Department of Mathematical Sciences.

Electives

All electives should be selected after consultation with a Mathematical Sciences faculty advisor. Any mathematics course numbered 331 or above may be used as a mathematics, technical, or free elective. Any NJIT course at or above the 100 level may be used as a technical or free elective; except a technical elective is a course that has a significant mathematical and/or scientific content. All elective courses are to be chosen in consultation with a faculty advisor in the Department of Mathematical Sciences.

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Applied Statistics Minor

(16 - 17 credits)

Code	Title	Credits
MATH 222	Differential Equations	3-4
or MATH 226	Discrete Analysis	
MATH 333	Probability and Statistics	3
MATH 337	Linear Algebra	3

MATH 344	Regression Analysis	3
Statistics course approved by the minor coordinator		4
Total Credits		**16-17**

More **information on this minor** can be found on the Mathematical Sciences website (http://math.njit.edu/academics/undergraduate/minorinappliedstat.php).

B.S. in Applied Physics & B.S. in Mathematical Sciences, Applied Mathematics

(122 Credits)

First Year		
1st Semester		**Credits**
MATH 111	Calculus I	4
CS 100 or CS 115	Roadmap to Computing or Introduction to Computer Science in C++	3
CHEM 125	General Chemistry I	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
MATH 112	Calculus II	4
PHYS 114	Introduction to Data Reduction with Applications	3
PHYS 121 or PHYS 122	Physics II or Electricity & Magntsm ECE Appl	3
PHYS 121A	Physics II Lab	1
CHEM 125A	General Chemistry Lab I	1
CHEM 126	General Chemistry II	3
	Term Credits	**15**
Second Year		
1st Semester		
MATH 213	Calculus III B	4
MATH 244	Introduction to Probability Theory	3
PHYS 234	Physics III	3
PHYS 231A	Physics III Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
2nd Semester		
MATH 222	Differential Equations	4
MATH 335	Vector Analysis	3
MATH 337	Linear Algebra	3
PHYS 335	Introductory Thermodynamics	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
Third Year		
1st Semester		
MATH 331	Introduction to Partial Differential Equations	3
MATH 332	Introduction to Functions of a Complex Variable	3
PHYS 430	Classical Mechanics I	3

PHYS 432	Electromagnetism I	3
	Term Credits	**12**
2nd Semester		
MATH 340	Applied Numerical Methods	3
PHYS 433	Electromagnetism II	3
Physics/OPSE Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**12**
Fourth Year		
1st Semester		
MATH 450	Methods Of Applied Math	3
MATH 473	Intermediate Differential Equations	3
MATH 480	Introductory Mathematical Analysis	3
PHYS 442	Introduction to Quantum Mechanics	3
	Term Credits	**12**
2nd Semester		
MATH 451	Methods Appl Math II	3
PHYS 450	Advanced Physics Lab	3
Phys/OPSE Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**12**
Fifth Year		
1st Semester		
Math 300+ Elective		3
Physics/OPSE Elective		3
Social Sciences GER (p. 114)		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**12**
	Total Credits	**122**

B.S. in Data Science

Data science is the study and practice of extracting information and structure from data that can then be used for reasoning and adding value to the solution of a problem. It has growing applications in health and medicine, finance, marketing, economics, genomics, social networks, cyber-security, journalism, and other fields where data is collected. It spans academic fields in computer science and mathematics such as machine learning and statistical inference, probability, linear algebra, computer programming, software engineering, high performance computing, and cloud computing.

The B.S. in Data Science program has two options, Computing (in the Ying Wu College of Computing) and Statistics (in the Department of Mathematical Sciences in the College of Science and Liberal Arts).

B.S. in Data Science (Computing Option)

(120 credits)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
MATH 111	Calculus I	4
PHYS 111	Physics I [1]	3
PHYS 111A	Physics I Lab [1]	1
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
CS 113	Introduction to Computer Science	3

MATH 112	Calculus II	4
PHYS 121	Physics II [1]	3
PHYS 121A	Physics II Lab [1]	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
CS 114	Introduction to Computer Science II	3
MATH 244	Introduction to Probability Theory	3
MATH 337	Linear Algebra	3
History and Humanities GER 200 level (p. 106)		3
Social Sciences GER (p. 114)		3
	Term Credits	**15**
2nd Semester		
CS 241	Foundations of Computer Science I	3
CS 280	Programming Language Concepts	3
IS 350	Computers, Society and Ethics	3
MATH 341	Statistical Methods II	3
YWCC 207	Computing & Effective Com	1
Data Science Elective 1		3
	Term Credits	**16**
Third Year		
1st Semester		
CS 288	Intensive Programming in Linux	3
CS 301	Introduction to Data Science	3
CS 331	Database System Design & Mgmt	3
CS 370	Introduction to Artificial Intelligence	3
COM 312 or COM 313	Oral Presentations or Technical Writing	3
	Term Credits	**15**
2nd Semester		
CS 435	Advanced Data Structures and Algorithm Design	3
Data Science Elective 2		3
CS 482	Data Mining	3
CS 375	Introduction to Machine Learning	3
History and Humanities GER 300+ level (p. 108)		3
YWCC 307	Professional Dev in Computing	1
	Term Credits	**16**
Fourth Year		
1st Semester		
CS 450	Data Visualization	3
CS 444	Big Data Systems	3
CS 492	Data Science Capstone I	3
MATH 478	Stat Methods in Data Sci	3
Data Science Elective 3		3
	Term Credits	**15**
2nd Semester		
Humanities and Social Science Senior Seminar GER (p. 112)		3
Free Elective 1 [2]		3
CS 493	Data Science Capstone II	3
MATH 344	Regression Analysis	3

Data Science Elective 4		3
	Term Credits	**15**
	Total Credits	**120**

Code	Title	Credits
Data Science (Computing Option) Electives		
YWCC 310	Co-op Work Experience I	3
CS 332	Principles of Operating Systems	3
CS 350	Intro to Computer Systems	3
CS 351	Introduction to Cybersecurity	3
CS 356	Introduction to Computer Networks	3
CS 357	Fundamentals of Network Security	3
CS 370	Introduction to Artificial Intelligence	3
CS 375	Introduction to Machine Learning	3
CS 444	Big Data Systems	3
CS 408	Cryptography and Internet Security	3
MGMT 316	Business Research Methods	3
MGMT 416	Artificial Intelligence for Business Decisions	3
MRKT 378	Marketing Analytics	3
MRKT 430	Marketing Research	3
MATH 345	Multivariate Distributions	3
MATH 388	Introduction to Chaos Theory	3
MATH 391	Numerical Linear Algebra	3
MATH 430	Analytical and Computational Neuroscience	3
MATH 447	Applied Time Series Analysis	3
MATH 448	Stochastic Simulation	3
MATH 461	Introduction to Statistical Computing with SAS and R	3
IS 333	Social Network Analysis	3
IS 392	Web Mining and Information Retrieval	3
FIN 218	Financial Markets and Institutions	3
FIN 306	Blockchain Technology for Business	3
FIN 310	Data-Driven Financial Modeling	3
FIN 320	Fin Data Analytics	3
IT 430	Ethical Hacking for System Administrators	3
IT 485	Special Topics in Information Technology I	3

B.S. in Data Science (Statistics Option)

(120 credits)

First Year		
1st Semester		**Credits**
CS 100	Roadmap to Computing	3
MATH 111	Calculus I	4
PHYS 111	Physics I [1]	3
PHYS 111A	Physics I Lab [1]	1
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
CS 113	Introduction to Computer Science	3
MATH 112	Calculus II	4
PHYS 121	Physics II [1]	3
PHYS 121A	Physics II Lab [1]	1

ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
CS 114	Introduction to Computer Science II	3
MATH 244	Introduction to Probability Theory	3
MATH 337	Linear Algebra	3
History and Humanities GER 200 level (p. 106)		3
Social Sciences GER (p. 114)		3
	Term Credits	**15**
2nd Semester		
CS 241	Foundations of Computer Science I	3
CS 280	Programming Language Concepts	3
MATH 213	Calculus III B	4
MATH 341	Statistical Methods II	3
Data Science Elective 1		3
	Term Credits	**16**
Third Year		
1st Semester		
MATH 340	Applied Numerical Methods	3
MATH 344	Regression Analysis	3
MATH 391	Numerical Linear Algebra	3
CS 301	Introduction to Data Science	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
MATH 345	Multivariate Distributions	3
MATH 447	Applied Time Series Analysis	3
MATH 478	Stat Methods in Data Sci	3
Data Science Elective 2		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
MATH 448	Stochastic Simulation	3
MATH 461	Introduction to Statistical Computing with SAS and R	3
MATH 462	Statistics and Statistical Learning (Capstone I)	3
CS 450	Data Visualization	3
Data Science Elective 3		3
	Term Credits	**15**
2nd Semester		
Humanities and Social Science Senior Seminar GER (p. 112)		3
Math Upper Level Elective (300+ level)		3
MATH 463	Statistics and Statistical Learning (Capstone II)	3
Data Science Elective 4		3
Free Elective [2]		4
	Term Credits	**16**
	Total Credits	**120**

Code	Title	Credits
Data Science (Statistics Option) Electives		
YWCC 310	Co-op Work Experience I	3

CS 331	Database System Design & Mgmt	3
CS 332	Principles of Operating Systems	3
CS 350	Intro to Computer Systems	3
CS 351	Introduction to Cybersecurity	3
CS 356	Introduction to Computer Networks	3
CS 357	Fundamentals of Network Security	3
CS 370	Introduction to Artificial Intelligence	3
CS 375	Introduction to Machine Learning	3
CS 444	Big Data Systems	3
CS 408	Cryptography and Internet Security	3
CS 435	Advanced Data Structures and Algorithm Design	3
CS 482	Data Mining	3
MGMT 316	Business Research Methods	3
MGMT 416	Artificial Intelligence for Business Decisions	3
MRKT 378	Marketing Analytics	3
MRKT 430	Marketing Research	3
MATH 222	Differential Equations	4
MATH 388	Introduction to Chaos Theory	3
MATH 430	Analytical and Computational Neuroscience	3
MATH 453	High-Performance Numerical Computing	3
MATH 477	Stochastic Processes	3
IS 333	Social Network Analysis	3
IS 392	Web Mining and Information Retrieval	3
FIN 218	Financial Markets and Institutions	3
FIN 306	Blockchain Technology for Business	3
FIN 310	Data-Driven Financial Modeling	3
FIN 320	Fin Data Analytics	3
IT 430	Ethical Hacking for System Administrators	3
IT 485	Special Topics in Information Technology I	3

1. Students considering switching to Computer Science or Mathematical Sciences should take PHYS 111/111A and 121/121A. Do not take PHYS 102/102A
2. Free electives should be chosen in consultation with the advisor. Some restrictions apply.

Computational Mathematics Concentration

B.S. in Mathematical Sciences, Computational Mathematics Concentration

(120 credit minimum)

First Year		
1st Semester		**Credits**
MATH 111	Calculus I	4
CS 100	Roadmap to Computing	3
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
MATH 112	Calculus II	4
Social Science GER (p. 114)		3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1

ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
MATH 213	Calculus III B	4
MATH 333	Probability and Statistics [1]	3
MATH 337	Linear Algebra	3
Select one of the following:		3
PHYS 234	Physics III	
CHEM 125	General Chemistry I	
BIOL 200	Concepts in Biology	
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
MATH 222	Differential Equations	4
MATH 340	Applied Numerical Methods	3
History and Humanities GER 300+ level (p. 108)		3
Application Elective		3
Free Elective		3
	Term Credits	**16**
Third Year		
1st Semester		
MATH 331	Introduction to Partial Differential Equations	3
MATH 391	Numerical Linear Algebra	3
MATH 480	Introductory Mathematical Analysis	3
Application Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
MATH 332	Introduction to Functions of a Complex Variable	3
MATH 440	Advanced Applied Numerical Methods	3
Select one of the following:		3
MATH 341	Statistical Methods II	
MATH 344	Regression Analysis	
MATH 447	Applied Time Series Analysis	
MATH 478	Stat Methods in Data Sci	
Application Elective		3
Technical Elective		3
	Term Credits	**15**
Fourth Year		
1st Semester		
MATH 448	Stochastic Simulation	3
MATH 450	Methods Of Applied Math	3
Technical Elective		3
Free Elective		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
2nd Semester		
MATH 451	Methods Appl Math II	3
MATH 453	High-Performance Numerical Computing	3
Math 300+ Elective		3
Technical Elective		3

Free Elective		3
	Term Credits	**15**
	Total Credits	**120**

[1] Students may substitute MATH 244 (https://catalog.njit.edu/search/?P=MATH%20244) Introduction to Probability Theory, with advisor approval.

General Education Requirements

All students are required to satisfy the General Education Requirements (GER). All GER courses should be selected in consultation with a faculty advisor in the Department of Mathematical Sciences. Refer to the General Education Requirements (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/) section of this catalog for further information on electives.

Co-op Courses

In Mathematical Sciences, the co-op courses, MATH 310 (https://catalog.njit.edu/search/?P=MATH%20310) Co-op Work Experience I and MATH 410 (https://catalog.njit.edu/search/?P=MATH%20410) Co-op Work Experience II, bear degree credit and count as technical or free electives, subject to approval by a faculty advisor in the Department of Mathematical Sciences.

Electives

All mathematics, technical, and free electives should be selected after consultation with a faculty advisor in the Department of Mathematical Sciences. Any mathematics course numbered 331 or above may be used as a mathematics elective. Any course at or above the 100 level having a significant mathematical and/or scientific content may be used as a technical elective. Any course at or above the 100 level may be used as a free elective.

Application Electives

Students are required to take 9 credits of application elective courses in a single area of specialization. Possible areas of specialization for application elective courses include: Biology, Chemistry, Computer Science, Economics/Finance, Physics, Statistics. Students interested in computer science are encouraged to consider the double major program.

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Computational Mathematics Minor

(16 hours)

Code	Title	Credits
MATH 222	Differential Equations	4
MATH 337	Linear Algebra	3
MATH 340	Applied Numerical Methods	3
Select two approved electives such as:		6
MATH 391	Numerical Linear Algebra	
MATH 440	Advanced Applied Numerical Methods	
MATH 448	Stochastic Simulation	
Total Credits		**16**

More information on this minor can be found on the Mathematical Sciences website (http://math.njit.edu/academics/undergraduate/minorincompumath.php).

Double Major in Biology & Mathematical Sciences

(124 credits)

First Year		
1st Semester		**Credits**
MATH 111	Calculus I	4
BIOL 200	Concepts in Biology	4
ENGL 101	English Composition: Introduction to Academic Writing	3
CHEM 125	General Chemistry I	3

CHEM 125A	General Chemistry Lab I	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
MATH 112	Calculus II	4
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
CHEM 126	General Chemistry II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
MATH 211	Calculus III A	3
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 243	Organic Chemistry I	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
BNFO 135 or CS 101	Programming for Bioinformatics or Computer Programming and Problem Solving	3
	Term Credits	**17**
2nd Semester		
MATH 222	Differential Equations	4
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
BNFO 236 or CS 101	Programming for Bioinformatics II or Computer Programming and Problem Solving	3
	Term Credits	**16**
Third Year		
1st Semester		
MATH 337	Linear Algebra	3
MATH 340	Applied Numerical Methods	3
Biology Functional Organism Laboratory		4
History and Humanities GER 200 (p. 106)		3
	Term Credits	**13**
2nd Semester		
MATH 331	Introduction to Partial Differential Equations	3
MATH 333	Probability and Statistics	3
MATH 373	Introduction to Mathematical Biology	3
Biology Cluster Elective		3
	Term Credits	**12**
Fourth Year		
1st Semester		
MATH 450	Methods Of Applied Math	3
MATH 371 or MATH 430	Physiology And Medicine or Analytical and Computational Neuroscience	3
Biology Cluster Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**12**

2nd Semester		
MATH 332	Introduction to Functions of a Complex Variable	3
MATH 451	Methods Appl Math II	3
Biology Laboratory Elective		4
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**13**
Fifth Year		
1st Semester		
MATH 480	Introductory Mathematical Analysis	3
Biology Laboratory Elective		3
Social Sciences GER (p. 114)		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**12**
	Total Credits	**124**

Biology Electives

Concept Cluster Ecology and Evolution

Code	Title	Credits
BIOL 222	Evolution	3
or R120 222	Evolution	
R120 282	Animal Behavior	3
R120 280	Ecology	3
R120 370	Plant Ecology	3

Concept Cluster Molecular and Cellular

Code	Title	Credits
R120 352	Genetics	3
or BIOL 352	Genetics	
R120 355	Cell Biology	3
R120 356	Molecular Biology	3
R120 360	Biochemistry	3
or CHEM 473	Biochemistry	

Concept Cluster Functional Organism(4 cr)

Code	Title	Credits
R120 211	Plant Kingdom	4
R120 230	Biology Of Seed Plants	4
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
R120 340	Mammalian Physiology	4
or BIOL 340	Mammalian Physiology	
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4

Laboratory/ Field Experience (Four Credit Laboratories)

Code	Title	Credits
R120 211	Plant Kingdom	4
R120 227	Biol Invertebrates	4
R120 230	Biology Of Seed Plants	4
R120 285	Comparative Vertebrate Anatomy	4
R120 311	Flora of New Jersey	4

R120 325 & R120 326	Animal Parasites and Parasitology Lab	4
R120 330	Plant Physiology	4
R120 335	General Microbiology	4
BIOL 340	Mammalian Physiology	4
or R120 340	Mammalian Physiology	
R120 342 & R120 343	Developmental Biology and Developmental Biology Lab	4
BIOL 347	Lab Approaches in Neuroscience	4
R120 404	Intro to Neuroanatomy	4
R120 405	Microanatomy of Cells	4
R120 430	Plant Growth & Development	4
BIOL 451	Cell Physiology and Imaging	4
R120 452	Molecular Biol Techniques	4

Three Credit Laboratories

Code	Title	Credits
R120 328	Ornithology	3
R120 371	Field Study Plant Ecology	3
R120 380	Field Ecology	3
R120 381	Ecological History of North Am	3
BIOL 484	Evolution of Animal Behavior Laboratory	3
BIOL 475	Ecological Field Methods and Analysis	3
R120 486	Tropical Field Biology	2

Biology Electives

Code	Title	Credits
BIOL 315	Principles of Neurobiology	3
BIOL 337	Collective Intel in Biol Syst	3
BIOL 338	Ecology of the Dining Hall	3
BIOL 441	Neurophysiology	3
BIOL 423	Physiological Mechanisms	3
R120 345	Comparative Physiology	3
R120 346	Neurobiology	3
R120 350	Immunology	3
R120 365	Evolutions of Humans	3
BIOL 468	Disease Ecology & Evolution	3
BIOL 375	Conservation Biology	3
BIOL 383	Neural Basis of Behavior	3
BIOL 400	Biology in Science Fiction	3
R120 402	Biology of Cancer	3
R120 422	Biological Invasions	3
BIOL 440	Cell Biology of Disease: Cells gone Bad!	3
BIOL 445	Endocrinology	3
or R120 445	Endocrinology	
BIOL 447	Systems Neurobiology	3
BIOL 448	Neuropathophysiology: Nervous System Gone Bad!	3
R120 455	Molec Cell Biology	3
BIOL 462	Comparative Biomechanics	3
R120 472	Environmental Assessment	3
BIOL 491 & BIOL 492	Research and Independent Study and Research and Independent Study	6

R120 493 & R120 494	Seminar In Biology and Seminar In Biol	2
BIOL 495	Honors Seminar in Biology	3

Mathematical Biology Concentration

B.S. in Mathematical Sciences, Mathematical Biology Concentration

(120 credit minimum)

First Year		
1st Semester		**Credits**
MATH 111	Calculus I	4
CS 100	Roadmap to Computing	3
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
MATH 112	Calculus II	4
CHEM 125	General Chemistry I	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
MATH 213	Calculus III B	4
MATH 227	Mathematical Modeling	3
BIOL 200	Concepts in Biology	4
Social Science GER (p. 114)		3
	Term Credits	**14**
2nd Semester		
MATH 222	Differential Equations	4
MATH 333	Probability and Statistics	3
MATH 337	Linear Algebra	3
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**17**
Third Year		
1st Semester		
MATH 331	Introduction to Partial Differential Equations	3
MATH 340	Applied Numerical Methods	3
MATH 371	Physiology And Medicine	3
BIOL 201	Found of Biol: Cell & Molecula	3
BIOL 202	Found of Biol: Cell & Molecula	1
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
MATH 332	Introduction to Functions of a Complex Variable	3
MATH 373	Introduction to Mathematical Biology	3

Technical Elective		3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
MATH 430	Analytical and Computational Neuroscience	3
MATH 450	Methods Of Applied Math	3
MATH 480	Introductory Mathematical Analysis	3
Free Elective		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
2nd Semester		
MATH 451	Methods Appl Math II	3
MATH 481	Advanced Calculus	3
Free Elective		3
Technical Elective		3
Technical Elective		3
	Term Credits	**15**
	Total Credits	**120**

General Education Requirements and Electives

All students are required to satisfy the General Education Requirements (GER). All GER courses and additional mathematics, technical, and free electives are to be selected in consultation with a faculty advisor in the Department of Mathematical Sciences. Refer to the General Education Requirements (p. 105) section of this catalog for further information on electives.

Co-op Courses

In Mathematical Sciences, the co-op courses, MATH 310 Co-op Work Experience I and MATH 410 Co-op Work Experience II, bear degree credit and count as technical or free electives, subject to approval by a faculty advisor in the Department of Mathematical Sciences.

Electives

All electives should be selected after consultation with a Mathematical Sciences faculty advisor. Any mathematics course numbered 331 or above may be used as a mathematics, technical, or free elective. Any NJIT course at or above the 100 level may be used as a technical or free elective; except a technical elective is a course that has a significant mathematical and/or scientific content. All elective courses are to be chosen in consultation with a faculty advisor in the Department of Mathematical Sciences.

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Mathematical Biology Minor

(16 hours)

Code	Title	Credits
MATH 222	Differential Equations	4
MATH 337	Linear Algebra	3
MATH 373	Introduction to Mathematical Biology	3
Select two approved electives such as:		6
MATH 371	Physiology And Medicine	
MATH 372	Population Biology	
MATH 430	Analytical and Computational Neuroscience	
MATH 431	Systems Computational Neuroscience	
Total Credits		**16**

More **information on this minor** can be found on the Mathematical Sciences website (http://math.njit.edu/academics/undergraduate/minorinmathbiology.php).

Mathematics of Finance and Actuarial Science Concentration

B.S. in Mathematical Sciences, Mathematics of Finance and Actuarial Science Concentration

(120 credits)

First Year		
1st Semester		**Credits**
MATH 111	Calculus I	4
CS 100	Roadmap to Computing	3
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
MATH 112	Calculus II	4
ACCT 115	Fundamentals of Financial Accounting	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
MATH 213	Calculus III B	4
MATH 244	Introduction to Probability Theory	3
MATH 337	Linear Algebra	3
ECON 265	Microeconomics	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
MATH 222	Differential Equations	4
MATH 341	Statistical Methods II	3
MATH 345	Multivariate Distributions	3
ECON 266	Macroeconomics	3
FIN 315	Fundamentals of Corporate Finance	3
	Term Credits	**16**
Third Year		
1st Semester		
MATH 340	Applied Numerical Methods	3
MATH 344	Regression Analysis	3
MATH 346	Mathematics of Finance I	3
Free Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
MATH 347	Mathematics of Finance II	3
MATH 356	Loss Models	3
MATH 447	Applied Time Series Analysis	3

MATH 477	Stochastic Processes	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
MATH 331	Introduction to Partial Differential Equations	3
MATH 432	Mathematics of Financial Derivatives I (Capstone I)	3
MATH 441	Actuarial Mathematics I	3
MATH 448	Stochastic Simulation	3
Select one of the following electives:		3
MATH 442	Actuarial Mathematics II	
MATH 478	Stat Methods in Data Sci	
MATH 480	Introductory Mathematical Analysis	
MATH 481	Advanced Calculus	
R390 330	Corporate Finance	
FIN 416	Advanced Corporate Finance	
FIN 422	International Finance	
FIN 423	Risk Analysis	
	Term Credits	**15**
2nd Semester		
MATH 433	Mathematics of Financial Derivatives II (Capstone II)	3
Select one of the following electives:		3
MATH 442	Actuarial Mathematics II	
MATH 478	Stat Methods in Data Sci	
MATH 480	Introductory Mathematical Analysis	
MATH 481	Advanced Calculus	
R390 330	Corporate Finance	
FIN 416	Advanced Corporate Finance	
FIN 422	International Finance	
FIN 423	Risk Analysis	
Free Elective		3
Free Elective		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**120**

General Education Requirements and Electives

All students are required to satisfy the General Education Requirements (GER). All GER courses and additional mathematics, technical, and free electives are to be selected in consultation with a faculty advisor in the Department of Mathematical Sciences. Refer to the General Education Requirements (p. 105) section of this catalog for further information on electives.

Co-op Courses

In Mathematical Sciences, the co-op courses, MATH 310 Co-op Work Experience I and MATH 410 Co-op Work Experience II, bear degree credit and count as technical or free electives, subject to approval by a faculty advisor in the Department of Mathematical Sciences.

Electives

All electives should be selected after consultation with a Mathematical Sciences faculty advisor. Any mathematics course numbered 331 or above may be used as a mathematics, technical, or free elective. Any NJIT course at or above the 100 level may be used as a technical or free elective; except a technical elective is a course that has a significant mathematical and/or scientific content. All elective courses are to be chosen in consultation with a faculty advisor in the Department of Mathematical Sciences.

Mathematics of Finance and Actuarial Science Minor

(16 hours)

Code	Title	Credits
MATH 222	Differential Equations	4
MATH 340	Applied Numerical Methods	3
MATH 346	Mathematics of Finance I	3
Select two approved electives such as:		6
MATH 334	Operations Research	
MATH 347	Mathematics of Finance II	
MATH 432	Mathematics of Financial Derivatives I (Capstone I)	
MATH 433	Mathematics of Financial Derivatives II (Capstone II)	
MATH 441	Actuarial Mathematics I	
MATH 448	Stochastic Simulation	
MATH 477	Stochastic Processes	
Total Credits		**16**

More **information on this minor** can be found on the Mathematical Sciences website (http://math.njit.edu/academics/undergraduate/minorinmathfacts.php).

Physics

With a primary focus on applied physics, the department offers research-intensive programs at the undergraduate and graduate levels to prepare students for professional careers and to foster the scientific literacy that informed citizens need in the 21stare at the forefront of research areas that include solar physics, photonics, imaging and optical science, biophysics, material science, and microelectronics. In solar physics, NJIT's Big Bear (http://www.bbso.njit.edu/)Observatory (http://www.bbso.njit.edu/) in California is the most powerful ground-based optical telescope dedicated to the study of the Sun and the terrestrial impact of phenomena such as solar flares. Members of the Physics Department (http://physics.njit.edu/) are also at the leading-edge of solar radio astronomy, at the Owens Valley Expanded Solar Array in California.

NJIT Faculty

A

Ahn, Keun Hyuk, Associate Professor

Ahn, Kwangsu, Assistant Research Professor

C

Cao, Wenda, Associate Professor

Chin, Ken K., Professor

Chen, Bin, Assistant Professor

D

Dias, Cristiano Luis, Assistant Professor

F

Farrow, Reginald C., Research Professor

Federici, John F., Distinguished Professor

Fleishman, Gregory David, Distinguished Research Professor

G

Gary, Dale E., Distinguished Professor

Gatley, Ian, Distinguished Professor

Georgiou, George E., University Lecturer

Gerrard, Andrew J., Professor

Gokce, Oktay Huseyin, Senior University Lecturer

Goode, Philip R., Distinguished Research Professor

J

Janow, Richard H., University Lecturer

Jerez, Andres, University Lecturer

Jing, Ju, Research Professor

K

Kim, Hyomin, Assistant Professor

Kosovichev, Alexander G., Professor

L

Lanzerotti, Louis J., Distinguished Research Professor

Levy, Roland A., Distinguished Professor

Liu, Chang, Research Professor

M

Maljian, Libarid A., University Lecturer

N

Nita, Gelu M., Research Professor

O

Opyrchal, Halina, Senior University Lecturer

Opyrchal, Jan, Undergraduate Lab Director

P

Perry, Gareth, Assistant Professor

Piatek, Slawomir, Senior University Lecturer

Prodan, Camelia, Associate Professor

R

Ravindra, N. M., Professor

Russo, Onofrio L., Associate Professor

S

Shneidman, Vitaly A., Senior University Lecturer

Sirenko, Andrei, Professor

T

Thomas, Benjamin, Assistant Professor

Thomas, Gordon A., Professor

Towfik, Nissim M., Associate Professor

Tyson, Trevor A., Distinguished Professor

W

Wang, Haimin, Distinguished Professor

X

Xu, Yan, Research Professor

Y

Yurchyshyn, Vasyl, Research Professor

Z

Zhou, Tao, Associate Professor

Programs

- Applied Physics - B.S. (p. 474)

Double Majors (p. 102)

- Applied Physics & Mathematical Sciences with Applied Mathematics Concentration - B.S. (p. 452)
- Computer Science and Applied Physics - B.S. (p. 218)
- Physics & Law, Technology and Culture - Astronomy Option (p. 478)
- Physics & Law, Technology and Culture - Optical Science & Engineering Option (p. 480)

Physics Courses

MTSE 301. Principles of Material Science and Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 111 and PHYS 121, CHEM 125 and CHEM 126, MATH 111 and MATH 112 or equivalent. Examines the interrelationships among structure, properties, and performance of engineering materials. Topics to be covered include atomic structure, crystallography, solid state imperfections and diffusion. The properties of metals, semiconductors, polymers, ceramics, and composites as well as their behavioral response to mechanical, chemical, optical, electrical, and magnetic stimuli are examined in light of their performance in service.

MTSE 311. Properties of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisite: two semesters of college physics or equivalent. Intended for engineering technology students and is an introduction to the principal metallic and nonmetallic engineering materials, including their physical properties, response to heat treatment, and corrosion -resistance.

MTSE 318. Engineering Materials. 4 credits, 5 contact hours (3;2;0).
Prerequisites: PHYS 111; CHEM 126. Introduces the student to such engineering materials as metals, viscoelastic materials, ceramics, polymers, and semiconductors. The approach is interdisciplinary with stress upon the structure of materials. Various mechanical and thermal treatments are discussed and related to the stability of the resultant properties. The laboratory sessions implement and emphasize the effects of these mechanical and thermal treatments on the materials.

MTSE 319. Engineering Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 111; CHEM 126. This course is identical to MTSE 318, with the laboratory omitted.

MTSE 451. X-Ray Diffraction. 3 credits, 4 contact hours (2;2;0).
Prerequisites: PHYS 234; CHEM 126; MATH 112; CS 100, CS 101, CS 115 or BNFO 135. Course combines lecture and laboratory work in introducing methods of X-ray diffraction. Simple sample synthesis will be conducted to initiate experiments. Topics include fundamentals of x-ray scattering, powder and single crystal diffraction techniques and data modeling methods. Local and national laboratory facilities will be utilized for experiments.

MTSE 452. Materials Science I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 111; CHEM 126; ME 435 or PHYS 335. Emphasizes the structure and properties of materials and the relationships between them. The primary topics include the thermodynamics of solids, fracture mechanisms, diffusion, elasticity, plasticity, fatigue strength, viscosity, and creep.

MTSE 453. Materials Science II. 5 credits, 7 contact hours (3;4;0).
Prerequisite: MTSE 452. Emphasizes the electronic properties of materials in conjunction with an introduction to ceramics. Topics include semiconductors, thermoelectricity, magnetism, conductivity, dielectric, optical properties, and an introduction to the properties and behavior of ceramics.

PHYS 102. General Physics. 3 credits, 3 contact hours (3;0;0).
Corequisite: PHYS 102A. Intended for students in architecture, computer science (B.A. only), STS and other disciplines requiring laboratory science electives. Elementary statics and dynamics. Subjects discussed are kinematics, Newton's laws of motion, energy, momentum, conservation principles, and mechanical properties of matter. Lab must be taken concurrently.

PHYS 102A. General Physics Lab. 1 credit, 2 contact hours (0;2;0).
Corequisite: PHYS 102. This course is the laboratory component of PHYS 102 and must be taken concurrently.

PHYS 103. General Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 102/PHYS 102A or PHYS 111/PHYS 111A all with grade of C or better. Corequisite: PHYS 103A. A continuation of PHYS 102 for students in architecture, computer science (B.A. only), STS and other disciplines requiring laboratory science electives. Topics discussed are heat, thermodynamics, sound, wave motion, illumination, geometric and physical optics, and color. Lab must be taken concurrently.

PHYS 103A. General Physics Lab. 1 credit, 2 contact hours (0;2;0).
Prerequisites: PHYS 102/PHYS 102A or PHYS 111/PHYS 111A all with grade of C or better. Corequisite: PHYS 103. This course is the laboratory component of PHYS 103 and must be taken concurrently.

PHYS 111. Physics I. 3 credits, 3 contact hours (3;0;0).
Corequisites: PHYS 111A and MATH 111. Elementary mechanics with an emphasis on the fundamental concepts and laws of mechanics, especially the conservation laws. Topics are scalar and vector quantities of mechanics; rectilinear and circular motion; equilibrium and Newton's laws of motion; work, energy, momentum; the conservation laws. Lab must be taken concurrently. See PHYS 111A.

PHYS 111A. Physics I Lab. 1 credit, 2 contact hours (0;2;0).
Corequisite: PHYS 111. Laboratory component of PHYS 111. Lab must be taken concurrently with PHYS 111.

PHYS 114. Introduction to Data Reduction with Applications. 3 credits, 3 contact hours (3;0;0).
Corequisite: MATH 111. Physics majors only. An introduction to both the theory and application of error analysis and data reduction methodology. Topics include the binomial distribution and its simplification to Gaussian and Poisson probability distribution functions, estimation of moments, and propagation of uncertainty. Forward modeling, including least-squares fitting of linear and polynomial functions are discussed. The course enables students to apply the concepts of the data reduction and error analysis using data analysis software to real data sets found in the physical sciences.

PHYS 121. Physics II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 111/PHYS 111A and MATH 111 all with a grade of C or better. Corequisites: PHYS 121A and MATH 112 with grade of C or better. This course deals with an introduction to electricity and magnetism. Topics include simple dc circuits, the electric field, the magnetic field, electric potential, capacitance relationships between electric and magnetic fields, inductance, and simple ac circuits. Lab must be taken concurrently. See PHYS 121A.

PHYS 121A. Physics II Lab. 1 credit, 2 contact hours (0;2;0).
Prerequisites: PHYS 111/PHYS 111A and MATH 111 all with grade of C or better. Corequisites: PHYS 121 or PHYS 122. Lab must be taken concurrently with PHYS 121 or PHYS 122. Laboratory component of PHYS 121 and PHYS 122.

PHYS 122. Electricity & Magntsm ECE Appl. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 111/PHYS 111A and MATH 111 all with a grade of C or better. Corequisites: PHYS 121A and MATH 112 with grade of C or better. This course emphasizes applications of electricity and magnetism to circuit problems, explores electric fields and magnetic fields of non-trivial charge and current distributions, introduce students to complex variables, and emphasizes methods for solving large linear problems. It provides a strong coupling of the underlying physics with calculus. Lab must be taken concurrently. See PHYS 121A.

PHYS 202. Introductory Astronomy and Cosmology. 3 credits, 3 contact hours (3;0;0).
A non-mathematical presentation of contemporary views of the origin, evolution, and structure of the solar system, stars, galaxies, and the universe. Special topics include neutron stars, black holes, gravitationally strange objects, and the big bang.

PHYS 202A. Astronomy and Cosmology Laboratory. 1 credit, 2 contact hours (0;2;0).
Includes demonstration of physical principles applicable to astronomy. Use of telescope for lunar, solar and planetary observations. Optional laboratory course associated with PHYS 202.

PHYS 203. The Earth in Space. 3 credits, 3 contact hours (3;0;0).
Prerequisite: None. Introduces fundamental phenomena, such as plate tectonics, erosion, volcanism, and glaciation. Studies the interaction between the Earth's four major reservoirs?atmosphere, hydrosphere, biosphere and solid earth; investigates the dependence of the Earth on the Sun; the effect of the Moon on the Earth. Extends knowledge gained from studying the Earth to other planets in this solar system.

PHYS 203A. The Earth in Space Lab. 1 credit, 2 contact hours (0;2;0).
Corequisite: PHYS 203. Optional laboratory course associated with PHYS 203.

PHYS 204. Biophysics of Life. 3 credits, 3 contact hours (3;0;0).
A quantitative, but non-mathematical, view of how living entities work in terms of the basic concepts of physics and biology. We will use active, studio learning to explore how the nervous system, the heart and the lungs work and how the blood pressure results. We will discuss how these concepts underlie topics ranging from birth to death, from touch to pleasure, from vision to beauty, and from a thought to a heartbeat. The course is geared to all majors.

PHYS 231A. Physics III Lab. 1 credit, 2 contact hours (0;2;0).
Prerequisites: PHYS 111/PHYS 111A; PHYS 121/PHYS 121A and MATH 112, all with grade of C or better. Corequisites: PHYS 231H or PHYS 234. Optional course associated with PHYS 234 and PHYS 231H.

PHYS 231H. Physics III Honors. 4 credits, 4 contact hours (4;0;0).
Prerequisites: PHYS 111/PHYS 111A; PHYS 121/PHYS 121A; MATH 111; MATH 112; all with grade of C or better. Third semester of a three-semester program in Honors Physics. Physical optics is treated in greater detail. Modern physics includes a greater number of topics, with special emphasis on the wave-particle duality in nature. Lab must be taken concurrently. See PHYS 231A.

PHYS 234. Physics III. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 121/PHYS 121A or PHYS 122/PHYS 121A and MATH 112 with a grade of C or better. Elements of simple harmonic motion, wave motion, geometric and physical optics are considered. The wave and particle duality of nature is emphasized and made plausible by an examination of the important experiments and theories which lead to the modern concepts of matter and radiation. The conservation laws are broadened to include the equivalence of mass and energy.

PHYS 310. Introduction to Atomic and Nuclear Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234; MATH 222, all with grade of C or better. Selected topics in atomic physics including the Pauli Exclusion Principle and the Atomic Shell Model. In nuclear physics, the two-body problem, nuclear models, alpha, beta, and gamma radiation, acclerators, and nuclear detectors are studied. R750 403 may be substituted for this course.

PHYS 311. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisite: Acceptance into the co-op program. Students gain major-related experience and reinforcement of the academic program. Work assignments are facilitated and approved by the Office of Cooperative Education and Internships. Participation in seminars and a final report/project is mandatory. Note: Normal grading applies to this COOP Experience.

PHYS 320. Astronomy and Astrophysics I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 121, with grade of C or better. A quantitative introduction to the astronomy of the sun, earth, and solar system, with an emphasis on the physical principles involved. Includes celestial mechanics, planetary atmospheres and the physics of comets, asteroids and meteorites.

PHYS 321. Astronomy and Astrophysics II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 320, with grade of C or better. A quantitative introduction to the astronomy of the stars, the galaxy, and cosmology, with an emphasis on the physical principles involved. Includes stellar interiors, stellar evolution, galactic dynamics, large-scale structure and early history of the universe.

PHYS 322. Observational Astronomy. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 320, with grade of C or better. Most class time is spent in an observatory performing observations of celestial objects such as the Sun, Moon, planets, stars, stellar clusters, and galaxies. Experimental projects include charting the skies, asterophotography (film and CCD), measuring masses of planets, rotational period of the Sun, topography of the Moon, H-R diagrams of stellar clusters, etc.

PHYS 335. Introductory Thermodynamics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 211 or MATH 213, all with grade of C or better. Corequisites: MATH 222, MATH 238 or MATH 335. Introductory thermodynamics, kinetic theory, statistical physics. Topics include equations of state, the three laws of thermodynamics, reversible and irreversible processes. R750 315 may be substituted for this course.

PHYS 350. Biophysics I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 121 with a grade of C or better. This course presents an introduction to general biophysics. Students will learn the basic principles behind cells, thermodynamics and statistical mechanics applied to cellular environments forces affecting conformation of biological molecules, protein and nucleic acid biophysics, membrane biophysics, and basic physics principles behind nerve impulses and heart and lung function and malfunction. Demonstrations and measurements using basic medical measurements will be used when feasible.

PHYS 390. Selected Topics of Current Interest in Physics. 1 credit, 1 contact hour (1;0;0).
Prerequisite: PHYS 234 with grade of C or better. Seminar covering topics that are currently in the forefront of physics. The lecture series offers exposure to such topics as nuclear physics, solid state physics, plasma physics, the special and general theories of relativity, and the history and philosophy of science.

PHYS 411. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: PHYS 311, with grade of C or better, and acceptance into the co-op program. Provides for co-op work assignments which must be approved by the Office of Cooperative Education and Internships. Participation in seminars and a final -report/project are mandatory. Note: Normal grading applies to this COOP Experience.

PHYS 418. Fundamentals of Optical Imaging. 3 credits, 4 contact hours (2;2;0).
Prerequisites: PHYS 234 or PHYS 231, with grade of C or better. This is a course with both lectures and experiments and the emphasis is on the hands-on experiences. Upon completion of the course, students should not only grasp the basic concepts involved in imaging science, but also be able to work on simple real world imaging systems. The main content of the lecture part of this course can be summarized as the following: Optical sources, detectors and their working mechanism; Image formation and transmission; Optical imaging system and their characteristics; Imaging processing and algorithms. This course is developed in close collaboration with Edmund Optics Inc.

PHYS 420. Special Relativity. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 and MATH 222, all with grade of C or better. An introduction to Einstein's Special Theory of Relativity at the advanced undergraduate level. Topics include invariance of the speed of light, relativity of time and space, the Lorentz transformations, space-time diagrams, the twin paradox and time travel, relativistic mechanics, rotating reference frames, laser gyroscopes, superluminal motion, phase and group velocities, and applications in high-energy physics, relativistic engineering, nuclear physics, astrophysics, and cosmology.

PHYS 421. General Relativity. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 and MATH 222, all with grade of C or better. An introduction to Einstein's General Theory of Relativity at the advanced undergraduate level. Topics include review of Newton's Theory of Gravitation, review of Einstein's Special Theory of Relativity, tensor calculus on both flat and curved manifolds, the covariant derivative, curvature, Einstein's Gravitational Field Equations, the weak-field limit, gravitational radiation, the black hole solution, Hawking radiation, the No-Hair Theorem, cosmology, and a history of the Universe.

PHYS 430. Classical Mechanics I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 and MATH 222 and MATH 328 or MATH 335, all with grade of C or better. Newtonian mechanics of particles and systems. Lagrange's and Hamilton's approaches. Continuous systems. R750 361 may be substituted for this course.

PHYS 431. Classical Mechanics II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 430, with grade of C or better. Theory of small oscillations and mechanical waves. Rigid bodies. Topics include stability, linearization methods, forced vibrators and perturbation theory, fluids and mechanics of continuous media. R750 362 may be substituted for this course.

PHYS 432. Electromagnetism I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 234H or PHYS 231H and MATH 222 or MATH 222H and MATH 328 or MATH 335, all with grade of C or better. Electrostatics and magnetostatics, Maxwell's equations with applications, and electrodynamics.

PHYS 433. Electromagnetism II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 432, with grade of C or better. Maxwell's equations with applications and electrodynamics.

PHYS 441. Modern Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 222 , all with grade of C or better. Topics include wave-particle duality, wave mechanics, two-state quantum systems, the motion of an electron in a periodic lattice, band theory of solids, electrical, thermal and magnetic properties of solids, and plasmas and super fluid systems. R750 316 may be substituted for this course.

PHYS 442. Introduction to Quantum Mechanics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 430, with grade of C or better. Wave-particle duality, the Schrodinger and Heisenberg formulations of quantum mechanics. The hydrogen atom, perturbation theory, and concepts of degeneracy, composite states and general properties of eigenfunctions. R750 404 may be substituted for this course.

PHYS 443. Modern Optics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 222, all with a grade of C or better. Electromagnetic theory of light, interference, diffraction, polarization, absorption, double refraction, scattering, dispersion, aberration, and an introduction to quantum optics. Other topics include holography, lasers, information retrieval, spatial filtering, and character recognition.

PHYS 444. Fluid and Plasma Dynamics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 222 , all with grade of C or better. Introduces the basics of plasma physics. Covers the following plasma parameters, single particle motions, plasma as fluid, waves, diffusion and resistivity, equilibrium and instability, kinetic theory, nonlinear effects. Applications in three areas: controlled fusion, astrophysics, and interaction between light and plasma.

PHYS 446. Solid State Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 222, with grade of C or better. Corequisite: PHYS 442. An introduction to modern concepts of the solid state. Topics include crystal structure and diffraction, crystal binding and elastic properties, thermal properties, dielectric phenomena, band theory of solids and Fermi surfaces, electrical conductors, semiconductors, magnetism, and super-conductivity. R750 406 may be substituted for this course.

PHYS 450. Advanced Physics Lab. 3 credits, 5 contact hours (1;4;0).
Prerequisites: PHYS 335, PHYS 430, PHYS 432, all with grade of C or better. Introduction to electrical measurements; instrumentation; theoretical and applied electronics, solid state electronic devices, digital circuitry; computer design; experiments in modern physics.

PHYS 451. Biophysics of Electricity and Radiation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 103 or PHYS 121 with a grade of C or better. This course will survey the basic principles of biophysics using electromagnetic waves as our theme. We will learn the basic therapeutic and destructive aspects of radiation from electrical fields at frequencies from below 60 cps to x-rays and beyond. We will also use active learning and prepare reports on research projects in class. In a general sense, the biophysical properties of radiation are important in the human nervous systems, in cancer treatment and in carcinogenesis. During this course, we will explore how nuclear radiation is unnecessarily feared in some cases and appropriately feared in others. The course is designed for Biophysics and Biology majors, but is also geared to Biomedical Engineers and Chemists.

PHYS 452. Atomic and Nuclear Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 222, all with grade of C or better. Topics include atomic spectra, atomic structure, and nuclear physics.

PHYS 456. Introduction to Solid State Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 222, all with grade of C or better. Treats the same topics as PHYS 446 while introducing the necessary modern physics. Designed for students choosing a minor in applied physics. Students majoring in applied physics are ineligible.

PHYS 461. Mathematical Methods of Theoretical Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 430, PHYS 432, PHYS 433, all with grade of C or better. Topics include vector and tensor analysis, matrix methods, complex variables, Sturm-Liouville theory, special functions, Fourier series and integrals, integral equations, and numerical solutions of differential equations.

PHYS 480. Topics in Applied Physics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Permission of instructor. Current topics and interests in applied physics and physics. Emphasis is on research and scientific development in microelectornics, optoelectronics, optical physics, materials science, surface science, solar physics, and modern physics.

PHYS 481. Applied Solid State Physics: Microelectronics I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 446, with grade of C or better. Topics include physics of bipolar and field effect devices, Phonon and optical spectra, unipolar devices, and thermal and high field properties of semiconductor devices.

PHYS 482. Applied Solid State Physics: Microelectronics II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 446, with grade of C or better. Topics include large-scale integrated circuits, device characteristics, charge-coupled devices, LED and semiconductor lasers, photodetectors, and electrical and optical properties of materials.

PHYS 483. Applied Solid State Physics. 3 credits, 6 contact hours (0;6;0).
Prerequisite: PHYS 446, with grade of C or better. Introduction to digital concepts; binary circuits and microprocessor architecture. Applications of discrete solid-state devices and integrated circuits are explored both in theory and practice. The laboratory also serves as an introduction to hardware and software components of a typical microcomputer.

PHYS 485. Computer Modeling of Applied Physics Problems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 234 or PHYS 231 and MATH 222, all with grade of C or better. General computer programming modeling methods and techniques. Numerical solutions to integro-differential equations. Eigenvalues problems. Application of computer-aided-design and other packages. R750 461 may be substituted for this course.

PHYS 490. Independent Study. 3 credits, 3 contact hours (0;0;3).
Prerequisite: Departmental approval. Undertake individual research or a project under the supervision of a member of the physics department. 21&62 750 485, 486 may be substituted for this course.

PHYS 491. Independent Study II. 3 credits, 3 contact hours (0;0;3).

Rutgers-Newark Courses

R750 109. Astronomy & Cosmology. 3 credits, 3 contact hours (3;0;0).

R750 110. Astronomy & Cosmology. 3 credits, 3 contact hours (3;0;0).

R750 131. Elements Of Physics. 3 credits, 0 contact hours (0;0;0).

R750 133. Elements Of Physics Lab. 1 credit, 1 contact hour (0;1;0).

R750 202. Physics As Librl Art. 3 credits, 0 contact hours (0;0;0).

R750 203. General Physics I. 4 credits, 3 contact hours (3;0;0).

R750 204. General Physics II. 4 credits, 4 contact hours (4;0;0).

R750 205. Intro Physics Lab. 1 credit, 1 contact hour (0;1;0).

R750 206. Intro To Physics Lab. 1 credit, 1 contact hour (0;1;0).

R750 213. Univ Physics. 4 credits, 4 contact hours (4;0;0).

R750 214. Elements Of Physics. 4 credits, 4 contact hours (4;0;0).

R750 222. Dynamics. 3 credits, 3 contact hours (3;0;0).

R750 307. Computer Electronics. 4 credits, 4 contact hours (4;0;0).

R750 308. Computer Electronics. 3 credits, 0 contact hours (0;0;0).

R750 315. Intro Thermodynamics. 3 credits, 3 contact hours (3;0;0).

R750 316. Modern Physics. 3 credits, 3 contact hours (3;0;0).

R750 333. App Math To Physics. 3 credits, 3 contact hours (3;0;0).

R750 361. Mechanics I. 3 credits, 3 contact hours (3;0;0).

R750 362. Mechanics. 3 credits, 3 contact hours (3;0;0).

R750 364. Applied Math To Physics. 3 credits, 3 contact hours (3;0;0).

R750 385. Elec-Magn Fields & Waves. 3 credits, 3 contact hours (3;0;0).

R750 386. Elec-Magn Flds & Waves. 3 credits, 3 contact hours (3;0;0).

R750 396. Trumpet. 1 credit, 0 contact hours (0;0;0).

R750 403. Intro Atom & Nucl Phys. 3 credits, 3 contact hours (3;0;0).

R750 404. Quantum Mechanics. 3 credits, 3 contact hours (3;0;0).

R750 406. Solid State Physics. 3 credits, 3 contact hours (3;0;0).

R750 407. Advancd Phys Lab I. 1 credit, 0 contact hours (0;0;0).

R750 408. Adv Physics Lab II. 1 credit, 1 contact hour (0;1;0).

R750 410. Physical Electronics. 2 credits, 2 contact hours (2;0;0).

R750 411. Physical Optics. 3 credits, 3 contact hours (3;0;0).

R750 446. Solid State Physics. 3 credits, 0 contact hours (0;0;0).

R750 461. Computation Physics. 3 credits, 3 contact hours (3;0;0).

R750 462. Adv Math Meth In Phy. 0 credits, 0 contact hours (0;0;0).

R750 485. Individual Research. 1-3 credits, 3 contact hours (3;0;0).

R750 486. Individual Research. 3 credits, 0 contact hours (0;0;0).

R750 492. Physics Seminar. 1 credit, 1 contact hour (1;0;0).

R750 493. Readings In Physics. 3 credits, 3 contact hours (3;0;0).

R750 494. Reading In Physics. 3 credits, 3 contact hours (3;0;0).

B.S. in Applied Physics

(120 credits minimum)

Bachelor of Science in Applied Physics - Astronomy Option

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
MATH 111	Calculus I	4
CS 113 or CS 115	Introduction to Computer Science or Introduction to Computer Science in C++	3
CHEM 125 or CHEM 121	General Chemistry I or Fundamentals of Chemical Principles I	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
PHYS 114	Introduction to Data Reduction with Applications	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
MATH 112	Calculus II	4
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
CHEM 125A	General Chemistry Lab I	1
	Term Credits	**15**
Second Year		
1st Semester		
MATH 213	Calculus III B	4
MATH 225	Survey of Probability and Statistics *	1
PHYS 234	Physics III	3
PHYS 231A	Physics III Lab	1
History and Humanities GER 200 level (p. 106)		3
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**15**
2nd Semester		
MATH 222	Differential Equations	4
MATH 328	Mathematical Methods for Scientists and Engineers	3
PHYS 335 or R750 315	Introductory Thermodynamics or Intro Thermodynamics	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**13**
Third Year		
1st Semester		
PHYS 432	Electromagnetism I	3
PHYS 320	Astronomy and Astrophysics I	3
History and Humanities GER 300+ level (p. 108)		3
PHYS 430	Classical Mechanics I	3
MATH Elective		3
	Term Credits	**15**
2nd Semester		
PHYS 433	Electromagnetism II	3
PHYS 321	Astronomy and Astrophysics II	3
PHYS 418	Fundamentals of Optical Imaging	3
Math/Phys/CS Elective		3

Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
PHYS 420	Special Relativity	3
PHYS 442 or R750 404	Introduction to Quantum Mechanics or Quantum Mechanics	3
Math/Physics/CS Elective		3
Technical Elective		3
Social Science GER (p. 114)		3
	Term Credits	**15**
2nd Semester		
PHYS 322	Observational Astronomy	3
PHYS 421	General Relativity	3
PHYS 450	Advanced Physics Lab	3
Technical Elective		3
Technical Elective		3
	Term Credits	**15**
	Total Credits	**120**

* Students can take MATH 333 (Probability and Statistics) instead of MATH 225

Electives

Math/Phys/CS

Consult the physics department for information about qualifying courses.

Technical

Consult the physics department for information about qualifying courses.

Refer to the **General Education Requirements** for further information on GER electives.

Co-op Courses

Co-op courses bearing degree credit replace a technical elective or another course approved by the faculty advisor in the students major department. In applied physics, both PHYS 311 Co-op Work Experience I and PHYS 411 Co-op Work Experience II are taken for degree Credit with permission.

Bachelor of Science in Applied Physics - Optical Science and Engineering Option

(120 credits minimum)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
MATH 111	Calculus I	4
CS 113 or CS 115	Introduction to Computer Science or Introduction to Computer Science in C++	3
CHEM 125 or CHEM 121	General Chemistry I or Fundamentals of Chemical Principles I	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
PHYS 114	Introduction to Data Reduction with Applications	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1

MATH 112	Calculus II	4
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
CHEM 125A	General Chemistry Lab I	1
	Term Credits	**15**
Second Year		
1st Semester		
MATH 213	Calculus III B	4
MATH 225	Survey of Probability and Statistics *	1
PHYS 234	Physics III	3
PHYS 231A	Physics III Lab	1
History and Humanities GER 200 level (p. 106)		3
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**15**
2nd Semester		
MATH 222	Differential Equations	4
MATH 328	Mathematical Methods for Scientists and Engineers	3
PHYS 335 or R750 315	Introductory Thermodynamics or Intro Thermodynamics	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**13**
Third Year		
1st Semester		
OPSE 301	Introduction to Optical Science and Engineering	3
OPSE 310	Virtual Instrumentation	3
History and Humanities GER 300+ level (p. 108)		3
PHYS 430	Classical Mechanics I	3
PHYS 432	Electromagnetism I	3
	Term Credits	**15**
2nd Semester		
OPSE 402	High Power Laser and Photonics Applications	3
PHYS 433	Electromagnetism II	3
PHYS 418	Fundamentals of Optical Imaging	3
PHYS 446	Solid State Physics	3
Phys/OPSE Elective		3
	Term Credits	**15**
Fourth Year		
1st Semester		
PHYS 442 or R750 404	Introduction to Quantum Mechanics or Quantum Mechanics	3
Phys/OPSE/EE Elective		3
Technical Elective		3
Technical Elective		3
Social Science GER (p. 114)		3
	Term Credits	**15**
2nd Semester		
PHYS 450	Advanced Physics Lab	3
Free Elective		3
Technical Elective		3
Phys/EE Elective		3

Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**120**

* Students can take MATH 333 (Probability and Statistics) instead of MATH 225

Electives

Phys/OPSE

Consult the physics department for information about qualifying courses.

Math/Phys/CS

Consult the physics department for information about qualifying courses.

Math/Phys/EE/CS

Consult the physics department for information about qualifying courses.

Technical

Consult the physics department for information about qualifying courses.

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

Co-op Courses

Co-op courses bearing degree credit replace a technical elective or another course approved by the faculty advisor in the students major department. In applied physics, both PHYS 311 Co-op Work Experience I and PHYS 411 Co-op Work Experience II are taken for degree Credit with permission.

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Physics & Law, Technology and Culture (Astronomy Option) - B.S.

(138 credits minimum)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
MATH 111	Calculus I	4
CS 113 or CS 115	Introduction to Computer Science or Introduction to Computer Science in C++	3
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
PHYS 114	Introduction to Data Reduction with Applications	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
MATH 112	Calculus II	4
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
CHEM 125A	General Chemistry Lab I	1
	Term Credits	**15**

Second Year		
1st Semester		
MATH 213	Calculus III B	4
MATH 225	Survey of Probability and Statistics [1]	1
PHYS 234	Physics III	3
PHYS 231A	Physics III Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**15**
2nd Semester		
MATH 222	Differential Equations	4
MATH 328	Mathematical Methods for Scientists and Engineers	3
PHYS 335 or R750 315	Introductory Thermodynamics or Intro Thermodynamics	3
Legal Foundations Elective [2]		3
LTC Core Elective		3
	Term Credits	**16**
Third Year		
1st Semester		
PHYS 432	Electromagnetism I	3
PHYS 320	Astronomy and Astrophysics I	3
PHYS 430	Classical Mechanics I	3
Elective (Math) [3]		3
Legal Foundations Elective [2]		3
	Term Credits	**15**
2nd Semester		
PHYS 433	Electromagnetism II	3
PHYS 321	Astronomy and Astrophysics II	3
PHYS 418	Fundamentals of Optical Imaging	3
Elective (Math/Physics/Computer Science) [3]		3
LTC Core Elective		3
	Term Credits	**15**
Fourth Year		
1st Semester		
PHYS 420	Special Relativity	3
PHYS 442 or R750 404	Introduction to Quantum Mechanics or Quantum Mechanics	3
Elective (Math/Physics/Computer Science) [3]		3
Technical Elective [4]		3
Legal Foundations Elective		3
	Term Credits	**15**
2nd Semester		
PHYS 322	Observational Astronomy	3
PHYS 421	General Relativity	3
PHYS 450	Advanced Physics Lab	3
LTC Core Elective		3
HSS Senior Seminar GER (p. 112) [5]		3
	Term Credits	**15**
Fifth Year		
1st Semester		
HIST 310	Co-op in Law, Technology, Culture and History I	3
LTC Core Elective		3

Social Science GER (p. 114)		3
Technical Elective [4]		3
Technical Elective [4]		3
	Term Credits	**15**
	Total Credits	**138**

1 Math 333 is an acceptable alternative to Math 225
2 The first two Legal Foundations Electives must satisfy the History and Humanities 300 Level GER (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/).
3 Math/Physics/Computer Science Electives: Consult the Physics Department for information about qualifying courses.
4 Technical Electives: Consult the Physics Department for information about qualifying courses.
5 The HSS Senior Seminar (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/hss-capstone/) should be an approved law-related course as determined by the LTC Program advisor.

Code	Title	Credits
LEGAL FOUNDATIONS ELECTIVES		
Select three of the following:		
HIST 361	The Founding of the American Nation	3
HIST 362	Sex, Gender, and the Law in American History	3
HIST 364	American Law in the World	3
HIST 369	Law and Society in History	3
MGMT 290	Business Law I	3
STS 300	Legal Reasoning, Writing, and Technology	3
R790 304	Intro Law And Legal Res	3

Code	Title	Credits
LTC CORE ELECTIVES		
Select four of the following:		
EVSC 335	Environmental Law	3
HIST 320	Law and Evidence	3
HIST 338	Environmental Justice and Climate Change in America	3
HIST 370	Legal issues in the History of Media	3
HIST 375	Legal Issues in Environmental History	3
HIST 378	Medicine and Health Law in Modern America	3
HIST 384	Invention and Regulation	3
IE 447	Legal Aspects of Engineering	3
IT 331	Privacy and Information Technology	3
IT 332	Digital Crime	3
IT 400	Information Technology and the Law	3
R790 382	Environm Pol & Policy	3

Physics & Law, Technology and Culture (Optical Science & Engineering Option) - B.S.

(135 credits minimum)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
MATH 111	Calculus I	4
CS 113 or CS 115	Introduction to Computer Science or Introduction to Computer Science in C++	3

CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
PHYS 114	Introduction to Data Reduction with Applications	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
MATH 112	Calculus II	4
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
CHEM 125A	General Chemistry Lab I	1
	Term Credits	**15**
Second Year		
1st Semester		
MATH 213	Calculus III B	4
MATH 225	Survey of Probability and Statistics [1]	1
PHYS 234	Physics III	3
PHYS 231A	Physics III Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**15**
2nd Semester		
MATH 222	Differential Equations	4
MATH 328	Mathematical Methods for Scientists and Engineers	3
PHYS 335 or R750 315	Introductory Thermodynamics or Intro Thermodynamics	3
Legal Foundations Elective [2]		3
LTC Core Elective		3
	Term Credits	**16**
Third Year		
1st Semester		
OPSE 301	Introduction to Optical Science and Engineering	3
OPSE 310	Virtual Instrumentation	3
PHYS 430	Classical Mechanics I	3
PHYS 432	Electromagnetism I	3
Legal Foundations Elective [2]		3
	Term Credits	**15**
2nd Semester		
OPSE 402	High Power Laser and Photonics Applications	3
PHYS 433	Electromagnetism II	3
PHYS 446	Solid State Physics	3
PHYS 418	Fundamentals of Optical Imaging	3
Elective (Physics/OPSE) [3]		3
	Term Credits	**15**
Fourth Year		
1st Semester		
PHYS 442 or R750 404	Introduction to Quantum Mechanics or Quantum Mechanics	3
Elective (Physics/OPSE/EE) [4]		3
Technical Elective [5]		3
LTC Core Elective		3

Legal Foundations Elective		3
	Term Credits	**15**
2nd Semester		
PHYS 450	Advanced Physics Lab	3
Elective (Physics/EE) [6]		3
Technical Elective [5]		3
LTC Core Elective		3
HSS Senior Seminar GER (p. 112) [7]		3
	Term Credits	**15**
Fifth Year		
1st Semester		
HIST 310	Co-op in Law, Technology, Culture and History I	3
Social Science GER (p. 114)		3
LTC Core Elective		3
Technical Elective [5]		3
	Term Credits	**12**
	Total Credits	**135**

1. Math 333 is an acceptable alternative to Math 225
2. The first two Legal Foundations Electives must satisfy the History and Humanities 300 Level GER (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-level/).
3. Physics/OPSE Electives: Consult the Physics Department for information about qualifying courses.
4. Physics/OPSE/EE Electives: Consult the Physics Department for information about qualifying courses.
5. Technical Electives: Consult the Physics Department for information about qualifying courses.
6. Physics/EE Electives: Consult the Physics Department for information about qualifying courses.
7. The HSS Senior Seminar (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/hss-capstone/) must be a law-related course as determined by the LTC Program advisor.

Code	Title	Credits
LEGAL FOUNDATIONS ELECTIVES		
Select three of the following:		
HIST 361	The Founding of the American Nation	3
HIST 362	Sex, Gender, and the Law in American History	3
HIST 364	American Law in the World	3
HIST 369	Law and Society in History	3
MGMT 290	Business Law I	3
STS 300	Legal Reasoning, Writing, and Technology	3
R790 304	Intro Law And Legal Res	3

Code	Title	Credits
LTC CORE ELECTIVES		
Select four of the following:		
EVSC 335	Environmental Law	3
HIST 320	Law and Evidence	3
HIST 338	Environmental Justice and Climate Change in America	3
HIST 370	Legal issues in the History of Media	3
HIST 375	Legal Issues in Environmental History	3
HIST 378	Medicine and Health Law in Modern America	3
HIST 384	Invention and Regulation	3
IE 447	Legal Aspects of Engineering	3
IT 331	Privacy and Information Technology	3
IT 332	Digital Crime	3

IT 400	Information Technology and the Law	3
R790 382	Environm Pol & Policy	3

Interdisciplinary Programs

Communication and Media - B.A. (p. 428)

Communication and Media - B.S. (http://catalog.njit.edu/undergraduate/science-liberal-arts/humanities-and-social-sciences//communication-media-bs/)

Law, Technology and Culture (p. 386)

Science, Technology and Society (p. 434)

Environmental Science (p. 352)

Theatre Arts and Technology (p. 429)

- Environmental Studies and Sustainability Minor (p. 483)

Environmental Studies and Sustainability Minor

(15 credits)

Five courses in environmental studies and sustainability approved by the minor coordinator

More **information on this minor** can be found on the College of Science and Liberal Arts website (https://csla.njit.edu/).

Newark College of Engineering

One of the oldest and largest professional engineering schools in the United States, Newark College of Engineering offers 13 undergraduate degree programs, 16 master’s and 10 doctoral degree programs. Undergraduate enrollment is more than 2,500, and more than 1,100 are enrolled in graduate study. The 150-member faculty includes engineers and scholars who are widely recognized in their fields.

Programs

- Biomedical Engineering - B.S. (p. 525)
- Chemical Engineering - B.S. (p. 547)
- Civil Engineering - B.S. (p. 563)
- Computer Engineering - B.S. (p. 577)
- Concrete Industry Management (CIM) - B.S. (p. 647)
- Electrical Engineering - B.S. (p. 583)
- General Engineering - B.S. (p. 609)
- Industrial Engineering - B.S. (p. 600)
- Engineering Technology, Computer Technology (CMPT) - B.S. (p. 620)
- Engineering Technology, Electrical and Computer Engineering Technology (ECET) - B.S. (p. 623)
- Engineering Technology, Manufacturing Engineering Techology (MNET) - B.S. (p. 626)
- Engineering Technology, Mechanical Engineering Technology (MET) - B.S. (p. 628)
- Engineering Technology, Medical Informatics Technology (MIT) - B.S. (p. 631)
- Engineering Technology, Construction Engineering Technology (CET) - B.S. (p. 640)
- Engineering Technology, Construction Management Technology (CMT) - B.S. (p. 643)
- Engineering Technology, Surveying Engineering Technology (SET) - B.S. (p. 645)
- Engineering Technology, Technology Education (TEED) - B.S. (p. 652)
- Mechanical Engineering - B.S. (p. 602)
- Materials Engineering (p. 553)

Accelerated Programs **(**p. 102**)**

- Biomedical Engineering Option, Pre-Health - B.S. (p. 539)

- Biomedical Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/biomedical/minor/)
- Chemistry Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/chemical-materials-engineering/chemistry-minor-chemical-engineering-majors/) (for Chemical Engineering majors)
- Computer Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/electrical-computer/computer-engineering-minor/) (not for Electrical Engineering or Computer Science majors)
- Computer Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/electrical-computer/computer-engineering-minor-computer-science-majors/) (for Computer Science majors)
- Computer Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/electrical-computer/computer-engineering-minor-electrical-engineering-majors/) (for Electrical Engineering majors)
- Electrical Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/electrical-computer/electrical-engineering-minor/) (not for Electrical Engineering or Computer Science majors)
- Electrical Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/electrical-computer/electrical-engineering-minor-computer-engineering-majors/) (for Computer Engineering majors)
- Environmental Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/civil-environmental/environmental-engineering-minor/)
- Geosystems Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/civil-environmental/geosystems-minor/)
- Geriatric Engineering Technology Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/saet-semd/geriatric-minor/)
- Grand Challenges of Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/saet-semd/grand_challenges_of_engineering_minor/)
- Industrial Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/mechanical-industrial/industrial-engineering-minor/)
- Manufacturing Engineering Technology Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/saet-semd/manufacturing-engineering-technology-minor/)
- Materials Engineering Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/chemical-materials-engineering/materials-engineering-minor/)
- Remote Sensing Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/newark-college-engineering/saet-sbed/remote_sensing_minor/)

Programs

- Biomedical Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/biomedical/ms/)
- Chemical Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/chemical-materials-engineering/chemical-ms/)
- Civil Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/civil-environmental/civil-ms/)
- Civil Engineering - M.S. online (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/civil-environmental/civil-ms-online/)
- Computer Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/electrical-computer/computer-ms/)
- Critical Infrastructure Systems - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/civil-environmental/critical-infrastructure-systems-ms/)
- Electrical Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/electrical-computer/electrical-ms/)
- Engineering Management - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/mechanical-industrial/engineering-management-ms/)
- Engineering Science - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/interdisciplinary-engineering-science/ms/)
- Environmental Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/civil-environmental/environmental-ms/)
- Healthcare Systems Management - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/mechanical-industrial/healthcare-systems-management-ms/)
- Industrial Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/mechanical-industrial/industrial-ms/)
- Internet Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/electrical-computer/internet-ms/)
- Manufacturing Systems Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/mechanical-industrial/manufacturing-systems-ms/)
- Materials Science and Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/chemical-materials-engineering/materials-science-engineering-ms/)
- Mechanical Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/mechanical-industrial/mechanical-ms/)

- Occupational Safety and Health Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/mechanical-industrial/occupational-safety-health-ms/)
- Pharmaceutical Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/chemical-materials-engineering/pharmaceutical-ms/)
- Pharmaceutical Systems Management - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/mechanical-industrial/pharmaceutical-systems-management-ms/)
- Power and Energy Systems - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/electrical-computer/power-energy-systems-ms/)
- Telecommunications - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/electrical-computer/telecommunications-ms/)
- Transportation - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/civil-environmental/transportation-ms/)

Double Majors (http://catalog.njit.edu/archive/2022-2023/graduate/academic-policies-procedures/special-programs/)

- Architecture - M.Arch. and Civil Engineering - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/architecture-design/architecture/march-civil-engineering-ms/)

Programs

- Biomedical Engineering - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/biomedical/phd/)
- Chemical Engineering - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/chemical-materials-engineering/chemical-phd/)
- Civil Engineering - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/civil-environmental/civil-phd/)
- Computer Engineering - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/electrical-computer/computer-phd/)
- Electrical Engineering - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/electrical-computer/electrical-phd/)
- Environmental Engineering - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/civil-environmental/environmental-phd/)
- Industrial Engineering - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/mechanical-industrial/industrial-phd/)
- Materials Science & Engineering - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/chemical-materials-engineering/materials-science-engineering-phd/)
- Mechanical Engineering - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/mechanical-industrial/mechanical-phd/)
- Transportation - Ph.D. (http://catalog.njit.edu/archive/2022-2023/graduate/newark-college-engineering/civil-environmental/transportation-phd/)

Newark College of Engineering Courses

BME 101. Introduction to Biomedical Engineering. 0 credits, 1 contact hour (1;0;0).
This course is open only to freshmen and new transfer students. This is seminar course to introduce freshmen to biomedical engineering field and multiple core career paths they can pursue . Faculty and recent BME graduates are invited to talk about their experience at their workplace and how they chose their career paths.

BME 105. Introduction to Human Physiology I. 2 credits, 2 contact hours (2;0;0).

BME 106. Introduction to Human Physiology II. 1 credit, 1 contact hour (1;0;0).

BME 111. Introduction to Physiology. 3 credits, 3 contact hours (3;0;0).
This course is open only to freshmen and transfer students. An overview of human physiology is presented as an introduction to subsequent core courses in the Biomedical Engineering curriculum. Not intended to be an exhaustive review of physiology, the course will instead emphasize key examples that highlight understanding of the interaction between the biomedical and engineering worlds.

BME 210. Processing Fund for Biol Signa. 3 credits, 4 contact hours (3;1;0).
Prerequisite: Sophomore Standing. This course will introduce the fundamentals of filtering and processing specifically designed for applications using biologically inspired signals. This course will provide an introduction to computation and data analysis using MATLAB - an industry standard programming and graphical environment that is employed in several core and elective courses in engineering. A major component of this course is the application of digital signal processing to biologically inspired signals using MATLAB.

BME 301. Electrical Fundamentals of Biomedical Engineering. 3 credits, 4 contact hours (2;2;0).
Prerequisites: Grade of C or higher in PHYS 121 and MATH 112. Course lectures and laboratories will address important issues for biomedical engineers at the introductory level; covering the origins of bio-electric signals and the instrumentation involved in collection of biopotentials from the electrodes to processing of the signals on the computer. Some other topics included are the transducers/sensors and modern engineering software used in bio-instrumentation. Laboratory work will provide hands-on experience in all of these areas. The course will also address practical issues in design of medical devices such as noise, resolution, linearity, and saturation. This course is offered in Studio format that involves the integration of lectures and labs into one highly participatory structure.

BME 302. Mechanical Fundamentals of Biomedical Engineering. 3 credits, 4 contact hours (3;1;0).
Prerequisites: Grade of C or higher in PHYS 121 and MATH 112. Course lectures and laboratories will address important issues covering the mechanical fundamentals that are important bases for later learning experiences. This course introduces the students to to engineering mechanics and how those principles are relevant to biomechanical issues. This course is offered in Studio format that involves the integration of lectures and labs into one highly participatory structure.

BME 303. Biological and Chemical Foundations of Biomedical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Grade of C or higher in CHEM 126 or CHEM 122. This course covers organic chemistry, biochemistry and cellular mechanics in sufficient depth to give biomedical engineering students a strong enough background for them to understand the introductory aspects of the discipline, which focus on the application of engineering principles to medicine and surgery.

BME 304. Material Fundamentals of Biomedical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: A Grade of C or higher in (CHEM 126 or CHEM 122) and PHYS 111.This course is an introduction to the field of biomaterials with an emphasis on the wound healing process and interactions between the human body and implanted devices fabricated from various types of biomaterials. The thrust of this course will be to illuminate the processes occurring at the tissue-biomaterial interface. Attention will be given to the biological events occurring at the molecular level on the surface of an implanted device. The nature of these surfaces and the physiological consequences of these processes will be examined in terms of how the body and functioning of the device are impacted.

BME 311. Co-op Work Experience. 3 credits, 3 contact hours (0;0;3).
Restriction: sophomore standing or above, approval of department, and permission of Career Development Services. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated by the co-op office and approved by the department. Mandatory participation in seminars and completion of a report.Note: Normal grading applies to this COOP Experience.

BME 321. Adv Mechanics for Biomed Engr. 3 credits, 3 contact hours (3;0;0).
Prerequisite:BME 302 with a grade of C or better This course provides an understanding of engineering mechanics, especially as applied to biomechanical systems. Students should be familiar with static equilibrium analysis and concepts of stress and strain. Course topics include method of sections, area moment of inertia, mechanical properties of materials, torsion, bending, stress transformation, Mohr’s circle, and deflection of beams.

BME 333. Biomedical Signals and Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 301, MATH 222, (BME 210 or BME 310). BME Tools such as the Laplace and Fourier Transforms, time-frequency analysis are introduced. Applications include signals and noise, processing of the ECG, mathematics of imaging and derivation of useful physiological parameters from input signals.

BME 351. Introduction to Biofluid Mechanics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 302, MECH 236 and (MECH 320 or BME 321). Introduction to the principles of fluid flow. Basic fluid principles, such as fluid properties, fluid statics, conservation of mass, momentum, and energy will be discussed and presented in BME context. Special attention will be given to the non-Newtonian nature of blood, viscous flow in arteries, unsteady flows, and to the fluidic output of the heart. The textbook material will be supplemented throughout the course to emphasize examples relative to BME.

BME 352. Thermal Science for Biomedical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 112, PHYS 111, CHEM 126, BME 111. Corequisites: MATH 211 OR MATH 213. Thermal Science is the field of study that includes aspects of thermodynamics, heat transfer, fluid flow, and mass transport that are important to biomedical engineering. This includes phase change of substances, energy, power, heating, and cooling. The course will cover fundamental concepts in each of these areas with specific attention to biomedical technologies and physiological processes. Analytical methods and computer simulation tools will be used in the course.

BME 372. Electronics of Medical Devices. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 111 and BME 301 with a C or better. The first of a two-semester sequence that covers the design of electronic circuits for Biomedical applications. This course covers basic operational amplifier circuits as well as the operation of semiconductor diodes and transistors. An introduction to digital logic circuits is also provided. Computer simulation as well as hands-on breadboarding of electronic circuits are used throughout the course to supplement the lectures.

BME 373. Biomedical Electronics II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: BME 372. This is a continuation of BME 372 emphasizing biomedical applications of oscillators, active filters, and wave-shaping circuits.

BME 382. Engineering Models of Physiological Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 111, BME 301, BME 302 and MATH 222 all with a C or better. Students learn to develop quantitative models of organs and organ systems from an engineering viewpoint. Students translate their understanding of physiological systems into models that evolve dynamically based on engineering block diagrams. Additional topics include: hierarchical structure, sensitivity analysis, parameter estimation, negative feedback control, and characteristic traits of models. Students will use models to gain insight into how a physiological system functions and to design a biomedical engineering device or procedure that interacts with the physiological system. Systems studied include the cardiovascular system, gas exchange in the lungs, nerve and muscle action potentials, and musculo-skeletal spinal reflex.

BME 383. Measurement Lab for Physiological Systems and Tissue. 3 credits, 4 contact hours (1;3;0).
Prerequisites: BME 302, (BME 210 or BME 310), (MATH 279 or MATH 333). Through laboratory experiences, students will apply engineering methods for measuring and interpretating the properties of physiological systems and biological tissues. Topics include measurements relevant to cardio-pulmonary, nerve and muscular systems.

BME 384. Biomechanics Laboratory. 3 credits, 4 contact hours (1;3;0).
Prerequisites: BME 302, MECH 236, BME 321, (MATH 279 or MATH 333), (CS 101 or BNFO 135 or CS 115 or BME 210). This course is an introduction to the experimental analysis of the biomechanics of human motion. Laboratory experiments include the application and integration of anatomical and mechanical concepts to a wide variety of activities. Students will develop basic competence in a systematic approach to the observation, analysis and evaluation of human movement in clinical, educational, and industrial environments.

BME 385. Cell and Biomaterial Engineering Laborarory. 3 credits, 4 contact hours (1;3;0).
Prerequisite: MATH 112, PHYS 121, BME 304 and (MATH 279 or MATH 333) all with a C or better. This laboratory course is designed to provide students with valuable hands-on experience in the field of cellular and biomaterial engineering. Experiments include biomaterial fabrication and characterization, mechanical testing of biomaterials, colorimetric protein assay, cell-based assay, the basics of cell culture techniques, the basics of light and electron microscopy, and image capture and analysis. A lecture on the principles of a given technique will be followed by laboratory activity.

BME 386. Biosensor and Data Acquisition Lab. 3 credits, 4 contact hours (2;2;0).
Prerequisites: BME 210 and BME 301. Laboratory exercises involve projects at all levels of a medical device system from sensors to data acquisition and data processing. The course will introduce measurements for different sensors with Biopac Amplifiers and Arduino Microprocessors. Circuits are constructed to condition the signals from sensors and convert them into a format that can be displayed or acquired into a computer. The final projects help to develop the skills to integrate various parts of a medical device system, collect and analyze data and troubleshoot a device.

BME 411. Co-op Work Experience. 0 credits, 0 contact hours (0;0;0).
Prerequisites: BME 311 and completion of sophomore year, approval of department, and permission of Career Development Services. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated by the co-op office and approved by the department. Mandatory participation in seminars and completion of a report. May count as BME or approved elective. Grade will now be issued as a letter grade.

BME 420. Advanced Biomaterials Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 302, BME 304, and (MTSE 301 or MTEN 201). The goal of this course is to understand material selection, important properties of materials for use in the body, and failure modes of applied biomaterials. The course will cover the structure and properties of materials used as biomaterials including metals, ceramics, synthetic polymers, and biopolymers. The structure of these materials will be explored to understand how it defines the behavior of a material. The bulk behavior of materials will be reviewed, including the generalized Hooke's Law, and new concepts will be introduced (including thermal strain, surface properties, and viscoelasticity). Students will be presented with problems of property characterization, failure analysis and performance testing. Students will work in teams to analyze a marketed implant or device using biomaterial(s) using the tool and concepts learned in the course.

BME 422. Biomaterials Characterization. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 112, PHYS 121, BME 304 and (MTSE 301 or MTEN 201) all with a C or better. The quantum mechanical origins of spectroscopy, the relationship of spectroscopic behavior to thermal characteristics of a material, and the differences in approach to the chemical and physical characterization of synthetic and biological polymers are discussed.

BME 427. Biotransport. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222 and (BME 303 or R120 102 or BIOL 201). This course is an introduction to transport phenomena in biological systems. The objective of this course is to gain knowledge of the basic principles of transport phenomena. The course will cover conservation relations in fluid transport with an emphasis on conservation of mass at the tissue and cellular levels. Topics will include fundamentals of mass transport and applications such as transport in porous media, transvascular transport and drug delivery.

BME 430. Fundamentals of Tissue Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 302, (BME 303 or R120 102 or BIOL 201), BME 304, MATH 222 and (MTSE 301 or MTEN 201). This course is an introduction to the field of tissue engineering as a therapeutic approach to treating damaged or diseased tissues in the biotechnology industry. In essence, new and functional living tissue can be fabricated by delivering cells, scaffolds, DNA, proteins, and/or protein fragments at surgery. This course will cover the advances in the fields of cell biology, molecular biology, material science and their relationship towards developing novel "tissue engineered" therapies.

BME 451. Biomechanics I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MECH 236; BME 321. Tensor analysis. Kinematics of continuous media. Stress. The elastic solid. Newtonian fluid. Conservation principles of mass, momentum and energy. Viscometric flows. Formulation of constitutive equations. Applications to the modeling of bone and other living tissues.

BME 452. Mechanical Behavior and Performance of Biomaterials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 302, BME 304, MATH 222, (MATH 279 or MATH 333), and BME 321. Biomaterial selection and performance is essential to the design and implementation of most any biomedical application. Students will learn about important properties of materials for use in the body and failure modes of applied biomaterials. Material behavior will be reviewed, including the generalized Hooke's Law, and new concepts will be introduced including thermal strain, surface properties, and viscoelasticity. Material biocompatibility will be introduced in regards to body responses including cell and tissue interaction, toxicity and safety.

BME 471. Principles of Medical Imaging. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 301, (BME 210 or BME 310). This is an introductory undergraduate course in biomedical imaging. This course will cover medical physics, instrumentation, data aquisition and processing to generate structural and functional images. A number of modalities including X-ray, Computer Tomography, Ultrasound, and magnetic resonance imaging systems are included. This course is an elective in the Bioinstrumentation track.

BME 472. FDA Regulation of Medical Devices. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 301. Restrictions: none. The course will teach the FDA regulatory process including design documentation and quality management system to attain FDA approval for medical devices. Statistical tests for the development of human randomized clinical trials and non-clinical bench testing of medical devices will be taught with safety standards for medical devices. A project will be assigned to teach students how to apply for FDA approval for a student-selected medical device.

BME 478. Introduction to CAD for Biomechanics. 4 credits, 6 contact hours (4;2;0).
Prerequisites: BME 302 and (MECH 320 or BME 321). Introduction to Computer Aided Designing and analysis as applied to biomedical engineering design programs. Topics include theoretical insight into the process of design and geometrical modeling and design using industry standard CAD (Computer Aided Design) software packages. The course will also include several projects involving the application of design principles to standard problems in biomedical design.

BME 489. Medical Instrumentation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 301 and (BME 210 or BME 310). This course covers the hardware and instrumentation needed to measure variables from different physiological systems. The following topics will be taught: electrodes, sensors and transducers. Bioelectric amplifiers, electrical safety and computing. Applications include the study and design of instrumentation for measurement of the ECG, EEG, EMG, respiratory system, nervous system in general.

BME 491. Research and Independent Study I. 3 credits, 3 contact hours (0;0;3).
In depth research experience taught under the guidance of a professor typically within a laboratory. Approved requirements are needed for engineering credit. Research thesis required. Needs permission of professor.

BME 492. Research and Independent Study II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: BME 491. Approved requirements are needed for engineering credit. Research thesis required. Needs permission of professor.

BME 493. Honors Research Thesis I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: GPA 3.5, an appropriate research methods course and COM 313. Part of a two semester undergraduate research thesis. Students will learn how to formulate a hypothesis, design a scientific based experiment, analyze data using statistics, interpret data, and describe work within oral defense and written thesis.

BME 494. Honors Research Thesis II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: BME 393 Part of a two semester undergraduate research thesis. Students will learn how to formulate a hypothesis, design a scientific based experiment, analyze data using statistics, interprete data, and describe work within oral defense and written thesis.

BME 495. Capstone Design I. 2 credits, 4 contact hours (1;0;3).
Prerequisites: BME 372 or MTSE 301 or MTEN 201 or (MECH 236 and MECH 320) or (MECH 236 and BME 321) or BME 386. Restrictions: Senior Standing. The course introduces the student to the definition of design as well as introducing issues of intellectual property, bioethics and safety, and professional societies. The goal of this course is to provide students with the guidance to choose a capstone design topic and advisor conduct library/search engine background research and to prepare the design proposal for their chosen project.

BME 496. Capstone Design 2. 3 credits, 4 contact hours (1;3;0).
Prerequisite: BME 495. Implementation of the project approved in BME 495. This portion of the project includes library research, time and cost planning, oral and written reports, as well as construction, troubleshooting and demonstration of a working prototype.

BME 498. ST:. 3 credits, 3 contact hours (3;0;0).

CE 101. CE Computer Aided Design. 1 credit, 2 contact hours (0;2;0).
Co-requisite or CE CAD teaches students the use of basic tools, such as Autocad software, used in the preparation of Civil Engineering contract documents. Autocad is a widely used computer program for generating engineering drawings.

CE 200. Surveying. 2 credits, 3 contact hours (2;1;0).
Prerequisite: MATH 111 or ENGR 101. Angle and distance measurement; leveling; topographic mapping; traverse and area computations; horizontal and vertical curves; cross sections; triangulation; state plane coordinates; global positioning system. Emphasis on the use of the computer for solving typical field and office problems. Lab should be taken concurrently.

CE 200A. Surveying Laboratory. 1 credit, 3 contact hours (0;3;0).
Corequisite: CE 200. Field exercises in conjunction with the classroom exercises in CE 200 utilizing classical and electronic instruments and COGO/CAD software.

CE 210. Construction Materials and Procedures. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENGL 101. Introduction to construction management organization, contracts, construction safety, engineering economics, and engineering ethics. Studies current practices of heavy construction including soil and rock excavation productivity, and building construction materials and procedures. Field trips to construction sites provide opportunities to directly view many of the practices.

CE 260. Civil Engineering Methods. 2 credits, 3 contact hours (2;1;0).
Prerequisites: ENGL 101, CE 101, CE 200, CE 200A. Provides students with in-depth experience in computer applications in civil engineering and with written and oral communication.

CE 307. Geometric Design for Highways. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CE 200, CE 200A. Highway design based on a study of traffic distribution, volume, and speed with consideration for the predictable future. Analysis of elements of at-grade intersections and interchanges and the geometrics of highway design and intersection layout with advanced curve work including compound and transition curves.

CE 311. Co-op Work Experience I. 0 credits, 0 contact hours (0;0;0).
Restriction: completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a -report.

CE 320. Fluid Mechanics. 3 credits, 4 contact hours (3;1;0).
Prerequisites: MECH 235 with a grade of C or better, MATH 112 and PHYS 111/PHYS 111A. Corequisite: MECH 236. This course is designed to present the fundamental laws relating to the static and dynamic behavior of fluids. The emphasis is placed on applications dealing with the flow of water and other incompressible fluids. These include flow in pipe systems and natural channels.

CE 320A. Hydraulics Laboratory. 1 credit, 3 contact hours (0;3;0).
Prerequisite or corequisite: CE 320. Explores the principles of fluid mechanics through laboratory experiments. Investigates various hydraulic phenomena with both physical and computer models. Demonstrates basic civil engineering design principles for pipe networks, open channel systems, and ground water regimes.

CE 321. Water Resources Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 200, CE 200A, MATH 279 or MATH 305. Training in methods of developing water supplies and the means to treat supplies for consumptive use. Covers hydrologic techniques such as surface and ground water yield, hydrograph and routing analyses, and probabilistic methods related to hydrologic studies.

CE 322. Hydraulic Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 320, CE 321. The objective is to provide the tools required to design water distribution systems, storm drains, and sanitary sewers. Examines related hydrologic and hydraulic techniques.

CE 332. Structural Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MECH 237 with a grade of C or better. A working knowledge of free body diagrams, equilibrium conditions for force systems and moments. The primary objective is an understanding of the various methods of analyzing determinate and indeterminate beams, frames, and trusses encountered in practice.

CE 333. Reinforced Concrete Design. 2 credits, 3 contact hours (2;1;0).
Prerequisite: CE 332. The student must have a working knowledge of structural analysis including determinate and indeterminate beams and frames. Primary objectives include the following: to acquaint the student with the properties of concrete and steel and with the behavior of reinforced concrete as a structural material; also, to develop methods for the design of reinforced concrete structural members such as beams, slabs, footings, and columns. Both ultimate strength design and working stress method will be studied.

CE 341. Soil Mechanics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MECH 237 with a grade of C or better or equivalent. Corequisite: CE 341A. A study of soil types and properties is made with the objective of developing a basic understanding of soil behavior. The methods of subsurface investigation and compaction are presented. Fundamentals pertaining to permeability, seepage, consolidation, and shear strength are introduced. Settlement analysis is also presented. Lab must be taken concurrently.

CE 341A. Soil Mechanics Laboratory. 1 credit, 3 contact hours (0;3;0).
Corequisite: CE 341. Students perform basic experiments in soil mechanics.

CE 342. Geology. 3 credits, 3 contact hours (3;0;0).
Restriction: Sophomore status. Studies science of geology with emphasis on physical geological processes. Stresses the principle of uniformity of process in the context of rock and soil formation, transformation, deformation, and mass movement. Includes aspects of historical geology and geomorphology.

CE 350. Transportation Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 200, CE 200A. A study of the principal modes of transportation, with emphasis on the planning, design and construction of facilities for modern transportation systems.

CE 351. Intro To Transportation System. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 200, CE 200A, CE 350 A study of the principal modes of transportation, with emphasis on the planning, design and construction of facilities for modern transportation systems.

CE 360. Sustainable Civil Engr Mat. 3 credits, 3 contact hours (3;0;0).
Prerequistes: CHEM 121 or 125 and MECH 237 (with a grade of C or better) This course will provide instruction on engineering materials used in the construction of civil engineering projects. Additionally, the fundamentals of sustainability and sustainable design within the context of civil engineering will be discussed. The engineering properties of aggregates, wood, metal, portland cement concrete and asphaltic concrete and design of these materials will be covered. These materials will be used to discuss sustainability concepts and design within civil engineering.

CE 381. Geomorphology. 3 credits, 3 contact hours (3;0;0).
This is a course in geomorphology, the study of landforms and the contemporary processes that create and modify them. The course will emphasize earth surface processes and quantitative analysis of landform change. Lectures will stress geomorphic principles and two field-based problems will enable students to apply these principles to contemporary geomorphic problems in engineering and management with a focus on the natural environment.

CE 406. Remote Sensing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 234. Principles of remote sensing are covered including general concepts, data acquisition procedures, data analysis and role of remote sensing in terrain investigations for civil engineering practices.

CE 410. Construction Scheduling and Estimating. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CE 210. Quantity take off, cost estimate and CPM computer analysis of typical building or highway projects. A study is made of construction project organization, contract requirements and management control techniques with an introduction to computer applications.

CE 412. Construction Codes and Specifications. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CE 210. Code and specification aspects of engineered construction. Topics include professional ethics, contracts, specifications, bidding procedures, building codes such as B.O.C.A. and New Jersey Uniform Construction Code, Energy Code Provisions, construction safety, and the impact of the EPA on construction.

CE 413. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: CE 311 or equivalent, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience. Mandatory participation in seminars and completion of requirements including a report and/or project.Note: Normal grading applies to this COOP Experience.

CE 414. Engineered Construction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 210, CE 332, CE 341. Design, erection, and maintenance of temporary structures and procedures used to construct an engineering project. Business practices, codes, design philosophies, construction methods, hardware, inspection, safety, and cost as they pertain to engineered construction projects.

CE 431. Construction Materials Lab. 1 credit, 3 contact hours (0;3;0).
Prerequisites: CE 210, MECH 237 with a grade of C or better, CE 210. This course provides an understanding of the basic properties of construction materials, and presents current field and laboratory standards and testing requirements for these materials. Students select a material or component assembly for testing, design a testing procedure, and present their results.

CE 432. Steel Design. 2 credits, 3 contact hours (2;1;0).
Prerequisite: CE 332. A working knowledge of structural analysis including determinate and indeterminate beams and frames is essential. The development of current design procedures for structural steel elements and their use in multistory buildings, bridges, and industrial buildings.

CE 443. Foundation Design. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 341, CE 341A. Site investigation, selection of foundation types and basis for design, allowable loads, and permissible settlements of shallow and deep foundations. Computations of earth pressure and design of retaining walls.

CE 450. Urban Planning. 3 credits, 3 contact hours (3;0;0).
Prerequisite: junior engineering standing. Introduction to urban planning, its principles, techniques, and use. Topics include development of cities, planning of new towns, redevelopment of central cities, and land use and transportation planning.

CE 461. Professional Practice in CEE. 3 credits, 3 contact hours (3;0;0).
Develop an understanding of the process to become a licensed professional engineer and familiarize the students with the professional practice of engineering including codes of ethics and professional business practices and to provide an adequate background for the Fundamentals of Engineering.

CE 465. Green and Sustainable Civil Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 210 and Junior standing. Designed to teach students currently available approaches that incorporate renewable energy and sustainable development concepts in civil engineering projects. This will include various methods of planning, design, and evaluation which promote increased energy efficiency and sustainable use of materials. Cost estimating and life cycle planning will also be included. The course will encourage students to look beyond the information in the course, to come up with additional methodologies which may not currently be in use.

CE 485. Special Topics in Civil Engineering. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in an area of civil engineering not regularly covered in any other CE course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course.

CE 490. Civil Engineering Projects. 3 credits, 3 contact hours (0;0;3).
Restriction: senior standing in civil engineering and approval of the department. Work on an individually selected project, guided by the department faculty advisor. The project may include planning, research (library or laboratory), engineering reports, statistical or analytical investigations, and designs. Any of these may follow class-inspired direction or the student may select his or her own topic. The project must be completed and professionally presented by assigned due dates for appropriate review and recording of accomplishment.

CE 491. Research Exper-Civil Engr. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Junior standing, agreement of a department faculty advisor, and approval of the associate chairperson for undergraduate studies. This course provides the student with an opportunity to work on a research project under the individual guidance of a member of the department. A written report is required for course completion. Open to students with a GPA of 3.0 or higher.

CE 494. Civil Engineering Design I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 210, CE 260, CE 320, CE 321, CE 350, CE 341 , CE 341A and senior standing in civil engineering. Simulates the submission and acceptance process normally associated with the initial design phases for a civil engineering project. Familiarizes students with the preparation of sketch plats, preliminary engineering design, and a related environmental assessment. Requirements include written submittals and oral presentations in defense of the project.

CE 495. Civil Engineering Design II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 333, CE 432, CE 443. Pre or Corequisite: CE 494. Provides students with the type of design experience they would receive if engaged in civil and environmental engineering design practice including incorporating engineering standards and multiple constraints. Students can select from these design areas: structures, geotechnical engineering, transportation and planning, and sanitary and environmental engineering.

CE NEXT. Civil Engineering Next Generation Professional Practice Seminar. 0 credits, 1 contact hour (0;0;1).
Restrictions: Civil and Environmental Engineering Junior and Senior students only. CE Next Gen is a non-credit elective course that introduces students to several soft skills that will enhance their ability to succeed in the field of civil and environmental engineering. Students will develop skills in communication, relationship building, public speaking, business etiquette, time management, negotiating, interviewing and presentation. The course will also help students improve their self-confidence, emotional intelligence, and interpersonal skills. Students will engage in a variety of in- class activities, homework, group projects, and presentations throughout the semester. The group projects will provide a platform to focus on the skills learned and connect skillsets.

CET 233. Structural Analysis in Construction. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MET 237. This course will cover the aspects of the design and construction of structural steel and reinforced concrete for construction engineering technology students. This will include the design of beams, slabs and columns as well review of the connection of these structural members as encountered in practice.

CET 313. Construction Procedures I. 3 credits, 3 contact hours (3;0;0).
Corequisite: CET 317. An introduction to heavy construction practices. Emphasis is on construction equipment, site preparation, earthmoving, compaction, dewatering, piles, drilling and blasting, and tunnelling. Case studies in heavy construction are used.

CET 314. Construction Procedures II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CET 313, CET 317. An introduction to building construction practices and building materials. Emphasis is on structural systems, construction materials and detailed finishing operations required to make a serviceable structure. Case studies in building construction are used.

CET 317. Construction Computing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 106 Application of available software to construction-related computing problems, including: strength of materials, structural analysis, fluids/ hydraulics, surveying, scheduling, cost estimating, and computerized drafting (CAD).

CET 322. Construction Codes and Regulations. 3 credits, 3 contact hours (3;0;0).
An introduction to the New Jersey Uniform Construction Code, the BOCA National Building Code, NJ DOT Standard Specifications and the CSI specification format. A code analysis of a typical construction project is undertaken.

CET 323. Construction Safety. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CET 313 and CET 314 This course will address the safety issues encountered in construction as mandated by the Occupational Safety and Health Act (OSHA)and other similar regulations.

CET 331. Structural Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CET 233. Study of types and behavior of modern structures using both analytical and intuitive techniques. Examples include beam and column, one- and two-way slab systems, wood and masonry systems, and wind and seismic analysis.

CET 341. Soils and Earthwork. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MET 237 A study of the significant soil types and tests. Problems are investigated relating to soil mechanics, soil supported foundations for engineering structures. Appropriate field trips are made.

CET 411. Cost Estimating. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CET 313, CET 314, CET 317. Take off of quantities of materials from typical building and highway projects. Pricing for labor, materials, and equipment. Crew sizes, productivity and manpower leveling. Computerized cost estimating and take off methods. Prepare a complete bid estimate for a construction project.

CET 413. Environmental Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CET 313, CET 314, CET 431. An introduction to construction-related environmental science topics, including basic environmental chemistry, geology, ground water hydrology, basic air quality, surface water run-off, erosion and sedimentation control, indoor air quality, and vibration analysis. Case studies cover various construction activities with respect to their effect on the environment and the manner in which they can be controlled.

CET 415. Construction Project Management. 3 credits, 3 contact hours (3;0;0).
Restriction: Senior standing in construction enginerring technology or contruction management technology. An introduction to construction management and administration methods and procedures including the design and construction process, project organizational structure, construction planning, contract administration, records and reports, financial management, risk analysis, manual and computerized GANTT and CPM scheduling, change orders and extra work, claims and disputes, cost accounting and document tracking.

CET 416. Senior Construction Project. 2 credits, 3 contact hours (1;2;0).
Prerequisites: CET 415; second semester senior standing in construction engineering technology or construction management technology. Simulates the methods and procedures used to successfully manage a construction project. Provides familiarization with constructability analysis, value engineering, productivity improvement, quality control, advanced field and office administration techniques, problem solving, and construction automation. Extensive use of construction-related computer software. Written submittals and oral presentations required.

CET 421. Construction Contracts. 3 credits, 3 contact hours (3;0;0).
Legal aspects of the various types of construction contracts and specifications. Scope, format, and use of various types of contracts such as owner-contractor and contractor-sub-contractor.

CET 431. Construction Testing. 3 credits, 4 contact hours (2;2;0).
Prerequisite: MET 237. Exposure to a variety of construction-related field tests and field testing equipment. Includes concrete mix design, concrete testing, soil density and compaction, asphalt tests, load testing of wood, mortar analysis and testing, brick and CMU testing, and quality control methods and procedures for finishes.

CET 435. Design of Temporary Structures. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CET 331. Analysis of loadings on, and design of, temporary structures required in construction. Formwork, shoring and scaffolding systems, temporary bridges, trenching, and temporary retaining walls are among the subjects covered. Construction safety associated with temporary structures is stressed.

CET 460. Forensics in Construction. 3 credits, 3 contact hours (3;0;0).
Restriction: Senior standing in construction engineering technology. Construction failure, in its many forms, are both interesting and instructive and in the context of this course students will study construction failures in their many forms.

CET 490. Special Project. 3 credits, 3 contact hours (0;0;3).
Prerequisite: Senior standing in construction engineering technology. The student works on one or more individually selected projects guided by the department staff. The project must be construction related and may include planning, research (library or lab), engineering report, and statistical, analytical, or field investigation. Any of these may follow class-inspired direction, or the students may branch out on their own. The project(s) of each student must be completed and professionally presented by assigned due date for appropriate review and recording of accomplishments.

CET 491. Special Projects. 1 credit, 1 contact hour (1;0;0).
Restriction: Senior standing in construction engineering technology. The student works on an individually selected project guided by the department staff. The project may be design- or construction-related and may include research, engineering design, technical report, or field investigation. Requirements will include a written submittal.

CET 492. Special Projects. 2 credits, 2 contact hours (0;0;2).
Restriction: Senior standing in construction engineering technology. The student works on a selected project guided by the department staff. The project may be design or construction related and may include research, engineering design, technical report or field investigation. Requirements will include a written submittal.

CET 493. Special Projects. 3 credits, 3 contact hours (3;0;0).

CET 497. Co-op Work Experience. 3 credits, 3 contact hours (0;0;3).
Restriction: Approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as co-op/intern. Mandatory participation in seminars and completion of requirements that include a report and/or project.Note: Normal grading applies to this COOP Experience.

CHE 101. Introduction to Chemical Engineering. 1 credit, 1 contact hour (1;0;0).
Pre or Corequisite: CHEM 125. Restriction: CHE students only. An introduction to the field of chemical engineering and to the Otto H. York Department of Chemical and Materials Engineering. Topics include the curriculum, student professional societies (AIChE Student Chapter), undergraduate research opportunities, cooperative education, and learning more about the chemical engineering profession and career pathways. The course also introduces basic engineering calculations as well as processes and their variables.

CHE 201. Material and Energy Balances. 4 credits, 5 contact hours (4;0;1).
Prerequisites: CHEM 126, MATH 112. Pre or Corequisites: CHE 101. Corequisites: CHE 230. This course covers the basic principles of material and energy balances for a variety of chemical engineering systems. Basic unit operations and simple designs of chemical processes are introduced.

CHE 210. Chemical Process Calculations I. 2 credits, 3 contact hours (2;0;1).
Prerequisites: CHEM 126, MATH 112. Analysis of chemical processes is introduced, emphasizing steady and unsteady-state mass and species balances. This course uses primarily chemistry and algebra to determine, for a wide variety of processes and applications, the flow and concentrations of different chemical species.

CHE 230. Chemical Engineering Thermodynamics I. 3 credits, 4 contact hours (3;0;1).
Prerequisites: CHEM 126, MATH 112, PHYS 111. Corequisite MATH 211 (or MATH 213). The Fundamentals of thermodynamics are applied to chemical engineering processes. Thermophysical properties and their engineering correlations are covered. Applications include chemical engineering and related fields such as environmental and biomedical engineering.

CHE 240. Chemical Process Calculations II. 2 credits, 3 contact hours (2;0;1).
Prerequisites: CHE 210 and CHE 230. This course covers the basic principles of energy balances for a variety of engineering systems. Combined with material from other sophomore courses, simple designs of chemical processes are considered. The course also introduces chemical process simulation software.

CHE 260. Fluid Flow. 3 credits, 4 contact hours (3;0;1).
Prerequisites: CHE 201 or CHE 210, CHE 230. Corequisite: MATH 222. This course considers the principles of molecular and turbulent transport of momentum, particularly as they apply to pressure drop calculations in piping systems, packed columns, and other flow devices. Flow around submerged objects is also considered.

CHE 312. Chemical Process Safety. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHE 342, CHE 370. Corequisites: CHE 349, MTEN 201 or CHE 375. A study of the technical fundamentals of chemical process safety: includes impact of chemical plant accidents and concepts of societal and individual risk; hazards associated with chemicals and other agents used in chemical plants, including toxic, flammable and reactive hazards: concepts of inherently safer design; control and mitigation of hazards to prevent accidents, including plant procedures and designs; major regulations that impact safety of chemical plants; consequences of chemical plant incidents due to acute and chronic chemical release and exposures; hazard identification procedures; introduction to risk assessment.

CHE 342. Chemical Engineering Thermodynamics II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHE 230, MATH 211 (or MATH 213), CHEM 236. The principles and methods developed in Chemical Engineering Thermodynamics I are extended to multicomponent systems, and used to treat phase and chemical equilibrium as well as such applications as chemical reactors and refrigeration systems.

CHE 349. Kinetics and Reactor Design. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHE 342, CHE 370, MATH 222, CHEM 236. Derive and solve species and energy balances for single chemical reactors; introduces heterogeneous catalysis, non-ideal reactors as ideal reactor combinations, and special topics such as polymeric or biochemical reactions.

CHE 360. Separation Processes I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHE 342, CHE 370. This is the first course in separations, examines traditional methods and technologies by which chemical engineers separate and purify mixtures. Emphasis here is on strippers, absorbers, distillations, and extractions.

CHE 365. Chemical Engineering Computing. 3 credits, 4 contact hours (2;2;0).
Prerequisites: CHE 370, CS 115 co-requisite: CHE 360. Introduction to basic concepts of computational methods for solving chemical engineering problems and performing process simulations. Topics include common numerical techniques encountered in chemical engineering, for the solution of linear and nonlinear algebraic equations and ordinary differential equations, differentiation/integration, optimization and interpolation/regression of data. Students will be exposed to modern computational software and commercial chemical processes simulators.

CHE 370. Heat and Mass Transfer. 4 credits, 4 contact hours (4;0;0).
Prerequisites: CHE 201 or CHE 240, CHE 260, MATH 222. The principles of heat and mass transfer in chemical engineering systems are covered. Steady and unsteady heat transfer is examined, with emphasis on the heat exchanger design. Mass transfer by steady and unsteady molecular diffusion, and turbulent convective mass transfer is studied.

CHE 375. Structure, Properties and Processing of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126, PHYS 121 or PHYS 122, MATH 112. This course introduces the principles of materials engineering from the perspective of structure-property-processing relationships. Instead of covering different types of materials separately, this course will use the principles common to engineering of all important materials as an underlying theme. These are atomic/molecular structure, nanoscale, morphology, principles of phase transformation, structure development during processing, and property dependence on structure. All these topics will be introduced through the paradigm of comparing metals, ceramics and polymers. Besides single component systems, advanced materials such as multiphase and/or multicomponent systems (e.g. composites and gels) and nanomaterials will be discussed based on these principles. An integral part of this course will be the criteria for selection of materials for specific end-use conditions and customer specifications, which can incorporate various engineering standards and multiple constraints such as public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

CHE 380. Introduction to Biotechnology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 122 or CHEM 126. Basic principles of molecular biotechnology with selected examples of applications.

CHE 396. Chemical Engineering Laboratory I. 3 credits, 5 contact hours (0;5;0).
Prerequisites: CHE 370, COM 313. Corequisite: MATH 225A. In this first course in chemical engineering capstone laboratory, experiments are conducted in the areas of fluid mechanics and heat transfer. Bench and pilot-scale equipment is used. Oral and written reports are prepared by the students.

CHE 402. ST:. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Junior or senior standing in chemical engineering. Combined laboratory and lecture course emphasizing photonics and laser applications in chemical engineering.

CHE 415. Introduction to 3D Printing. 3 credits, 4 contact hours (2;2;0).
Prerequisites: Junior standing or higher. This course introduces 3D printing technologies including history and basics of 3D printing, currently available 3D printing methods and printable materials as well as current and emerging applications of 3D printing. Students will get a general idea on the major players in 3D printing industry and global effects of 3D printing. The course will be composed of a lecture and a hands-on laboratory session, during which students will create a 3D design and print a functional prototype.

CHE 427. Biotransport. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHE 230 and MATH 222. Introduction to basic concepts of transport phenomena as applied to biological systems. Topics include the structure and composition of the human body, the properties of the blood and its flow in the cardiovascular system, and the body as a heat source and as a series of compartments involved in the mass transfer of materials (such as those in the kidneys and lungs). Students learn to analyze solute transport in biological systems and apply it to the design of biomedical devices.

CHE 444. Introduction to Polymer Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHE 370. Introduction to the basic concepts of polymer engineering. Topics covered include rheology, heat transfer, and kinetics of polymerization reactors.

CHE 460. Separation Processes II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHE 360. This second course in separations examines non-traditional methods and technologies such as fixed-bed processes, membranes, crystallization, and mechanical separations.

CHE 472. Process and Plant Design. 4 credits, 4 contact hours (4;0;0).
Prerequisites: CHE 312, CHE 349, CHE 360, CHE 365, IE 492, MTEN 201 or CHE 375. A capstone course in the chemical engineering program that incorporates various engineering standards and multiple constraints such as public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. This class is divided into four- to six-student groups in the design process. Each group must solve an open-ended plant design problem, including process–equipment specification while considering various engineering standards and constraints. They write a project report and present their project to a wide audience (open to public) at the end of the semester.

CHE 473. Mathematical Methods in Chemical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222, CHE 349, CHE 360, and CHE 370. An introduction to the use of differential equations to solve chemical engineering problems.

CHE 476. Introduction to Biochemical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 245, CHE 349. Corequisite: CHE 349. The application of chemical engineering to biochemical processes. Topics include enzyme reactions, dynamics of microbial populations, fermentation equipment, bioreactor design, and sterilization.

CHE 489. Process Dynamics and Control. 3 credits, 4 contact hours (3;0;1).
Prerequisites: CHE 349, CHE 365. This course is an introduction to chemical process dynamics and control. Topics include analysis of the dynamics of open-loop systems, the design of control systems, and the dynamics of closed-loop systems. Control techniques and methodologies, used by practicing chemical engineers, are emphasized.

CHE 490. Special Topics in Chemical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Junior or senior standing and approval of the CHE Program Director. Restrictions: Restricted to majors in NCE only. The study of novel, contemporary, and/or advanced topics in an area of chemical engineering not regularly covered in any other CHE course. The precise topics to be covered in the course will be announced in the semester prior to the offering of the course.

CHE 491. Research and Independent Study I. 3 credits, 3 contact hours (0;0;3).
Restriction: senior standing in chemical engineering, agreement of a department faculty advisor, and approval of the associate chairperson for undergraduate studies. Normally a GPA greater than 3.0 is required to participate in the course. Provides the student with an opportunity to work on a research project under the individual guidance of a member of the department. A written report is required for course completion.

CHE 492. Research and Independent Study II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: CHE 491. A continuation of CHE 491.

CHE 495. Chemical Engineering Laboratory I. 2 credits, 5 contact hours (0;5;0).
Prerequisites: FED 101, CHE 312, CHE 360, CHE 370, COM 313, MATH 225. In this first course in chemical engineering capstone laboratory, experiments are conducted in the areas of fluid mechanics and heat transfer. Bench and pilot-scale equipment is used. Oral and written reports are prepared by the students.

CHE 496. Chemical Engineering Laboratory II. 3 credits, 6 contact hours (0;6;0).
Prerequisites: CHE 349, CHE 489, CHE 495, CHEM 339. In this second course in chemical engineering capstone laboratory, experiments are conducted in the areas of mass transfer, separations, reaction engineering, and process dynamics and control. Bench and pilot-scale equipment is used. Oral and written reports are prepared by the students.

CIMT 101. Introduction to the Concrete Industry. 3 credits, 3 contact hours (3;0;0).
This course is an overview of the concrete industry including historical aspects, the chemistry, properties and uses of concrete, production and delivery, and management of production facilities. Students will also be introduced to concrete construction and contracting, environmental concerns, professionalism, and career opportunities in the concrete industry.

CIMT 205. Concrete Properties and Testing. 3 credits, 4 contact hours (2;2;0).
The effects of concrete-making materials (aggregates, cements, admixtures, etc.) on the properties of fresh and hardened concrete will be studied and analyzed from an applications point of view. Concrete mixture proportioning calculations, statistical analysis of strength tests, and the economics of various concrete mixes will also be discussed.

CIMT 210. Concrete Applications I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CIMT 101 and CIMT 205. This course is the first of two courses designed to provide a detailed study of the many applications of concrete in the construction of buildings, pavements, and other facilities as they relate directly to the concrete industry. Emphasis will be placed on the advantages, disadvantages and unique problems facing the concrete industry and suppliers of materials used in the manufacture of concrete products.

CIMT 305. Concrete Applications II. 3 credits, 3 contact hours (3;0;0).
This course is a continuation of CIMT 210 and focuses on codes, specifications and industry standards as well as the production and delivery issues related to traditional and unique concrete applications.

CIMT 310. Concrete Products and Delivery. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CIMT 210 Concrete Applications I. This course will provide the student with a basic understanding of managing the order and delivery process common to all concrete products. An emphasis will be given to planning, organizing and controlling at both the management level as well as the supervisory level.

CIMT 315. Concrete Construction Methods. 3 credits, 3 contact hours (3;0;0).

CIMT 405. Advanced Concrete Testing and Quality Assurance. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CIMT 205. This course will focus on advanced concrete testing techniques and quality assurance procedures currently used in the industry for traditional and specialty applications.

CIMT 410. Senior Project in CIM. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Senior standing in Concrete Industry Management. The student works on one or more individually selected projects guided by the department staff. The project must be concrete industry related and may include planning, research (library or lab), engineering report and statistical, analytical, or field investigation. Any of these may follow class-inspired direction, or the students may branch out on their own. The project(s) of each student must be completed and professionally presented by assigned due date for appropriate review and recording of accomplishments.

CIMT 491. Special Project in CIM. 1 credit, 1 contact hour (1;0;0).

CIMT 492. Special Project in CIM. 2 credits, 2 contact hours (2;0;0).

CIMT 493. Independent Study. 3 credits, 3 contact hours (0;0;3).

CIMT 497. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as co-op/intern. Mandatory participation in seminars and completion of requirements that include a report and/or project.Note: Normal grading applies to this COOP Experience.

CIMT 498. Coop Work Experience II. 3 credits, 3 contact hours (0;0;3).

CMT 332. Structural Systems for Construction Management. 3 credits, 3 contact hours (3;0;0).
Study of the types and behavior of building structural systems using qualitative analysis techniques. Systems to be covered will include those involving structural steel, reinforced concrete, wood and timber, and plain and reinforced masonry. The effect of wind and seismic events on these systems is reviewed.

CMT 414. Environmental Science for Construction Management. 3 credits, 3 contact hours (3;0;0).
An introduction to construction-related environmental topics, including environmental chemistry, geology, ground water hydrology, outdoor air quality, surface water run-off, erosion and sedimentation control, indoor air quality, asbestos abatement, radon remediation, and noise and vibration.

CMT 436. Temporary Structures for Construction Management. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CMT 332. Study of the types of the various temporary systems and structures used in field construction activities, including concrete forming and falsework, sheeting and shoring for excavations, scaffolding, barricades, ladders, and temporary bridges and ramps. Construction safety with respect to the systems is covered.

CMT 452. Mechanical and Electrical Systems for Construction. 3 credits, 3 contact hours (3;0;0).
Study of the different types of water supply, plumbing, fire protection, heating, ventilation, air conditioning and electrical systems commonly employed in residential and commercial buildings. Case studies include an overview of the design of these systems and their installation in the field.

CPT 310. Computer Design Fundamentals for Computer Technology. 3 credits, 4 contact hours (2;2;0).
Restriction: enrolled in the computer technology option. Boolean algebra, gates, combinational and sequential logic. Memory, microprocessor, and I/O control IC's. Sequential bus architecture.

CPT 315. Computer Architecture for Computer Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CPT 310. Computer design fundamentals for computer technology, Von Neumann computer architecture: processor, memory and I/O. Processor organization: registers, ALU, and control. Memory organization and memory bus, I/O organization: I/O bus, memory mapped I/O. Number representations and ALU designs. Fundamentals of assembly language, lab exercises in assembly language are used throughout to illustrate concepts.

CPT 325. Medical Informatics Technology. 3 credits, 3 contact hours (3;0;0).
Restriction: Junior standing. Medical Informatics (MI) professionals use information technology to benefit the health and human services industry. One of the main challenges is to develop an integrated medical record/information system that links doctors, pharmacists, medical imaging facilities and hospitals. In addition, MI professionals will also develop skills to design and develop suport technology for seniors to maintain independent life styles. This includes remote monitoring systems linked to medical professionals, software for support services, and home automation technology.

CPT 330. Software Web Applications for Engineering Technology I. 3 credits, 4 contact hours (2;2;0).
Common software applications using software objects. The use of software objects in the management of programming projects. Projects illustrate concepts.

CPT 335. Networks Applications for Computer Technology I. 3 credits, 4 contact hours (2;2;0).
Prerequisites: C++, Visual Basic, UNIX utilities. Covers common gateway interface (CGI), servers, network protocols, network administration, server and network per-formance.

CPT 341. Visual Basic.NET for Engineering Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisite: Previous programming experience. Creation of windows with text, controls, menus and graphics, events detection, files and objects management, object oriented techniques.

CPT 373. Web App Development for Mobile. 3 credits, 4 contact hours (2;2;0).
Prerequisites: A basic programming course, in addition is recommended an introductory web programming course. Mobile platforms are becoming ubiquitous and software development for these devices is becoming an essential skill for technical professionals. This software/App development course integrates software and web skills with cross platform open source tools that allow developers to write apps for multiple platforms. Course topics will include PhoneGap and open course development software, App layout, CSS (styling) and navigation (transition animations), JavaScript and native functions, geolocation listeners and Asynchronous JavaScript and XML (AJAX) skills. A class project will incorporate skills introduced in this course. Medical informatics majors will design and build an Electronic Medical records Apps. Other projects will be tailored to the interest of other majors.

CPT 395. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Restriction: Approval of the department and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

CPT 401. Senior Project. 2 credits, 2 contact hours (2;0;0).
Prerequisite: MIS 345. Restriction: senior standing in computer technology. Project management and development, scheduling, proposal writing, documentation of software projects, technical presentations. The successful completion of the project consists of research on a recent computer software and/or hardware product, and the application of the findings to the development of a project, which must include a software component. The senior project may be replaced by a cooperative education experience course, subject to advisor's approval.

CPT 425. Medical Informatics Technology II. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CPT 325. Restriction: Senior standing. Advanced topics, builds on the core competencies introduced in Medical Informatics I. This course focuses on: Management of Information in Healthcare Organizations/Cost Benefit Analysis, Health and Financing, Consumer Health and Telehealth and Wireless Patient-Monitoring Systems. Cutting edge technologies that will impact on future healthcare delivery.

CPT 430. Software Web Applications for Engineering Technology II. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CPT 330. Common applications using software objects. The use of software objects in the management of programming projects. Projects are used to illustrate concepts.

CPT 435. Networks Applications for Computer Technology II. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CPT 335. Network security. Database implementations. Scaling.

CPT 440. Visual Basic Applications for Engineering Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CPT 340. PC-based control techniques, embedded systems. Database control. Real-time control. Network data acquisition. Man-machine interface and ergonomics considerations.

CPT 450. Computer Graphics for Computer Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisites: Calculus II, knowledge of the programming language used in the course, check with the instructor. Drawing shapes, curves and text. Colors and areas, point of light, shading. Masking, 2-D drawings and transformations, 3-D drawings and transformations. Animation. Introduction of a popular graphics package. Lab exercises are used throughout to illustrate concepts.

CPT 491. Special Projects in Computer Technology. 1 credit, 1 contact hour (1;0;0).
Restriction: Senior standing in computer technology. The student works on selected projects guided by the department staff.

CPT 492. Special Projects in Computer Technology. 2 credits, 2 contact hours (2;0;0).
See CPT 491.

CPT 493. Special Projects in Computer Technology. 3 credits, 3 contact hours (3;0;0).
See CPT 492.

ECE 101. Introduction to Electrical and Computer Engineering. 0 credits, 1 contact hour (0;0;1).
Familiarize students with various disciplines, career opportunities and curricula in electrical and computer enginneering. Invited speakers include faculty and industrial representatives.

ECE 231. Circuits and Systems I. 3 credits, 4 contact hours (4;0;0).
Prerequisites: PHYS 122 and MATH 112. The basic concepts of electric circuit theory and system analysis. Topics include basic circuit elements, loop and node analysis, network theorems, sinusoidal steady-state analysis, power, resonance, mutual inductance, and ideal transformers.

ECE 232. Circuits and Systems II. 3 credits, 4 contact hours (4;0;0).
Prerequisite: ECE 231. Corequisite: MATH 222. A continuation of circuits and systems with special emphasis on transient response. Topics include Laplace transform analysis, transfer functions, convolution, Bode diagrams, and Fourier series.

ECE 251. Digital Design. 3 credits, 4 contact hours (4;0;0).
Prerequisite: PHYS 122. The design of combinational and sequential logic circuits used in digital processing systems and computers. Basic register transfer operations are covered. Topics include Boolean algebra, minimization techniques and the design of logic circuits such as adders, comparators, decoders, multiplexers, counters, arithmetic logic units, and memory systems.

ECE 252. Microprocessors. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 251. An introduction to microprocessor system organization and assembly language programming. The course covers the architecture, instruction set and assembly language of a specific microprocessor. Other topics included are memory organization, input/output interfacing, interrupt processing as well as exception processing. The problems associated with the design of a single board computer are also covered. Students receiving degree credit for CIS 453 cannot receive degree credit for ECE 352. Co-listed as COE 252.

ECE 271. Electronic Circuits I. 3 credits, 4 contact hours (3;0;1).
Prerequisite: ECE 231. Corequisite: ECE 232. The electronic devices, junction diodes, bipolar transistors and field-effect transistors, are introduced and studied based on semiconductor physics models. The study then continues with analysis and design of main digital electronic circuits (NMOS and CMOS) inverters and logic gates, MOS memory and storage circuits) and with introduction to analog electronic circuits such as simple one transistor amplifiers.

ECE 291. Electrical Engineering Laboratory I. 1 credit, 3 contact hours (0;3;0).
Prerequisites: ECE 231, ENGL 101. Corequisites: ECE 232. Laboratory work in the areas covered in ECE 231, ECE 232. Assembling, testing and analysis of basic analog circuits. Emphasis electronic measurement techniques, instrumentation and data analysis. Simulations of dc, ac, and transient circuit response on the personal computer.

ECE 3. ECE Technical Elective. 3 credits, 3 contact hours (3;0;0).**

ECE 310. Co-op Work Experience I. 0 credits, 0 contact hours (0;0;0).
Restriction: completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report.

ECE 321. Random Signals and Noise. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 232. Corequisite: ECE 333. Random processes occurring in electrical engineering. An introduction to probability and random variables is followed by stochastic processes and noise. Topics include auto- and cross-correlation functions, power spectral density, response of linear systems to random signals, and noise figure calculations.

ECE 333. Signals and Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 232, MATH 222. A continuation of circuits and systems. Topics include signal models, system representations and properties, convolution, Fourier transform, sampling, z-transform, and an introduction to IIR and FIR filter design.

ECE 342. Energy Conversion. 4 credits, 5 contact hours (3;2;0).
Prerequisites: ECE 231, ECE 291. Magnetic materials and design of singly- and multiply-excited magnetic circuits. Applications to electromechanical energy converters. Transformers, and the steady-state performance of dc and ac motors, and generators. Integrated laboratory involves experiments with ac and dc electric motors, generators, and transformers.

ECE 353. Computer Organization and Architecture. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 252. Emphasizes the hardware design of computer systems. Topics include register transfer logic, central processing unit design, microprogramming, ALU design, pipelining, vector processing, micro-coded arithmetic algorithms, I/O organization, memory organization and multiprocessing.

ECE 354. Digital Test. 2 credits, 2 contact hours (2;0;0).
Prerequisites: ECE 251 or equivalent, MATH 333 or equivalent. Covers theory and practice related to test technology. Topics include fault modeling, test generation, fault simulation, design for testability, fault diagnosis, built-in self-test, scan design, and many others. Surveys several industrial design for testability structures.

ECE 361. Electromagnetic Fields. 3 credits, 4 contact hours (3;0;1).
Prerequisites: ECE 231, MATH 213 and MATH 222. The study of static electric and magnetic fields, basic laws of electrostatics (Coulomb’s and Gauss’s laws), scalar electric potential, electrostatic force and energy; basic laws of magnetostatics (Biot–Savart and Ampere’s laws), magnetostatic force and energy, vector magnetic potential; fundamental meaning of capacitance, resistance and inductance in terms of electric and magnetic fields. Characterization of materials (conductors, dielectrics, magnetic materials). Laws of electromagnetic fields from Poisson’s and Laplace’s to Maxwell’s equations.

ECE 362. Electromagnetic Waves Propagation. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 361. Maxwell's equations solutions, reflection and refraction of plane waves in dielectric and conducting media, transmission lines; transients and frequency domain solutions in lossy and lossless lines, Smith chart and its applications, parallel plate and rectangular waveguides.

ECE 368. Signal Transmission. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 232, ECE 251. This course is not for EE majors. Signal transmission both within and between digital systems. Topics include the telegrapher's equations, wave propagation, lattice diagrams, transients in digital systems, crosstalk, proper termination for high-speed logic, and the transmission characteristics of various interconnecting geometries.

ECE 372. Electronic Circuits II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 232, ECE 271. Principles of MOSFET and BJT small signal amplifiers: Q point design, input and output impedance, gain, and signal range limitations for different single stage configurations. Design of analog integrated circuits including differential amplifiers, current sources, active loads. Transistor high frequency models, Miller effect, and frequency response of multistage amplifiers. Feedback in multistage amplifiers. Design and analysis of nonlinear circuits based on comparators. Design and analysis of signal generators.

ECE 374. Electronic Device I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 271. This course addresses electronic devices on a fundamental level. Topics include semiconductors, structure and properties of p/n junction, Schottky barrier, BJT, MOS, MOS FET, semiconductor optoelectronics.

ECE 375. Introduction to Semiconductor Devices. 4 credits, 5 contact hours (3;2;0).
Prerequisites: ECE 271, ECE 291. This course addresses electronic devices on a fundamental level. Topics include major semiconductor properties, p/n junction, Schottky barrier, BJT, MOSFET and optoelectronics devices. Integrated laboratory involves measurements and simulations of semiconductor device characteristics.

ECE 392. Electrical Engineering Laboratory II. 2 credits, 3 contact hours (0;3;0).
Prerequisites: ECE 271, and ECE 291. Co-requisite: ECE 372. Laboratory work in the areas covered in ECE 232, ECE 271 and ECE 372. Design, computer simulation, testing and performance analysis of analog and digital electronic circuits.

ECE 394. Digital Systems Lab. 1 credit, 3 contact hours (0;3;0).
Prerequisites: ECE 251, ECE 271 and ECE 291. Experiments emphasize digital design from basic electronic circuits to complex logic. Topics include switching speed, basic sequential circuits, the arithmetic/logic unit, and computer memories.

ECE 395. Microprocessor Laboratory. 2 credits, 4 contact hours (0;4;0).
Prerequisites: ECE 291, ECE 252. In this laboratory the students are expected to learn to apply their theoretical knowledge of both the hardware and software aspects of microprocessors. To attain this objective the students are required to construct a microprocessor based single board computer (SBC), with adequate interfacing capabilities to be able to perform some useful control tasks. Programming of the device is done in assembly language. Some of the experiments that follow the construction project deal with software while others deal with the problems of interfacing of microprocessors.

ECE 405. Electrical Engineering Principles. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 121 or PHYS 122 and Junior standing. (No credit for ECE students.) For non-electrical engineering majors. Topics include basic dc and ac circuits, basic electronics, an introduction to electromechanical energy conversion and control theory.

ECE 410. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ECE 310, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience. Mandatory participation in seminars and completion of requirements that include a report and/or project. May count as EE or approved elective. Note: Normal grading applies to this COOP Experience.

ECE 414. Electrical and Computer Engineering Project I. 1 credit, 1 contact hour (1;0;0).
Prerequisites: ECE 353, ECE 368, ECE 394 and ECE 395, or ECE 321, ECE 341 or ECE 342, ECE 372, ECE 392. With the instructor's approval, some of these courses can be taken as co-requisites. Student teams prepare and submit technical proposals for the senior design ("capstone") project to be completed the following semester in ECE 416 or ECE 417. Discussion of issues related to the engineering profession, including such topics as: intellectual property, sources of technical information, engineering codes and standards, professional organizations, professional registration. Required of all ECE students.

ECE 416. Electrical and Computer Engineering Project II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 414. Continuation and completion of the project based on the proposal approved in ECE 414. Progress of the project is monitored by the instructor with demonstrations and presentations at given due dates of the regularly scheduled course. An oral presentation and demonstration of the project by the student team must be given and a written report submitted at the end of the course. Successful projects are approved for the presentation at the Senior Design Project Workshop in the presence of students, faculty and industry representatives.

ECE 417. Electrical & Computer Engineering Project II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: ECE 414. Faculty adviser approval required. Continuation and completion of the project based on the proposal approved in ECE 414 guided by a faculty or a faculty and industrial mentors with meetings scheduled as needed. A formal written report is presented to the faculty advisor at the end of the course. An oral presentation of a successful project is made at the Senior Design Project Showcase attended by students, faculty, and industry representatives.

ECE 418. Independent Study. 3 credits, 3 contact hours (0;0;3).
Requirements: senior standing or approval of the associate chairperson for undergraduate studies, a GPA greater than 3.0, and agreement of a faculty advisor. Provides the student with an opportunity to work on a research project under individual guidance of a faculty. The required work and intellectual challenge correspond to at least those of other senior ECE courses. A written report is required for the course completion.

ECE 421. Digital Data Communication. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 232, MATH 333, or ECE 321. Topics include signal classification, correlation, spectral analysis, noise, signal transmission through linear systems, principles of digital data transmission, AM, FM and pulse modulations, sampling and digitalization of signals, inter-symbol interference and equalization, channel capacity, data compression techniques, error detection and correction methods.

ECE 422. Computer Communications Networks. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 321 or MATH 333. Introduction to the fundamental concepts of computer communication networks. Topics include the OSI reference model, the physical, data link, network, and transport layers, TCP/IP, LANs (including token ring, token bus, and ethernet), ALOHA, routing and flow control.

ECE 423. Data Communications Networking Devices. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 421 or ECE 481. Provides a working knowledge of data communication networking devices, including modems, routers, multiplexers, switches, and concentrators and are used as building blocks in the implementation, modification, or optimization of data communications networks. Emphasizes device design, functionality and physical layer protocols.

ECE 424. Optical Communication Network. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 232 and either ECE 321 or MATH 333. Focuses on digital optical networks, architecture, modulation techniques, and detection noise. Related topics are wireless communication, infrared link, and CATV. Computer simulations of network systems are done with commercial software packages.

ECE 425. Wireless Communication Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 481 or ECE 421. Introduction to wireless system design and engineering. Develops an understanding and appreciation of the wireless engineering problems such as cellular layout design, resource allocation, mobility management, capacity and performance and signaling load calculations. Introduces physical layer building blocks such as modulation, synchronization, coding, diversity, equalization, and spreading.

ECE 429. Computer Communications Lab. 2 credits, 4 contact hours (0;4;0).
Prerequisite: ECE 422. Experiments with different protocols and standards used in the TCP/IP computer communications, including Ethernet/802.3 standard, Address Resolution Protocol (ARP), Internet Protocol (IP), Transport Control Protocol (TCP), User Datagram Protocol (UDP), and others. Exercises with network measurements and virtualization tools, and configurations of some commercial routers are included.

ECE 431. Introduction to Feedback Control Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 333, or ECE 232 and MATH 337. Concept of feedback control. Typical feedback control systems. System dynamics by Laplace transform and state space methods. Stability definition and assessment: Routh-Hurwitx criteria. Graphical stability methods: Root locus, Nyquist and Bode plots. Performance evaluation and simulation. Matlab/Simulink used extensively. A good background in Laplace transform and linear (matrix) algebra highly desirable.

ECE 432. Advanced Control Systems and Robotics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 431. Study of control systems with an emphasis on the modern control theories based on state space methods. Modeling and analysis of dynamic systems, feedback and feedforward control strategies, observers, and computer-based control systems. An introduction to optimal control, which is the foundation of advanced intelligent control methods such as model predictive control and reinforcement learning. The topics covered in the course are illustrated with applications in robotics.

ECE 435. Medical Imaging Instrumentation and Data Acquisition Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 231, ECE 252 and ECE 333. Three-Dimensional medical imaging modalities including X-ray Computer Tomography, Magnetic Resonance Imaging, Single Photon Emission Computer Tomography, Positron Emission Tomography, and Ultrasound utilizes advanced highly integrated electronic sensors, fast processor-based computers, and advanced signal proessing and reconstruction methods.

ECE 436. Bio Control Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 431. This course provides an introduction to dynamic and control in biological systems, with particular emphasis on engineering aspects of biological oscillators/waves. A combination of theoretical and simulation tools will be applied to analyze the qualitative and quantitative properties of selected biological systems. Feedback and control mechanisms in selected biological systems will be introduced. Real time signal acquisition and processing are also adressed.

ECE 439. Control Systems Laboratory. 2 credits, 4 contact hours (0;4;0).
Prerequisite: ECE 431. Laboratory work in the design and synthesis of control systems, closely coordinated with the control systems elective.

ECE 441. Power Electronics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 373. Electronic devices and circuits used to energize various apparatus and systems. Topics include circuits, freewheeling diodes, thyristors, firing and commutation of silicon-controlled rectifiers, converters, dc choppers, and power supplies.

ECE 442. Power Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 341 or ECE 342. Introduction to power plants and power networks. Topics include transmission line parameters, system modeling, economic operations of power systems, load flow studies, short circuit analysis, and power system stability.

ECE 443. Renewable Energy Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 231 and ECE 271. This course presents the various sources of renewable energy including wind, solar, and biomass as potential sources of energy and investigates the contribution they can make to the energy profile of the nation. The technology used to harness these resources will be presented. Discussions of economic,environment, and social policies are integral components of the course.

ECE 449. Power Systems Laboratory. 2 credits, 4 contact hours (0;4;0).
Pre or Corequisite: ECE 442. Laboratory work in the design and synthesis of power systems, closely coordinated with the power systems elective.

ECE 451. Advanced Computer Architecture. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 353. This course focuses on advanced concepts in computer systems design, and the interaction between hardware and software components at various levels (i.e., hardware/software codesign). It introduces common performance measures and tradeoffs used by hardware and software designers to facilitate comparative analysis. The main topics are power wall and memory wall technology challenges, pipelining, multicore architecture, advanced memory technologies with an emphasis on non-volatile memories, introduction to parallel computing, domain-specific architectures (i.e., FPGA, ASIC), and an introduction to analog and digital in-memory computing.

ECE 452. High Performance Computer Architecture. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 451. The course focuses on recent advances and topics of current active research in the field of computer architecture. It includes new computing paradigms such as brain-inspired non-von Neumann architectures, heterogeneous computing systems, and parallel machine learning accelerator architectures. It also covers topics related to hybrid memory systems, architectures of emerging memory technologies, rowhammer and secure and reliable memory systems, and memory consistency.

ECE 453. Introduction to Discrete Event Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 251 or CS 251 or equivalent, and MATH 333 or ECE 321 or equivalent. Introduces logical models, timed models, and stochastic timed models of discrete event systems. Applies petri net methodology to the modeling of computer systems, flexible manufacturing systems, communication networks, and robotics. Contrasts the approaches of simulation, elementary queueing theory, and Markov processes.

ECE 457. Digital Image Processing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 333. An introduction to the fundamental techniques for digital image processing. Covers human visual sstems, image sensing and acquisition, image sampling and quantization, 1-D and 2-D systems, image enhancement, image restoration, image degradation, features extraction, and image segmentation.

ECE 459. Advanced Computer Systems Design Lab. 2 credits, 4 contact hours (0;4;0).
Prerequisites: ECE 451, ECE 495. Corequisite: ECE 452. Design laboratory component of the advanced computer systems technical track offered to COE majors in the senior year. Experiments emphasize advanced CPU design concepts, such as RISC approaches and exception handling, multiprocessor and systolic array computers, and FPGAs. Develop software programs to test the capabilities of these hardware designs.

ECE 461. Microwave and Integrated Optics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 362. The analysis and design of microwave transistor amplifiers and oscillators using scattering parameter techniques. Topics include transmission line theory, scattering parameters, matching networks, signal flow graphs, amplifier design considerations (power gain stability, noise and band width), and negative resistance oscillator design.

ECE 462. RF/Fiber Optics Systems Elective. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 362. Topics include dielectric waveguides and optical fibers, semiconductor optical sources and detectors; rf/microwave modulation and demodulation of an optical carrier; design concepts in optical transmitters and receivers; and usage of CAD software tools for rf/microwave simulations.

ECE 463. Optoelectronics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 374. The course addresses electronic and optoelectronics device concepts. Topics include optical materials, semiconductor materials, light propagination in waveguide, solar cell, LED and modulation of light.

ECE 469. RF/Microwave and Fiber Optics Systems Laboratory. 2 credits, 4 contact hours (0;4;0).
Corequisite: ECE 462. Laboratory work in characterization of RF/microwave transmission structures and optical fibers, sources and detectors, spectral and time domain (OTDR) measurements in micro-waves and optics. Experiments in microwave and fiber optic links. Usage of CAD software tools for RF/microwave simulations.

ECE 472. Pulse Techniques. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 373. Topics in electronics including linear and non-linear operational-amplifier circuits, the frequency compensation of operational-amplifiers, higher-order active filters including switched-capacitor designs, waveform generators, multi-vibrators, timers, waveshapers, converters, and other selected topics.

ECE 475. VLSI Circuits. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 372. Topics include MOSFETs, their characteristics and use in analog and digital circuit design, static and dynamic circuits; memory cells; differential stages; symbolic layout of NMOS and CMOS circuits; fundamentals of silicon processing technology and associated design rules and methodology; calculation of chip performance including power, speed and area; logic arrays.

ECE 481. Digital Communications Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 321. An introduction to digital communications systems and modulation and techniques, along with simulation experiments of communications systems and techniques in Matlab/Simulink. Description of AM and FM modulations, sampling and digitalization of signals, baseband and carrier-modulated digital transmission, signal detection in noise, inter-symbol interference and equalization, channel capacity, data compression techniques, error detection and correction methods.

ECE 482. Communications Systems Elective. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 481. A continuation of the study of communications systems with selected topics from different areas of communications theory such as sampled-data communications, information theory and noise.

ECE 489. Communications Systems Laboratory. 2 credits, 4 contact hours (0;4;0).
Prerequisite: ECE 421. The laboratory experiments are designed using Matlab/Simulink and Software Defined Radio (SDR). The major lab tasks include time and frequency domain analysis of AM and FM signals, generation and detection of digitally modulated waveforms such as BPSK, QPSK, 16QAM and 64QAM which are widely used in wireless communication networks. Through the experiments, students learn how to use Matlab/Simulink to control the SDR, to assess and combat the impairments due to noise and interference, and become familiar with instruments such as spectrum analyzers, audio analyzers and noise generators.

ECE 492. Electrical Engineering Laboratory III A. 1 credit, 3 contact hours (0;3;0).
Prerequisites: ECE 341, ECE 392. Restrictions: For Electrical Engineering majors only. A senior laboratory with experiments in power and energy conversion, including ac and dc electric motors, generators, and transformers.

ECE 493. Electrical Engineering Laboratory III B. 1 credit, 3 contact hours (0;3;0).
Prerequisites: ECE 374, ECE 392. Restrictions: For Electrical Engineering majors only. A senior laboratory with experiments involving semiconductor and optoelectronic devices. Characteristics of diodes, transistors, solar cells, and semiconductor sensors are measured using computer-controlled instrumentation.

ECE 494. Electrical Engineering Laboratory III. 2 credits, 3 contact hours (1;2;0).
Prerequisites: ECE 341, ECE 374, ECE 392. A senior laboratory with experiments in two distinct areas: A) power and energy conversion, and B)semiconductor devices. Part A involves experiments with full size ac and dc electric motors, generators, and transformers. In part B characteristics of diodes, transistors and solar cells are measured using computer controlled instrumentation.

ECE 495. Computer Engineering Design Lab. 3 credits, 5 contact hours (1;4;0).
Prerequisites: ECE 353, ECE 394. Preparation for putting into practice the concepts learned in ECE 353. Emphasizes hardware design and debugging. Topics include combinational and sequential logic design using CAD tools, design based upon PLA/PLD devices, computer interface design using hardware and software, and an open-ended design project such as a central processing unit design.

ECE 498. Special Topics in Electrical and Computer Engineering. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in an area of electrical and computer engineering not regularly covered in any other ECE course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course.

ECET 201. Circuits I. 3 credits, 4 contact hours (2;2;0).
This first course in Electrical Circuits introduces the student to both DC and AC Circuit Theory. It includes Ohm's and Kirchoff's Laws for analysis of series and parallel circuits. Series-parallel, ladder and bridge networks are analyzed. Resonance and frequency response are included along with an introduction to AC circuits. Circuit simulations and laboratory experiments are designed to support the theory and obtain measurement skills.

ECET 202. Circuits II. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 201 or ECE 231 and MATH 138 or MATH 111. This second course in Electrical Circuits expands on Circuit Theory introduced in ECET 201. It includes Ohm's and Kirchhoff's Laws for analysis of series and parallel AC circuits. Series-parallel, ladder and bridge networks are analyzed using AC signals. Resonance and frequency response are included. The basic theory and operation of diodes and transistors, including dc biasing are studied. Circuit simulation and laboratory experiments are designed to support the theory and obtain measurement skills.

ECET 205. Fundamentals of Analog Electronics. 3 credits, 4 contact hours (2;2;0).
Prerequisite: ECET 202 or ECE 232 This course introduces students to the active components used in electronics circuits. It covers the physics, the characteristics, and some applications of semiconductor diodes and transistors. The applications will include amplifiers, rectifiers, op amps, oscillators, and timers. Circuit simulation and laboratory experiments are designed to support the theory and provide measurement skills.

ECET 210. Intro. to Microprocessors and Computer Architecture. 3 credits, 4 contact hours (2;2;0).
Prerequisite: None This is an introductory course in computer architecture and microprocessor applications for students who already have basic knowledge of digital circuit principles. Computer hardware architecture is analyzed, and assembly-language programs are written and run. Computer architecture concepts are applied through the use of assembly software programs for a popular microprocessor family. Theoretical ideas are reinforced by building and testing realistic experimental systems in the laboratory.

ECET 211. Computer Architecture. 2 credits, 4 contact hours (3;1;0).
Prerequisites: (CS 100 or CS 106 or CS 113 or CS 114 or CS 115 or CS 116) and ECET 215. This course covers the fundamentals of computer architecture and organization including processor organization, registers, ALU, memory, and IO. The architecture and design of each element is studied and reinforced during lab. Lab projects may include the design a simple RISC microcomputer using HDL or the use of RISC microcontroller systems to perform basic IO and control functions. HDL and assembly languages are studied.

ECET 214. Introduction to Communications. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 202 or ECE 232. Corequisite: ECET 205 A study of amplitude modulation, frequency modulation, and pulse modulation systems of transmission and reception, including applications of these systems in radio, television and telemetry. Introduces the latest digital communications theory and applications. Computer simulation and laboratory experiments are designed to support the theory and obtain measurement skills.

ECET 215. Introduction to Digital Electronics. 3 credits, 4 contact hours (2;2;0).
The first course in digital electronics develops the fundamentals of the binary system, circuit implementation from Boolean functions and map minimization. Course includes study of combinational logic, sequential logic circuits, flip-flops, counters, and shift register. Computer simulation and laboratory experiments are designed to support the theory and obtain measurement skills.

ECET 300. Circuit Analysis: Transform Methods. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (ECET 303 or ECE 232) and (MATH 238 or MATH 112) and (ECET 205 or ECE 271). Corequisites: MATH 322 or MATH 222. The principles, theorems and techniques of circuit analysis are reviewed. The technique of waveform and circuit transforms is introduced. Laplace transforms are studied and applied in the solution of circuit problems with a variety of input functions. Fourier analysis also is introduced. Extensive use of computer simulation software.

ECET 303. Circuit Measurements. 2 credits, 4 contact hours (1;3;0).
Prerequisites: (ECET 205 or ECE 271) and (MATH 138 or MATH 111). Lecture and laboratory sessions are designed to develop techniques for the measurement of various circuit parameters as well as the theoretical prediction of these parameters. Extensive use of computer simulation software.

ECET 305. Integrated Circuit Applications. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 303 and MATH 238 or MATH 112. Corequisite: ECET 300. Provides a working knowledge of the characteristics and applications of integrated circuits. Topics include how linear ICs work, the most common circuit configurations in which ICs are used, and how to design the most commonly needed circuits with ICs, using manufacturers specification sheets.

ECET 310. Microprocessors I. 3 credits, 4 contact hours (2;2;0).
Prerequisites: Courses in digital logic and introduction to microprocessors (AAS level). Develops a working knowledge of the characteristics and applications of microprocessors. Emphasis is put on the architecture and instruction set of an advanced microprocessor. Representative data handling problems are studied and tested in the laboratory.

ECET 311. Embedded Systems I. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (CS 100 or CS 106 or CS 113 or CS 114 or CS 115 or CS 116) and (ECET 211 or CPT 315 or ECE 252) and (ECET 215 or ECE 251) and (ECET 205 or ECE 271). Develops a working knowledge of the characteristics and applications of devices used in embedded systems such as microcontrollers. Emphasis is put on the architecture, instruction sets, and assemblers. Representative data handling problems and interfacing are studied and tested in the laboratory using state-of-the art hardware.

ECET 314. Communication Systems. 3 credits, 4 contact hours (2;2;0).
Corequisite: ECET 300. A study of amplitude modulation, frequency modulation, and pulse modulation systems of transmission and recep-tion, including applications of these systems in radio, television, and telemetry. Introduces the latest digital communications theory and applications. Perform appropriate laboratory exercises and projects.

ECET 319. Electrical Systems and Power. 3 credits, 4 contact hours (2;2;0).
Prerequisites: Physics I and Calculus (AAS level). Restriction: For non-ECET majors only. The fundamentals of ac and dc circuit theory are studied. Transistor and diode theory and their applications in amplifiers and filters are investigated. Electrical machines are also included in this course. Computer simulation as well as appropriate laboratories are required.

ECET 329. Analog and Digital Electronics. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 201 or ECE 231. Building on ECET 201, a study of more advanced topics in electronics including AC circuit analysis, op-amps, transistors, digital logic, and microcontrollers. Computer simulation as well as laboratories are required.

ECET 344. Numerical Computing for Engineering Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (CS 100 or CS 106 or CS 113 or CS 114 or CS 115 or CS 116) and (MATH 238 or MATH 112). An introduction to the use of a computer to analyze and solve problems common in engineering. Using computers and the application language students will confront a variety of tasks that will promote an object oriented programming structure. The goal of this course is to understand and program routines commonly used in the design of computer algorithms for computer-based problems. Practical applications as well as mathematical programming are stressed.

ECET 350. Computerized Industrial Controls. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (ECET 211 or CPT 315) and ECET 311. This course introduces students to the theory and application of computerized control systems and technologies used in industry today. The course focuses on the hands-on development and integration of programmable logic controllers (PLCs), motor controllers (drives), and supervisory software.

ECET 365. Digital Logic and Circuit Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECET 215 or ECE 251 Develops the mathematics and minimization techniques together with the circuit implementation for the design of combinational and sequential digital solid-state logic circuits. Studies decoders, mulitplexers, counters, registers, and PLDs. Computer and communications circuits are used as examples. Projects employ computer simulation of digital circuits.

ECET 395. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Restriction: Completion of Freshman year and Approval of the department and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

ECET 400. Senior Project. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 305 and ECET 344 and ECET 411 and COM 313. Capstone project course for the ECET program. Students work as a group to design and develop a product. Students must study project management, concurrent engineering, proposal development, research, societal impact, market research, prototyping and testing. Students develop a formal project proposal, Gantt chart and design specifications for their project. Students apply technical knowledge to build and test their project. Documentation and demonstration of formal testing procedures, computer analysis, simulation, time and cost estimates and compliance with specifications is required. Students present a functioning prototype of the project to a design review board and other students enrolled in the course.

ECET 401. ECET Senior Project I. 2 credits, 2 contact hours (2;0;0).
Prerequisites: ECET 344, ECET 305, ECET 411 and COM 313. The first course in a two-course sequence comprised of Senior Project 1 (ECET 401) and Senior Project 2 (ECET 402). Project management, concurrent engineering, proposal development, library research, and computer usage are stressed. Students develop a formal proposal, technical specifications, Gantt chart, and design specifications for the senior project to be implemented in ECET 402.

ECET 402. ECET Senior Project II. 1 credit, 2 contact hours (0;2;0).
Prerequisite: ECET 401 (The previous semester) Apply technical knowledge to implement, build, and test the project approved in ECET 401.Complete library research, design specifications, computer analysis, simulation, and time and cost estimates. Purchase and build a working prototype of the design. Complete formal testing procedures to verify that the prototype meets design specifications. Submit formal written documentation and present the project during an oral presentation to a design review board and other students in the class.

ECET 406. Control Systems and Transducers. 4 credits, 6 contact hours (3;3;0).
Prerequisite: ECET 305. Class and laboratory study of analog and digital automatic control. Using Laplace transforms, principles of analysis and design of control systems are introduced. Transducer characteristics and their application in instrumentation and control are investigated. Several experiments are implemented using Programmable Logic Controllers (PLCs).

ECET 410. Microprocessors II. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 310 and ECET 365. Covers the operations, bread boarding, and interfacing of devices peripheral to microcom-puters. Emphasizes embedded applications of microprocessers to systems requiring both hardware and software development. Advanced topics include programmable peripheral I/O controllers, interrupts and local ISA, PCI and USB buses.

ECET 411. Embedded Systems II. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 311. This course is the second of two embedded systems courses. The primary objective is to prepare students in the ECET curriculum to design embedded systems as part of senior project and also in industry. The design of embedded systems is investigated at the hardware and software level with an emphasis on processor and system architecture. The C language is used for programming.

ECET 412. Power Generation and Distribution. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 205 or ECE 271. Restrictions: Junior or Senior Standing. Electrical generation, transmission, and distribution systems with an emphasis on 3 phase analysis, design, short circuit currents due to symmetrical faults, and reliability considerations of the electric power system. The laboratory portion includes hands on activities and experiments that align electric power theory with application. Design considerations for inside / outside plant, worker safety, system interconnection and protection, while focusing on reliability and cost considerations are covered.

ECET 414. Solar Photovoltaic Site Planning and System Installation. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 205 or ECET 329. Restrictions: Junior or Senior Standing. This course covers the following topics on solar photovoltaic (PV) systems: introduction to renewable energy and PV systems, solar thermal systems, solar radiation, sun path characteristics, panel installation, and troubleshooting. Moreover, the identification and analysis of a PV array site as well as the development of a site layout are discussed with emphasis on the implementation of the associated electrical codes and safety rules. This course will prepare the students for the North American Board of Certified Energy Practitioners (NABCEP) test for certified solar PV system installer.

ECET 415. Fundamentals of Telecommunications. 3 credits, 4 contact hours (2;2;0).
Prerequisites: CS 100 or CS 106 or CS 113 or CS 114 or CS 115 or CS 116. Restrictions: Junior or Senior Standing. The focus of this course is on network data communication systems and related protocols. Main topics include transmission media including coax, twisted pair, fiber optics, wired, and wireless media. The Transmission Control Protocol/Internet Protocol (TCP/IP) model, as well as the Open System Interface (OSI) model, are discussed with emphasis on the details of the TCP/IP model. Additional topics such as wired and wireless LAN, backbone networks, wide area networks, The Internet, networking security, and networking design are covered.

ECET 416. Networking Applications. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (CS 100 or CS 106 or CS 113 or CS 114 or CS 115 or CS 116) and ECET 415. Introduces students to the technology of networking with a particular focus on local area networks and the protocols associated with network communication. Comprised of two components: concept/theory and hands-on/applications in the laboratory. Topics include: an overview of network communication systems, networking concepts, network protocols, network standards, wide area networks, local area networks, enterprise networks, network topology, media access control, transport control protocol, internet protocol, and routing. Students learn to analyze traffic flow on network links and how to write network based software applications.

ECET 418. Transmission Systems. 3 credits, 4 contact hours (2;2;0).
Prerequisite: ECET 214. Restrictions: Junior or Senior Standing. A study of wireless and terrestrial transmission systems with an emphasis on fiber optics and the latest wireless techniques. The lectures examine the technologies as well as the advantages and disadvantages of the various transmission techniques. The laboratories are a mixture of fiber optic, microwave, and wireless experiments providing hands-on experience in these important areas.

ECET 419. Design of Internet Based Embedded Systems. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 411. Restrictions: Junior or Senior Standing. This course explores the fundamental technologies required to build modern embedded systems that are utilized and controlled over the internet. Students learn the basics of foundational internet technologies and data structures such as IoT basics, HTTP requests and response methods, REST web service structures, client/server model topologies, JSON data representation, apache web server, HTTP / IP routing basics, PHP, MySQL, and linux basics. The course explores combinations of these technologies to form complete client/server communication systems that are specifically design for control and utilization of embedded systems using web based communication. The course concludes with a final project where students design an internet based embedded system that can be controlled, monitored, and utilized over the internet.

ECET 430. Electronics Design for Manufacturing and Production. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 205 or ECET 329. Restrictions: Junior or Senior Standing. This course teaches the fundamental skills required to design and manufacture electrical systems on printed circuit boards. The fundamental skills of electronics CAD are taught along with industry standards for schematic designations, engineering change orders, component packaging, simulation, and verification. Students are taught basic and advanced topics in PCB construction, analysis, and layout including auto-routing with a focus on through hole and surface mount technology, impedance control, heat dissipation, interconnects, panelization techniques, and production specific features and designations. Manufacturing files and outputs are studied emphasizing the necessary considerations for mass production, testing, component selection, stencil designs, solder composition, and reliability concerns.

ECET 435. Digital Signals: Processing, Presentation, and Management. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (CS 100 or CS 106 or CS 113 or CS 114 or CS 115 or CS 116) and (MATH 138 or MATH 111). Restrictions: Junior Standing or Department Approval. This course covers the fundamentals of digital signal processing including signal acquisition, manipulation, and presentation. MATLAB, Python, and Excel are used as methods of computer programming, automation, and signal processing. Students learn the fundamentals of signal sampling, processing, reconstruction, digital signal types, quantization, encoding, FIR and IIR and filters, and various methods for the design of digital signal filters based on use cases and specifications. Emphasis is placed on effective data presentation techniques. The course concludes with a final project which can be implemented in hardware or software.

ECET 440. Clinical Internship. 3 credits, 3 contact hours (3;0;0).
By Advisement". Consists of 200 hours of experience in the clinical engineering department of a hospital. The student is under the supervision, and is evaluated by, the director of clinical engineering at the hospital. A final report is submitted to and graded by the NJIT faculty advisor.

ECET 444. Technology Applications of Object-Oriented Programming. 3 credits, 4 contact hours (2;2;0).
Prerequisite: ECET 344. Restrictions: Junior or Senior Standing. Brings together prior software knowledge and applies it to develop modern software applications. Comprised of theory and hands-on applications in the lab. Concepts in modular/structured design and object-oriented design will be combined to develop modern internet and database connected applications. Examine several case studies during the last few weeks. Design, construct and test a practical software project.

ECET 491. Special Projects in ECET. 1 credit, 3 contact hours (3;0;0).
By Advisement". Special projects course for ECET students with subject matter to be arranged by instructor and approved by program coordinator.

ECET 492. Special Projects in ECET. 2 credits, 3 contact hours (3;0;0).
By Advisement". See ECET 491.

ECET 493. Special Projects in ECET. 3 credits, 3 contact hours (0;0;3).
By Advisement". See ECET 491.

ECET 495. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: ECET 395. Provides major-related work experience as a co-op/intern. Mandatory participation in seminars and completion of requirements that include a report and/or project.

ENE 262. Introduction to Environmental Engineering. 3 credits, 4 contact hours (3;1;0).
Prerequisites: CHEM 126, MATH 112, and PHYS 121. To introduce students to the integrated science, engineering, design and management concepts of engineered environmental systems. The course will cover environmental regulations and standards, environmental parameters, mass balance and natural systems, water quality management, water and wastewater treatment, air pollution control, noise pollution, and solid and hazardous waste management. Background material and laboratories in the environmental sciences and management areas will be covered. Group term papers and presentations will be required.

ENE 360. Water and Waste Water Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENE 262 and junior standing. Training in the methods used for water pollution control. Topics include the chemical, physical, and biological processes that occur in waste treatment design and in receiving waters; modeling schemes to determine allowable loadings in various bodies of water; and waste treatment processes used for water pollution control.

ENE 361. Solid and Hazardous Waste Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENE 262 and junior standing. Exposure to the area of air pollution control, solid waste disposal, and radioactive waste disposal. Topics include the chemistry of contaminated atmospheres; the influence on meteorological conditions of dispersion of pollutants; abatement processes used in the control of emissions; classification and nature of solid waste, and solid waste disposal techniques; sources and methods for the disposal of radioactive contaminants; and related health effects.

ENE 362. Pollution Prevention. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126, MATH 111. Restriction: Junior Standing. This course presents pollution prevention concepts and principles, terminologies, life cycle impact approaches, and management strategies. It will also serve as a community based service learning course. The course introduces available improvement techniques for industrial pollution prevention and control and examines specific applications to industries biological, chemical, physical, and thermal techniques.

ENE 465. Sustainable Environmental Infrastructure. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENE 262. Environmental engineering concerns itself with preserving and restoring the quality of water, air, and soil. This course will examine drinking water, stormwater, wastewater, solid waste, and soil remediation activities from the perspective of sustainability, highlighting proven approaches. Sustainability will be framed within the Envision certification and Life Cycle Analysis (LCA) approach, with consideration of environmental justice issues.

ENE 485. Special Topics in Environmental Engineering. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in an area of environmental engineering not regularly covered in any other ENEcourse. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course.

ENE 490. Senior Project. 3 credits, 3 contact hours (0;0;3).

ENE 491. Research Experience in ENE. 3 credits, 3 contact hours (3;0;0).

ENGR 101. Analytical Meth for Engr Appl. 4 credits, 6 contact hours (4.5;1.5;0).
Prerequisite:SAT Math score of 500 or above This course provides foundation in analytical methods that are used by engineers through an application-oriented, hands-on introduction to engineering analytical methods.

ENGR 210. Career Planning Seminar for En. 1 credit, 1.5 contact hour (1.5;0;0).
Prerequisite: Sophomore Standing. This course aims at providing engineering students with multidisciplinary and career planning skills in a seminar environment with emphasis on career planning, resume writing, and interview skills.

ENGR 290. Pers of the Grand Challenges. 1 credit, 1 contact hour (1;0;0).
Prerequisite: Approval of the Instructor and the Grand Challenges Program Director; sophomore or higher standing. The first step for aspiring students in becoming a grand challenges scholar. Seven engaging colloquia will be offered every fall semester. Faculty conducting research in a Grand Challenge Theme will present the colloquia with one faculty member presenting at each colloquium. At the conclusion of each faculty presentation, and in the weeks in-between the presentations, students will engage in an activity organized to focus on exploring a potential engineering solution, addressing societal impacts, and holding debates on differing perspectives.

ENGR 301. Engineering Applications of Data Science. 3 credits, 4 contact hours (2;2;0).
Prerequisites: CS 100 or CS 101 or CS 106 or CS 113 or CS 115 or BME 210. Pre or Corequisites: MATH 225 or MATH 244 or MATH 279 or MATH 305 or MATH 333 or ECE 321 or IE 331 or MNET 315. Restriction: This course is intended for engineering majors. This is a course for junior level undergraduates in any engineering discipline focusing on the use of data science techniques to solve problems in engineering. We will first discuss the Python programming language and how it can be used to access, manipulate, explore, and visualize scientific datasets. We will discuss statistics and probability as it applies to engineering problems such as safety factors and probability of part failure; this includes conditional probability, probability distributions, hypothesis testing, and Bayesian inference. We will then discuss more advanced statistical models (“machine learning”), including linear and logistic regression, decision trees, and clustering. Possible applications of these methods will be demonstrated in such disciplines and topics as (but not limited to): chemical, mechanical and electrical engineering (optimization and controls), materials engineering (structure and property databases), biomedical engineering (medical diagnosis and medical imaging) and electrical and computer engineering (signal processing, target tracking, robotic navigation). Students will gain hands-on experience in implementing and utilizing these various methods through computational laboratory assignments and reports and a semester-long engineering design project.

ENGR 310. Co-op Work Experience I. 12 credits, 12 contact hours (0;0;12).
Prerequisites: ENGR 210; Completion of 36 credits; Cumulative GPA 2.5; Approval of department; Approval of CDS. Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Mandatory participation in seminars and completion of a report.

ENGR 311. Co-op Work Experience - Summer. 1 credit, 1 contact hour (0;0;1).
Prerequisites: ENGR 210; Completion of 36 credits; Cumulative GPA 2.5; Approval of department; Approval of CDS. Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Mandatory participation in seminars and completion of a report.

ENGR 320. Prototyping Essentials. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MATH 111 or MATH 113 or MATH 138 or (MATH 110 and ENGR 101) or (MATH 107 and ARCH 156). This course introduces students to the fundamental skills, equipment, safety procedures, and theory required to prototype and test basic mechanical and electrical systems as part of the engineering and product design process. Students learn basic prototyping skills starting with hand tools and moving to computer-controlled cutting, shaping, and measurement equipment such as 3D printers, water jets, lasers, CMM’s, mills, and lathes. Students learn to use software to design components, develop and interpret prints, and program fabrication and inspection machinery. Entrepreneurial concepts, budget, and economic factors associated with prototyping are discussed and examined. Laboratory exercises require students to design, model, fabricate, and validate components and systems. The course concludes with a final project requiring students to design and produce a physical project in the NJIT Makerspace.

ENGR 400. Multidisciplinary Engineering Design Project. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Junior or Senior standing and approval of instructor and NCE Associate Dean for Academic Affairs. Students design, document, and build a project or portion of a larger system as part of a multidisciplinary project under the supervision of a faculty member. Deliverables include written engineering design requirements, standards and specifications, bill of materials, detailed drawings suitable for fabrication, and a demonstration of a fabricated, assembled, tested, and functional project. Additional requirements may be added by the instructor with approval of the NCE Associate Dean for Academic Affairs.

ENGR 410. Co-op Work Experience II. 12 credits, 12 contact hours (0;0;12).
Prerequisites: ENGR 310; Completed at least 9 credits after ENGR 310; Cumulative GPA 2.5; Approval of department; Approval of CDS. Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Mandatory participation in seminars and completion of a report.

ENGR 423. Drone Science Fundamentals. 3 credits, 4 contact hours (3;1;0).
Restrictions: NCE students with senior standing and with instructor permission. This course will cover the fundamentals of quadrotor drone kinematics and dynamics, quadrotor sensor data analysis, linear and non-linear flight control, and motion planning for a single quadrotor. Students will be guided through the process of building a quadrotor drone, setting up the required flight control parameters and associated Hardware-In-The-Loop simulators, and using Python/C programming for basic single quadrotor motion planning algorithms. Students will also be guided through the preparation for the Federal Aviation Authority (FAA) Part 107 Certified Drone Pilot knowledge test.

ENGR 424. Robotics Science Fundamentals. 3 credits, 4 contact hours (3;1;0).
Prerequisites: BME 210 or CS 101 or CS 106 or CS 113 or CS 115. This hands-on course will cover experiments that elucidate the fundamentals of ground robots and robotic manipulators, sensor data analysis, linear and non-linear motion control, and motion planning for a ground robots and robotic manipulators. Student will be guided through the process of building such robots, setting up the required motion control parameters and associated Hardware-In-The-Loop simulators, and programming of sensor-based single and multi-robot motion planning algorithms.

ENGR 491. Research and Independent Study I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Approval of the Instructor (Faculty Mentor) and the Grand Challenges Program Director Junior or higher standing. Restrictions: Junior or higher standing. Provides the student with an opportunity to work on a research project under the individual guidance of a faculty mentor associated with the Grand Challenges Scholars Program. A written report, or a research paper, or a final presentation is required for course completion.

ENGR 492. Research and Independent Study II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGR 491. Restrictions: Junior or higher standing, and Approval of the Instructor (Faculty Mentor) and the Grand Challenges Program Director. Provides the student with an opportunity to continue to work on a research project under the individual guidance of a faculty mentor associated with the Grand Challenges Scholars Program. Students may continue the work they started in ENGR 491 or can work on a different grand challenge with the same or different faculty mentor. A written report, or a research paper or a final presentation is required for course completion.

ENGR 493. Service Learning Experience for Engineers. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGR 290. Restrictions: Junior or higher standing, and Approval of the Grand Challenges Program Director. Through service experiential learning, students will engage in acquiring a multi-cultural competency. A host of opportunities are available for fulfilling this competency: an experience will require prior approval of the GCSP Faculty Advisor and the Program Director. Students will be required to develop a plan in carrying out the experience. Potential opportunities include but are not limited to 1. An Engineers without Borders project, 2. An EPICS project, 3. A global internship or cooperative education experience that is voluntary (unpaid), and 4. A study abroad experience.

ESC 310. Work Experience I. 3 credits, 3 contact hours (0;0;3).

ET 101. Introduction to Engineering Technology. 0 credits, 2 contact hours (2;0;0).
This course introduces the student to engineering technology. Also included is an introduction to the various engineering technology options: Construction, Electrical and Computer, and Mechanical Engineering Technologies as well as Concrete Industry Management.

FED 101. Fundamentals of Engineering Design. 2 credits, 3 contact hours (2;1;0).
Corequisites: ENGL 101 and (ENGR 101 and MATH 110) or MATH 111. Teams of students work on open-ended engineering projects. Sections are offered to represent an introduction to real-world engineering design problems in a specific engineering discipline. Topics covered include introduction to basic engineering design elements, processes, measurements, product and project design and development, with hands-on experiments in a specific major area. Students also learn to use engineering tools for computer-aided design and simulation. Technical writing and oral presentation along with project management skills are emphasized. Students are required to take an FED section corresponding to their declared major. Undecided students will be placed in FED sections which best correspond to their interests according to space availability.

GEN 301. Applications of Microcontrollers and IoT devices. 3 credits, 4 contact hours (2;2;0).
Prerequisites: FED 101, CS 101 or CS 106 or CS 115 or BME 210. Microcontrollers are an integral part of many modern technological devices. This course will familiarize students to microcontrollers and its exciting applications in the fields of Internet of Things (IoT) and Robotics using a project-based hands-on approach. The microcontroller will be used as a component part of a broader design activity to introduce students to coding, logic, and automation in the wider context of product design. Students will work on multiple mini-projects to integrate a programmable system into a prototype such as a heart monitor, step counter, electronic scoreboard or a food temperature probe. Overall, this course will provide a basic understanding of software design and coding, microcontroller interfacing with sensors, actuators, motors etc., and robotics. Students will also develop modeling and prototyping skills and will be inspired towards making and service-learning.

GEN 491. Research Independent Study I. 3 credits, 3 contact hours (3;0;0).
Restriction: senior standing in general engineering. Provides the student with an opportunity to work on a research project under the individual guidance of a program faculty member.

GEN 492. Research Independent Study II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: GEN 491. A continuation of GEN 491.

IE 101. Introduction to Industrial Engineering. 1 credit, 2 contact hours (1;1;0).
An Introduction to the field of Industrial Engineering, the functions performed by industrial engineers, career paths and opportunities in the field, introduction to the student and senior professional societies, and initiation of a mentoring program.

IE 203. Applications of Computer Graphics in Industrial Engineering. 2 credits, 3 contact hours (1;2;0).
Restriction: sophomore standing. Methods, tools and technologies of networked, graphical/visual communication systems with an industrial engineering focus. Lean and sustainable green enterprise, product, process, service and shop floor level visual factory management systems. Provides analytical and practical knowledge of computer graphics in IE, including graphical standards necessary to meet the requirements of today?s practice. Introduction of modern web-based software tools and systems.

IE 224. Production Process Design. 3 credits, 4 contact hours (2;2;0).
Restriction: sophomore standing. Introduction to the theory and practice of manufacturing processes. Study covers the fabrication of metallic, plastic, and electrical products, operation of NC and other automatic equipment, and economics of the design and production process.

IE 310. Co-op Work Experience I. 0 credits, 0 contact hours (0;0;0).
Restriction: junior standing, approval of co-op faculty advisor, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their aca-demic program. Work assignments facilitated by the co-op office and approved by the co-op faculty advisor. Mandatory participation in seminars and completion of a report.

IE 331. Applied Statistical Methods. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 211. A presentation of statistical analysis techniques and their applications. Topics include the statistical measures describing data, frequency distributions, probability distributions, sampling parameter estimation, hypothesis testings, regression analyses, and analyses of variance. Special emphasis on their application to industrial fields.

IE 334. Engineering Economy and Capital Investment. 3 credits, 3 contact hours (3;0;0).
Restriction: junior standing. Introduction to the principles of engineering economics for utilization and evaluation of capital investments, including time value of money, depreciation, cost of capital, life cycle cost, net present value, and payback. Consideration of decisions involving multiple choice replacement, uncertainty, and risk.

IE 335. Engineering Cost Analysis and Control. 3 credits, 3 contact hours (3;0;0).
Restriction: junior standing. The tools and techniques applicable for cost analysis and control including standard costs, variance analysis, cost volume relationships, cost estimation, and utilization of accounting data for control of operations.

IE 339. Work Measurement and Standards. 3 credits, 4 contact hours (2;2;0).
Prerequisites: IE 203, IE 224. Emphasizes the measurement and evaluation of existing work methods and how improvement can be achieved. Topics include visual and micro-motion study techniques, motion economy, time study, and work sampling. The development and use of standard data and computerized techniques. Also, hands-on experience through a series of laboratory experiments.

IE 355. Human Factors. 3 credits, 3 contact hours (3;0;0).
Restriction: junior standing. Human-machine systems analysis including study of workplace layout, measurement of employee efficiency and productivity, criteria for tool and fixture design or selection, industrial fatigue, environmental influences on performance including the effects of illumination, noise, vibration, thermal, and other atmospheric factors. Basic ideas of industrial hygiene; the impact of OSHA; and special techniques for experimenting with human subjects, via demonstrations and supervised experiments.

IE 411. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: IE 310. Restriction: approval of co-op faculty advisor and permission of the Office of Cooperative Education and Internships. Full-time work experience of approximately one semester's duration. Provides major-related work experience as a co-op/intern. Mandatory participation in seminars and completion of requirements that include a report and an oral presentation to IE faculty. Note: Normal grading applies to this COOP Experience.

IE 436. Cost Analysis and Engineering Economics. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing. Not open to industrial engineering majors. Focuses on the economic factors of concern to manufacturing engineers. Major topics include justification of proposed capital expenditures, equipment retirement and replacement decisions, cost determination, profitability studies, and manufacturing budget construction and utilization for cost control.

IE 439. Deterministic Models in Operations Research. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112. The deterministic techniques of operations research. Topics include the applications of linear, nonlinear, integer, and dynamic programming methods and network flows analysis to solve industrial and systems engineering problems.

IE 440. Stochastic Models in Operations Research. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IE 331 and MATH 112. Probabilistic techniques of operations research. Topics include the applications of Markov chains, queueing and inventory control models to analyze and evaluate systems performance.

IE 441. Information and Knowledge Engineering. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing. Introduction to recent advances in the application of computers in industrial engineering and database structures, both sequential and random. Description of methods for organizing data, database modeling, information storage and retrieval. Also, applications of expert systems concepts and techniques.

IE 443. Senior Project I. 2 credits, 4 contact hours (1;3;0).
Restriction: senior standing. The first part of a capstone design experience that integrates the knowledge gained from various program courses and uses it in executing an industry-provided project. Students working in teams initiate the design or redesign process of a real-world system taking into consideration multiple realistic constraints and appropriate engineering standards. During this phase, contacts with the sponsor are established, data are collected, and the design approach is selected.

IE 444. Senior Project II. 2 credits, 4 contact hours (1;3;0).
Prerequisite: IE 443. The final part of the capstone design experience. Students complete the data analysis, finalize the design, explain the incorporation of constraints and standards, and may help the industrial sponsor with the implementation process. A substantial report of all activities is required and a presentation is made to a diverse audience that includes the project managers from industry.

IE 445. Idustrial Simulation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 101, IE 331 or equivalent. Introduction to the application of simulation modeling for the analysis of complex industrial and manufacturing service systems. Examples are chosen from real-life situations such as warehousing, material handling, robotics, transportation, and hospital emergency rooms. Verification/validation as well as statistical analysis of both input/output data are introduced.

IE 447. Legal Aspects of Engineering. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing. Familiarization with the U.S. system of case law, statutes and regulations applicable to professional relationships involving the engineer. Includes contracts, property, product liability and other torts, governmental regulatory bodies such as OSHA, EPA, and NRC, professional liability, and role of codes and standards.

IE 449. Industrial Robotics. 3 credits, 4 contact hours (2;2;0).
Prerequisites: CS 101, PHYS 121, junior or senior standing. Robotics in manufacturing systems. The field of robotics is studied with emphasis given to the role of programmable robots in manufacturing. Hands-on experience with hardware and software necessary for various industrial robot systems through laboratory experience.

IE 450. Product Engineering Standards. 3 credits, 3 contact hours (3;0;0).
Restriction: senior standing. Developing and using standards in the design, manufacturing, and use of products. Topics include economics of parts standardization, drawing and assembly techniques, and use of national and international standards. Review of the role of standards-setting bodies and methods for the development of product testing standards used in industry and commerce.

IE 451. Industrial Measuring Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IE 331. Reviews contemporary measuring systems and provides a basic under-standing of the various methods, their accuracy, reliability, and relative costs to perform. Includes measuring methods needed for compliance evaluation in accordance with occupational and safety legislation, industrial processes, and product design.

IE 453. Computer Integrated Manufacturing. 3 credits, 4 contact hours (2;2;0).
Restriction: junior or senior standing. Examines the components of computer integrated manufacturing (CIM) including the design of information frameworks and network protocols required to orchestrate full manufacturing automation. Study of CAD, CAPP, robotics, NC, CNC, computer interfacing, and database systems in the context of a CIM environment. Exposure to state-of-the-art CIM software and hardware.

IE 455. Robotics and Programmable Logic Controllers. 3 credits, 4 contact hours (2;2;0).
Restriction: junior or senior standing. Introduction to the design and implementation of programmable logic controllers for use in industry in the areas of automotive assembly, pharmaceutical manufacturers, the chemical industry, and others. Includes ladder logic, input/output ports, continuous process control, timing and counting functions, chaining sequences, and digital gate logic.

IE 456. Introduction to Industrial Hygiene. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IE 355. Analysis of the effects of various environmental stressors on people at work, including their interference with performance and the development of acute and chronic health problems. Study of how numerous airborne contaminants, noise, thermal extremes, ionizing and nonionizing radiation, etc., affect workers alone and in combination. Topics include measurement and evaluation techniques, TLVs, control methodologies, legal requirements for employers.

IE 459. Supply Chain and Production Planning. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IE 331 or MATH 333. A study of the components and functioning of integrated production, planning, and control systems. Forecasting, aggregate planning, scheduling, and recent models of production and inventory control for optimizing continuous and intermittent manufacturing operations. MRP basics. Introduction to using a computer to apply scheduling models.

IE 460. Measuring Techiniques and Quality Control. 3 credits, 3 contact hours (3;0;0).
Prerequisite: understanding of basic probability. Not open to industrial engineering majors; intended for other engineers, inspection supervisors, and management. Various types of control charts and acceptance sampling systems and procedures. These techniques are used widely in industry to improve product quality and reduce costs.

IE 461. Product Quality Assurance. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IE 331. Methods used to achieve higher product quality, to prevent defects, to locate chronic sources of trouble, to measure process capability, and to use inspection data to regulate manufacturing processes are emphasized. Preparation of statistical control charts and selection of suitable sampling plans.

IE 463. Invention and Entrepreneurship. 3 credits, 3 contact hours (3;0;0).
Restriction: Junior or Senior standing or permission of instructor. This course will teach students the process of developing new products. It takes students from the art of creativity through product design and concludes with the formulation of a business plan for marking and production. If the new product satisfies the requirements of novelty, usefulness and nonobviousness, a patent application may be filed.

IE 466. Material Handling and Facilities Layout. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IE 439. Analysis of organized human activities typified by industrial and office operations. Recent methods are applied to optimize location and layout of facilities. Introduction to modern material handling systems, expert systems in plant layout, logistics of motion of people and materials, flow analysis, plant layout, and material handling techniques.

IE 469. Reliability in Engineering Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IE 331 or equivalent, senior standing. Emphasizes the determination of systems reliability from a knowledge of characteristics and reliability of individual system components. Topics include reliability concepts, failure rates, systems analysis, optimization, maintenance, etc. Covers techniques for the formulation and evaluation of reliability models.

IE 472. Product Liability Engineering. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing. The techniques available to the engineer to minimize the hazards of design and manufacturing that result in product liability cases. The effect of legal precedents on design, manufacturing, advertising, marketing, and using a product within developing technical disciplines such as: reliability prediction and analysis methods, assuring the quality of manufactured products, loss control systems, safety engineering precepts, human factors principles and design review. Review of government regulations for safety and protection.

IE 473. Safety Engineering. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing. The principles and practices of safety engineering in product and facilities design. Safe practices and hazard control, safety standards and codes, inspection procedures, the role of insurance, governmental regulations, and safety statistics. Participation in current safety engineering research studies. The Occupational Safety and Health Act and related legislation.

IE 480. Special Studies in Industrial Engineering for Non-Majors. 3 credits, 3 contact hours (3;0;0).
Restriction: permission of the IE faculty advisor. Not open to industrial engineering majors. Individual investigations under faculty guidance through consultation, readings, and visits with recognized authorities and institutions, dealing with specialized industrial engineering problems. Explore in depth an area of interest and give a report in a seminar setting, and submit a written project report.

IE 481. Investigations in Industrial Engineering I. 3 credits, 3 contact hours (0;0;3).
Restriction: junior or senior standing, per-mission of the IE faculty advisor. Individual investigation under faculty guidance through consultation, readings, and visits with recognized authorities and institutions, dealing with specialized industrial engineering design problems. Explore in depth an area of interest and give a report in a seminar setting, and submit a written project report.

IE 482. Investigations in Industrial Engineering II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: IE 481, permission of the IE faculty advisor. Further individual investigations, a continuation of IE 481.

IE 492. Engineering Management. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing. An introduction for engineering majors to the fundamentals of engineering economics and the management process for engineering and development. Major topics include capital investment justification methods, project organization, scheduling and control techniques, legal, quality, and staffing issues.

ME 215. Engineering Materials and Processes. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CHEM 126 or CHEM 122. Students also must register for the lab component. Combined lecture and laboratory relating to the study of engineering materials. Processes of formation from liquid and particle state, plastic forming, molding deformation, and metal removal. Effects of heat treatment on material properties. Laboratory exercises involve basic machine tools and computer-controlled equipment.

ME 231. Kinematics of Machinery. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 213 and a C or better in MECH 234. Restriction: This course is restricted to students majoring in ME. Design, selection, and evaluation of mechanisms for various applications. Topics include displacement, velocity, and acceleration analysis of planar linkages, synthesis of function generators and motion generators, design of cams, gear-tooth geometry and analysis of gear trains.

ME 304. Fluid Mechanics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MECH 236, ME 311. Introduction to the basic principles of conservation of mass, momentum, and energy as they apply to engineering systems which utilize fluids. Some of the topics are dimensional analysis, theoretical and empirical analysis of one-dimensional compressible and incompressible flow, empirical analysis of external and internal flows, and elementary boundary layer theory.

ME 305. Introduction to System Dynamics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222, MECH 236, ME 231. Principles of dynamic system modeling and response with emphasis on mechanical, electrical, and fluid systems. Application of computer simulation techniques.

ME 310. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Completion of freshman year, approval of department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated by the co-op office and approved by the department. Mandatory participation in seminars and completion of a report.

ME 311. Thermodynamics I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211, PHYS 111. Thermodynamic fundamentals. Topics are the first and second laws of thermodynamics, physical properties of pure substances, entropy, ideal and real gases, and gaseous mixtures.

ME 312. Thermodynamics II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ME 311. A continuation of ME 311 including studies of irreversibility and combustion. Thermodynamic principles are applied to the analysis of power generation, refrigeration, and air-conditioning systems. Introduction to solar energy thermal processes, nuclear power plants, and direct energy conversion.

ME 315. Stress Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222, MECH 237, ME 215. Problems related to mechanical design. Topics include two-dimensional elasticity, transformation of stress and strain, plane stress problems, axisymmetric members, buckling criteria, and failure theories.

ME 316. Machine Design. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ME 231, ME 315. Aspects of the design process and design of machine elements. Mini-projects are used to introduce engineering design procedures.

ME 339. Fundamentals of Mechanical Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MECH 234. For industrial engineering majors. Topics include kinematics of mechanisms, machine components, and a brief intro-duction to mechanical vibrations. Students gain the ability to deal with design problems from the viewpoint of a non-specialist.

ME 343. Mechanical Laboratory I. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECE 405, MATH 279 or MATH 333 and MECH 236. Laboratory and lecture in instrumentation and measurement for mechanical engineering students. Applications for the sensing of such variables as pressure, temperature, mass flow, and displacement. Particular attention to the applicability and sensitivity of instruments.

ME 403. Mechanical Systems Design I. 3 credits, 3 contact hours (2;1;0).
Prerequisites: ME 304, ME 305, ME 312, ME 316. Lectures and projects covering problem solving methodology in the design, analysis, and synthesis of mechanical and thermal systems. The student's academic background combines with engineering principles and topics to serve as a foundation for broad engineering projects. Emphasis on creative thinking and the engineering design process in projects involving the optimal conversion of resources.

ME 405. Mechanical Laboratory II. 2 credits, 3 contact hours (1;2;0).
Prerequisites: ME 343, ME 312. Laboratory emphasizing the use of fundamental principles and instrumentation systems for the analysis and evaluation of mechanical components within a system.

ME 406. Mechanical Laboratory III. 2 credits, 3 contact hours (1;2;0).
Prerequisites: ME 405, ME 407. Laboratory covering the testing and evaluation of complete mechanical systems.

ME 407. Heat Transfer. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222, ME 304, ME 311. A study of the three fundamental modes of heat transfer: conduction, convection, and radiation. A physical interpretation of the many quantities and processes in heat transfer using numerical methods. Theory is applied to the analysis and design of heat exchangers and other applications. Where appropriate, computer simulation is used.

ME 408. Mechanical Systems Design II. 2 credits, 3 contact hours (1;2;0).
Prerequisites: ME 403, ME 407. A continuation of ME 403 from a more integrated viewpoint, with lectures on special topics. Concepts in optimization and computer simulation are considered in the design and synthesis of mechanical engineering systems. The projects are more comprehensive, emphasizing creative design that incorporates appropriate engineering standards and multiple constraints.

ME 410. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ME 310, approval of the department, and permission of the Office of Cooperative Education and Internships. Full-time work experience of approximately one semester's duration. Provides major related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and project. Note: Normal grading applies to this COOP Experience.

ME 425. Finite Element Method in Mechanical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 101, MATH 222, and MECH 237. Introduction to central ideas underlying the finite element method in mechanical engineering and its computer implementation. Fundamental concepts such as interpolation functions for one- and two-dimensional elements, bar element method, Galerkin's method, discretization of a model, methods of assembling global matrices, and the final solution techniques for obtaining nodal values. Specific applications to mechanical engineering problems in trusses, beams, torsion, heat transfer, fluid flow, plane stress, and plane strain.

ME 430. Introduction to Computer-Aided Design. 3 credits, 4 contact hours (2;2;0).
Prerequisites: CS 101, FED 101 and Math 222. Introduction to basic concepts of computer-aided design as applied to mechanical engineering design problems. Topics include numerical techniques, computer graphics, geometric modeling, design optimization, and databases for design. The laboratory uses current CAD software packages for mechanical design. Projects involve applications of the basic principles using student's own as well as available software.

ME 431. Introduction to Robotics and Automation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 101, MECH 236. Introduction to mechanics and control of robotic manipulators. Topics include spatial transformations, kinematics, dynamics, trajectory generation, actuators and control, and relations to product design and flexible automation.

ME 432. Principles of Air Conditioning and Refrigeration. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ME 304, ME 312; Corequisite: ME 407. A course in the fundamentals of air conditioning and refrigeration. Topics covered are psychometrics, cooling and heat load calculations, air distribution systems, duct design, vapor compression and absorption systems, and the principles of cooling towers.

ME 433. Vibration Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MECH 236, MATH 222. An introduction to the fundamental theory of mechanical vibrations. Undamped and damped systems with single and multiple degrees of freedom, transient vibration, vibrations of continuous media, and analog and numerical methods.

ME 435. Thermodynamics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211, PHYS 111. Intended for non-mechanical engineering students of all disciplines. Topics include the basic laws of thermodynamics, properties of fluids and solids, analysis of open and closed systems, gas and vapor power cycles, refrigeration and air conditioning, and an introduction to heat transfer. Cannot be taken for credit by mechanical engineering students.

ME 437. Structural Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ME 315. Fundamentals of structural analysis. Consideration of stresses and deflections of beams as well as the design of beams, columns, trusses, and structural connections of steel, reinforced concrete, and timber structures.

ME 438. Introduction to Physical Metallurgy. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126 or CHEM 122, and ME 215 or MTEN 205. Introduction to metallic microstructures, solid solutions and the mechanical properties of metals and alloys. Physical understanding of diffusion processes is emphasized in covering the relationship between the nature of metals and different heat treating processes.

ME 439. Principles of Tribiology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126, MECH 237. An introduction to the principles of wear resistance of machine parts and tribology. Physical understanding of different mechanisms of wear and friction and methods of increasing durability.

ME 441. Computer Simulation and Analysis in Mechanical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ME 430. This course covers various topics in Computer-Aided Design (CAD) and Computer-Aided Engineering (CAE). The course provides an in-depth understanding and skill of constructing 2-D drawings using well-known commercial CAD package, and integrating 3-D solid modeling techniques into simulation, and analysis animation of new designs using commercial CAD/CAE software. The students will have hands-on experience to analyze Structure, Heat Transfer, and Computational Fluid Dynamics problems by using several different software packages. The course also focuses on CAD Product Data Exchange using both Direct Database conversion and International Standards based conversion methods between major CAD/CAE systems. Typical industrial applications will be illustrated.

ME 451. Introduction to Aerodynamics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ME 304, ME 311. Introduction to the basic principles and properties of fluid flow around immersed bodies. Topics include the kinematics and dynamics of fluid fields, the thin airfoil, finite wing theory, and one-dimensional compressible flow.

ME 452. Dynamics of Space Flight. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MECH 236, MATH 222. An introduction to the mechanics of space flight. After a brief introduction to the physics of the solar system, the dynamics of space flight are developed from the Newtonian viewpoint. Covers the performance and propulsion methods of rocketry.

ME 455. Automatic Controls. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ME 305. Introduction to the principles of automatic controls. Emphasis on systems, considering their mechanical, hydraulic, pneumatic, thermal, and displacement -aspects. First and second order linear systems. Introduction to system analysis techniques such as Nyquist and Bode diagrams and applications in system design.

ME 470. Engineering Properties of Plastics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ME 215, MECH 237. A study of the physical properties of the various commerical thermosetting and thermoplastic resins. An introduction to linear viscoelastic theory and its relationship to measurable mechanical properties of plastics. Also, engineering properties such as flammability, chemical resistance, and electrical properties.

ME 471. Introduction to Polymer Processing Techniques. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ME 304, ME 407. A study of the various plastics processing techniques, including extrusion, injection molding, blow molding, compression molding, thermoforming, rotational molding, casting, etc. The relationship between product design and choice of process will be presented.

ME 490. Mechanical Engineering Project A. 3 credits, 3 contact hours (0;0;3).
Prerequisite: departmental approval required. One or more individually selected projects. Projects usually require library research, design, cost analysis, planning of testing. Also involves an engineering report and a technical presentation.

ME 491. Mechanical Engineering Project B. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ME 490 and departmental approval required. One or more selected projects. Projects usually require library research, design, cost analysis, planning of testing. Also involves an engineering report and a technical presentation.

ME 495. Selected Topics in Mechanical Engineering. 3 credits, 3 contact hours (3;0;0).
This course explores a special topic in mechanical engineering.

MECH 234. Engineering Mechanics. 2 credits, 2 contact hours (2;0;0).
Prerequisites: PHYS 111, MATH 112. A course for industrial, materials and mechanical engineering students in which the equilibrium of particles and rigid bodies subject to concentrated and distributed forces is studied.

MECH 235. Statics. 3 credits, 4 contact hours (3;0;1).
Prerequisites: PHYS 111, MATH 112. Available for CE students only. Provides an understanding of equilibrium of particles and rigid bodies subject to concentrated and distributed forces.

MECH 236. Dynamics. 2 credits, 2 contact hours (2;0;0).
Prerequisites: MECH 234 or MECH 235 with a grade of C or better or MECH 320 and MATH 112, PHYS 111/PHYS 111A. Provides an understanding of the mathematics of the motion of particles and rigid bodies, and of the relation of forces and motion of particles.

MECH 237. Strength Of Materials. 3 credits, 4 contact hours (3;1;0).
Prerequisites: MECH 234 or MECH 235 with a grade of C or better and MATH 112, PHYS111/PHYS 111A. A working knowledge of statics with emphasis on force equilibrium and free body diagrams. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions. Lab should be taken concurrently.

MECH 320. Statics and Strength of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 111, MATH 112. For chemical engineering and electrical engineering majors. Statics provides an understanding of the equilibrium of particles and rigid bodies, including simple machines, trusses, and frictional forces. Mechanics of materials covers pressure vessels, thermal stresses, torsion of shafts, stresses and deflection in beams, and column action.

MET 103. Engineering Graphics and Intro. to CAD. 2 credits, 3 contact hours (1;2;0).
A first course in Computer Aided Design (CAD), includes lab work using AutoCAD software. Topics include fundamentals of engineering graphics, AutoCAD command structure, setting units and limits, drafting primitives, layering, use of editing tools; grid, snap, and axis commands. Upon successful completion of this course, students should be able to effectively produce two-dimensional drawings using the AutoCAD software program.

MET 105. Applied Computer Aided Design. 2 credits, 3 contact hours (1;2;0).
Prerequisite: MET 103. A second course in Computer Aided Design (CAD), additional AutoCAD topics include blocks, move and copy, array, mirror, text, text styles, 3D and isometric modes. Upon successful completion of this course, students should be able to use advanced AutoCAD commands to quickly and efficiently produce 2D and 3D drawings, and also be able to modify the AutoCAD environment (e.g., menues, macros, etc.) to boost productivity.

MET 205. Advanced Computer Aided Design. 3 credits, 4 contact hours (2;2;0).
Prerequisite: MET 105. This course introduces advanced CAD applications, including attribute and attribute extraction, external reference files, solid modeling, surface rendering and animation. Upon successful completion of this course, students should be able to use a CAD software package to develop animations consisting of 3D models with rendered surfaces.

MET 235. Statics for Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 102 or PHYS 111 and MATH 238 or MATH 112. Provides an understanding of equilibrium of particles and rigid bodies subject to concentrated and distributed forces. Upon successful completion of this course, the students should be able to analyze problems involving the equilibrium of particles and rigid bodies, including simple machines, trusses, and frictional forces.

MET 236. Dynamics for Technology. 2 credits, 2 contact hours (2;0;0).
Prerequisites: MET 235 or MECH 234 or MECH 235. Provides an understanding of the mathematics of the motion of particles and rigid bodies, and of the relation of forces and motion of particles. Upon successful completion of this course, the students should be able to describe the motion of particles and rigid bodies as functions of time and position, develop their equations of motions due to applied forces, and determine post impact behavior.

MET 237. Strength of Materials for Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisite: MET 235 or MECH 234 or MECH 235. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structured problems, and an understanding of the mechanical behavior of materials under various load conditions. The laboratory experience is integrated within the course. Upon successful completion of this course, the students should be able to determine stresses and deformations for a variety of simple structural problems.

MET 301. Analysis and Design of Machine Elements I. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MATH 238 or MATH 112, and MET 237 or MECH 237. The principles of strength of materials are applied to mechanical design. Topics include theory of failure, stress concentration factors and fatigue, the design and analysis of shafts subjected to static and dynamic loadings, and critical speed of a rotating shaft.

MET 302. Analysis and Design of Machine Elements II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MET 301. A continuation of MET 301, including analysis and design of power screws, brakes, clutches, belts, chain drives, gears, gear trains, bearings, and other machine elements.

MET 303. Applied Thermodynamics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 138 or MATH 111 and PHYS 103 or PHYS 121. Basic principles of thermodynamics and their applications to internal combustion engines, turbines, compressors, power generating and refrigeration systems.

MET 304. Applied Fluid Mechanics. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MATH 238 or MATH 112, PHYS 103 or PHYS 121. An introduction to fluid statics and the basic laws of fluid flow; conservation of mass, momentum and energy. Applications of the basic laws to internal and external incompressible flow, including specific topics in pipe flow systems, centrifugal pumps and fans, streamlining, and fluid flow meters.

MET 307. Plastics Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (CHEM 301 or CHEM 126 or CHEM 122), and (MET 105 or FED 101), and (MET 237 or MECH 237). An introduction to the basic concepts of plastics conversion, resin classification, processing techniques and significant engineering properties.

MET 308. Plastics Processing Techniques. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MET junior standing, MET 307. A study of the various processing techniques for both thermoset and thermoplastic materials. Topics include extrusion, injection molding, blow molding, compression moldings, and casting processes.

MET 314. Dynamics of Machinery. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MET 236 or MECH 236, and MATH 238 or MATH 112, and MET 105 or FED 101. Acquaints students with motion and forces in machines. Topics include velocity and accelerations in linkages, gears, cam and gear trains, static and dynamic forces, and torques in linkages.

MET 395. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisite: MET JUNIOR STANDING. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

MET 401. Mechanical Design Project I. 2 credits, 2 contact hours (2;0;0).
Prerequisites: MET 302, MET 303, MET 304, MET 314, ECET 329, COM 313. Project and lecture applies the principles learned in all technical courses to more advanced design situations. Proposal of a typical mechanical engineering system is presented by an individual or by small groups. The proposal must meet the approval of course instructor. A formal proposal is required.

MET 403. Applied Thermodynamics II. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (MATH 309 or MATH 211 or MATH 213), and MET 303, and MET 304. Builds on a first course on thermodynamics and covers thermodynamic properties of steam, first and second law of thermodynamics. Topics include power and refrigeration cycles, psychrometric chart and combustion.

MET 404. Applied Heat Transfer. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (MATH 309 or MATH 211 or MATH 213), and MET 303, and MET 304. An introduction to the fundamental theories and applications of heat transfer. Emphasizes understanding and practical problem solving in covering the three fundamental modes of heat transfer: conduction, convection, and radiation.

MET 407. Structural Design. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MATH 238 or MATH 112, and MET 237 or MECH 237, and MET 105 or FED 101. Acquaints students with the fundamentals of structural design. Topics include analysis and design of structural members due to various loadings (tension, compression, bending, torsion, and shear), deflections of structural members, truss analysis, stress analysis of weldment.

MET 409. AirConditioning and Refrigeration. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MET 303, MET 304. Calculation of building cooling and heating loads, psychrometric charts, air distribution and duct design. Topics also include compression and absorption refrigeration cycles, automatic control of refrigeration systems, and building energy management.

MET 415. Automatic Control Systems. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (ECET 201 or ECE 405), and MET 314, and (CS 106 or CS 100 or CS 101 or CS 113), and (MET 105 or FED 101). Introduction to programmable logic controllers (PLC) as a tool for industrial controls of machines and process. Includes selections of hardware and software, ladder logic programming, wiring methods, maintenance and troubleshooting.

MET 448. Mechanical Design Project II. 1 credit, 2 contact hours (2;0;0).
Prerequisite: MET 401. Continuation of project MET 401. Oral presentation and formal written report are required.

MET 450. Mech Design Capstone Project. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MET 303, MET 304, MET 314, ECET 329, (COM 312 or COM 313). Corequisite: MET 302. Project and lecture applies the principles learned in all technical courses to more advanced design situations. Proposal of a typical mechanical engineering system is presented by an individual or by small groups. The proposal must meet the approval of course instructor. A formal proposal is required.

MET 491. Special Projects in MET. 1 credit, 3 contact hours (3;0;0).
One-credit special project course for MET students. Must have an instructor agreeing to sponsor the project. Approval by program coordinator is required.

MET 492. Special Projects in MET. 2 credits, 3 contact hours (3;0;0).
Two-credit special project course for MET students. Must have an instructor agreeing to sponsor the project. Approval by program coordinator is required.

MET 493. Special Projects in MET. 3 credits, 3 contact hours (3;0;0).
Three-credit special project course for MET students. Must have an instructor agreeing to sponsor the project. Approval by program coordinator is required.

MET 495. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: MET 395. Approval of the department, and permission of the Office of Cooperative Education and Internships. Full-time work experience for approximately one semester. Provides major-related work experience. Mandatory participation in seminars and completion of requirements that include a report and/or project.

MIT 231. Intro to Comp Security:Med Dev. 3 credits, 4 contact hours (2;2;0).
Prerequisites: An introductory Computer Programming Course: CS 100 or CS 106 and IT 120. Medical devices and systems are uniquely vulnerable to hacking and intrusion due to the nature of architecture: i.e. usually a dedicated device designed to solve a limited medical application such as an infusion pump that delivers medications in measured dosages. These systems rarely have more than a minimal computer footprint with limited or no operating system, i.e. a dedicated controller, and are usually updated periodically wirelessly. Our increased reliance on life sustaining technology required that computer professionals and engineers are educated on the evolving issues and solutions to these potentially life threatening dangers.

MIT 326. Electronic Medical Record Design. 3 credits, 4 contact hours (2;2;0).
This course will prepare students to manage medical records and related information in different medical settings like individual/group medical practices, health care organizations, long-term care settings, insurance companies, health-care software consulting companies, and/or government agencies. This course will also enable Medical Informatics student interns to become well versed in technology used during their internships. This course has two main objectives; first planning for Electronic Medical Record (EMR) adoption and implementation, and second, practical techniques of implementing and customizing Electronic Medical Records.

MIT 360. Introduction to Gerontology. 3 credits, 4 contact hours (2;2;0).
Prerequisites: Junior level standing, R920 201 or R830 101. Introduction to Gerontology is an introduction to the field of human aging. The course of study will include a multidisciplinary examination of the way in which human aging is viewed and how we perceive the process of growing older and how society responds to the issues of aging. The class will look at aging from multiple perspectives that include the social, political and biological sciences, arts and humanities, care giving and social services. This proposed course will provide students with an understanding of the unique challenges individuals experience as they age. Second it provides some basic hands/labs covering assistive technologies and personal and mobile sensors.

MIT 362. Geriatric Engineering I. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MIT 360 and (CS 106 or CS 113 or CS 115 or CPT 341) and (MATH 305 or MNET 315.) This course will first provide students with an understanding of the unique challenges individuals experience as they age. It introduces system design techniques to facilitate assistive technologies that foster independent living. The course provides a labs for the emerging field of designing assistive technologies and personal and mobile sensors. Labs will incorporate A hands low-power small footprint computing devices for sensor monitoring. Students will explore the feasibility of using, for example Raspberry Pi, and Arduino platforms, to monitor vital signs and export data to Electronic Health Record (EHR) platforms. Big Data challenges will be explored in preparation for meaningful use applications required by all EHR systems.

MIT 440. Clinical Internship. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Junior Level Standing, CPT 325 and permission MIT program coordinator. During the course of a semester the student gains 100 hours of experience in the IT or Network and Security department of a hospital. The student is under the supervision, and is evaluated by, the director of the corresponding program at the hospital. A final report is submitted to and graded by the BS, MIT Program Advisor at NJIT.

MIT 460. Economics of Aging: Microeconomics(individual) and Macroeconomic(global) Challenges. 3 credits, 5 contact hours (2;2;1).
Corequisites: MIT 360. Restrictions: Senior Standing. Microeconomics is the science of how people make decisions at the small scale. Macroeconomics looks at how the economy works as a whole ("on aggregate") This course will investigate the challenges an aging individual face dealing with fixed incomes in an environment of exploding health and housing costs and the larger effects on population aging on the global economy. Economic and political stresses on governments necessitated by demographics where fewer workers are paying for a growing older population. The impacts of technology and longer life spans will necessitate professionals to create new and innovative solutions. Included are computer simulations focused on modelling these economic forces.

MNET 215. Materials and Processes for Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MET 103, PHYS 103, PHYS 103A, CHEM 301 or CHEM 126 or CHEM 122. The course introduces students to applications of materials, manufacturing processes, and metrology. Topics include engineering materials, heat treatment process, fabrication processes, finishing processes, and inspection processes.

MNET 300. Concepts In Machining. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ME 215 and MET 105. Applications in the machining of various materials. Topics include speeds and feeds calculations, tooling concepts, gaging techniques and prototype construction.

MNET 303. Advanced Techniques in CAD/CAM. 3 credits, 4 contact hours (2;2;0).
Prerequisite: MET 105. Applications including hands-on experience with CAD/CAM systems. Emphasis is on understanding how displayed objects are represented and manipulated on the computer. Laboratory experiences contribute to an understanding of the advantages and limitations of CAD/CAM systems.

MNET 315. Industrial Statistics. 3 credits, 4 contact hours (2;2;0).
Introduction to statistics covering data collection, analysis and presentation. Specialized topics include probability, control charts, correlation, regression, hypothesis testing, and -experimentation.

MNET 318. Mnfg Process Design. 3 credits, 4 contact hours (2;2;0).
Prerequisite: MNET 303. A development of the principles of production, methodology and economics in view of production requirements with respect to materials, tolerances and finish. Production processes are matched to the product requirements. Laboratory work supports the lecture. Computer problem solving is incorporated in the course.

MNET 395. Coop Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments are facilitated by the co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

MNET 405. Numc Control Machn Tools. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ME 215 and MNET 303. Fundamental concepts of numerical control systems. Assignments include mill and lathe programming techniques, sheet metal processing, and CNC economics.

MNET 414. Industrial Cost Analysis. 3 credits, 3 contact hours (3;0;0).
An introduction to general costing techniques. Time value of money concepts are introduced to decision-making matters such as equipment justification, design selection and fabrication costs.

MNET 416. Production Scheduling. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MNET 315. A study of manual and computerized methods for setting schedules. Gantt charts, CPM, PERT, PERT/COST, and Line of Balance are some of the topics treated. Problems of line balancing and machine loading are discussed.

MNET 420. Quality Systems. 3 credits, 4 contact hours (2;2;0).
Prerequisite: MNET 315. Introduction in quality control that emphasizes design quality, total quality management and statistical process control. Additional topics include quality economics, ISO, reliability, service quality, measurement and acceptance sampling.

MNET 421. Contracts & Specs. 3 credits, 3 contact hours (3;0;0).

MNET 422. Tool Design. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MET 237, MNET 300 and MNET 303. Introduction to the design of cutting tools with emphasis on speeds, feeds, and power requirements. Covers design of jigs, fixtures, punch and dies, gaging and inspection tooling with emphasis on current industrial practices.

MNET 423. Motion & Time Study Tech. 3 credits, 4 contact hours (2;2;0).
A study of the basic principles of motion study concerning workplace design and related techniques involving process analyses, man-machine charts and micromotion study. Covers stopwatch time study techniques as well as predetermined time standards, work sampling and wage incentive system.

MNET 425. Advanced Manufacturing Rotation. 2 credits, 4 contact hours (3;1;0).
Prerequisites: MET 237, MNET 300, MNET 315, MNET 318. The course applies the principles learned in all technical courses to an Advanced Manufacturing environment. The student will rotate under the various manufacturing/metrology areas within an Advanced Manufacturing facility. Progress reports, oral presentation and a formal written report are required.

MNET 426. Manufacturing Project. 2 credits, 4 contact hours (1;3;0).
Prerequisite: Senior standing. A capstone project requiring a formal written report and oral presentation.

MNET 495. Cooperative Experien II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: MNET 395 or its equivalent, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as a co-op/intern. Mandatory participation in seminars and completion of requirements that include a report and/or project.

MTEN 101. Introduction to Materials Engineering. 1 credit, 1 contact hour (1;0;0).
This course provides an introduction to the field of materials engineering and to the Otto H. York Department of Chemical and Materials Engineering. Topics include the program curriculum, student professional societies, undergraduate research and cooperative education (co-op) opportunities, and learning about materials engineering profession and career pathways. Also included are lectures by MTEN faculty integrated with research laboratory tours and hands-on research experience.

MTEN 201. Introductory Principles of Materials Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126, PHYS 121 or PHYS 122, MATH 112. This course introduces the basic concepts of Materials Engineering, with introductory topics including structure, property, performance, and processing of materials. This course focuses on conventional materials including metallic materials and their alloys, ceramics, polymers, and composites. Relationship between structure and material properties, such as mechanical, electronic, thermal, optical, magnetic, and electrochemical, are investigated.

MTEN 205. Mechanical Behavior of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 or MATH 213, MTEN 201 and MECH 234. The course will introduce the fundamentals of the mechanical behavior of materials. The principles of stress, strain will be introduced. The elements of elasticity, plasticity, will be discussed in depth. The concept of crystal geometry, different lattice defects, work hardening will be taught. Furthermore, the fundamentals of plastic deformation of polycrystalline materials, dislocation theory, and fracture will be discussed in detail. The course will include written and oral presentation of team projects on analysis of relevant peer-reviewed papers on the latest development of the field.

MTEN 301. Thermodynamics of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 or MATH 213, PHYS 234, MTEN 205. Laws of thermodynamics and their correlation with molecular phenomena describing materials systems in equilibrium. Applications to properties, reactions and phase equilibria in materials. Thermodynamic foundation, interpretation and utilization of binary phase diagrams. Contemporary software for phase diagram calculation. Thermodynamic principles describing liquid and solid solutions, chemical reactions, and order-disorder phase transitions.

MTEN 305. Materials Characterization Methods. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MATH 211 or MATH 213, PHYS 234, CHEM 243, MTEN 201. This course gives an introduction to instrumentation for characterization of material structures and compositions and methods for measuring a wide range of material properties such as mechanical, electrical, thermal. Principles of microscopic imaging and the major branches of microscopy: optical, electron and scanning will be discussed. Principles of X-ray diffraction and X-ray, IR, UV, electron and ion spectroscopies will be introduced by considering interaction of materials with electromagnetic radiation, electrons, and ions. Principles of thermal analysis in which the properties of materials are studied as they change with temperature will be introduced. Characterization of hardness, strength, electrical conductivity will be discussed. Students will learn operation of analytical instrumentation and interpretation of experimental data at the NJIT Materials Characterization facility and CME undergraduate laboratory. The course will include written and oral presentation of team projects on analysis of peer-reviewed papers on specific techniques and equipment for materials characterization.

MTEN 310. Transport Phenomena in Materials I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222, PHYS 234, CHEM 243, MTEN 205. This course introduces the concepts of transport phenomena and develops the balance equations for the transport of mass, momentum, and energy. Classical force-flux relations that include Newton’s law of viscosity and Fourier’s law are considered. These equations, along with suitable boundary conditions, are applied to fluid mechanics and heat transfer problems relevant to materials characterization and processing. This includes laminar flows of both Newtonian and non-Newtonian fluids, conduction in solids, convective heat transfer, and phase change in single-component materials.

MTEN 311. Transport Phenomena in Materials II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MTEN 301 and MTEN 310. This course continues the development and application of the equations of transport phenomena and includes balance equations for transport at interfaces. Classical constitutive equations that include Fick’s law and the Nernst-Planck equation as well as expressions for both homogeneous and heterogeneous chemical reaction are considered. These equations, along with suitable boundary conditions, are applied to multi-component and charged systems that are relevant to materials characterization and processing. This includes diffusion, chemical reaction, charge and coupled transport, and phase change in multi-component materials.

MTEN 395. Materials Engineering Laboratory I. 3 credits, 6 contact hours (0;6;0).
Prerequisites: FED 101, MTEN 301, MTEN 305, MTEN 310, MATH 333. This course introduces modern materials characterization equipment, techniques and methods for qualitative and quantitative analysis of materials properties, methods of presenting collected data. Course emphasizes structure-properties relationships via the measuring properties of different classes of materials. This course includes physical, mechanical, thermal, electrical and optical properties measurements. Techniques for direct micro- and macrostructural analysis include X-Ray diffraction, optical and electron imaging.

MTEN 410. Soft Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MTEN 301 (or CHE 230 or ME 311 or BME 352) and MTEN 310 (or CHE 260 or ME 304 or BME 427). This course is an introduction to soft materials such as polymers, colloids, liquid crystals, gels, and biomaterials. The course will cover the structure, properties, and applications of soft materials. Specific topics will include kinetics in material synthesis/growth, assembly, phase behavior, phase transitions, dynamics, characterization techniques, and applications.

MTEN 450. Materials Engineering Design. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MTEN 311, MTEN 395, MATH 333. An advanced course focusing on the selection of materials to solve engineering problems, and processing, structure, property, and performance tradeoffs. Families of materials and their properties and how selection software can be used to optimize selection of the best material for a variety of applications given one or more constraints will be the main focus. Students will learn how processing influences material selection, and optimize selection with cost, health, safety, failure, and environmental effects. Finally, we will discuss recent advances in material databases.

MTEN 460. Materials Processing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MTEN 395. This course gives an introduction to fundamentals of material processing. Specifically, this course will deal with metals, polymers, and ceramics. The course will follow the processing and manufacturing of these materials from vapor and melt (or, liquid phase) to solid. Start-up material will be powder, solutions and dispersion. The effects of a particular processing technology on the final product structure, shape and properties will be described. Conventional and advanced manufacturing approaches will be discussed.

MTEN 490. Special Topics in Materials Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MTEN 311. Special topics related to materials engineering are covered in areas such as biomaterials, ceramics, electronic materials, energetic materials, metals and alloys, and polymeric materials.

MTEN 491. Research & Independent Study I. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing in materials engineering, agreement of a department faculty advisor, and approval of the associate chairperson for undergraduate studies. Normally a GPA greater than 3.0 is required to participate in the course. Provides the student with an opportunity to work on a research project under the individual guidance of a member of the department. A written report is required for course completion.

MTEN 492. Research and Independent Study II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MTEN 491. Restriction: junior or senior standing in materials engineering, agreement of a department faculty advisor, and approval of the undergraduate advisor. Normally a GPA greater than 3.0 is required to participate in the course. Provides the student with an opportunity to work on a research project under the guidance of a CME department faculty. A written report is required for course completion.

MTEN 496. Materials Engineering Laboratory II. 3 credits, 6 contact hours (0;6;0).
Prerequisite: MTEN 395. This course offers students hands on experience to synthesize and characterize a diverse set of material samples. Students will be establishing synthesis/structure/properties relationships for metal alloys with emphasis on shape memory alloys, composite materials with emphasis on filled silicones, and porous materials with focus on zeolites. Students will learn how the synthesis and processing affect the material crystallinity and properties; they will measure the processing characteristics of powders, and prepare and characterize gels.

SET 200. Introduction To Geomatics. 3 credits, 3 contact hours (3;0;0).
Plane surveying with angle and distance measurements; leveling; topographic mapping; traverse and area computations; horizontal and vertical curves; cross sections; triangulation; state plane coordinates; 3-D surveying using Global Positioning System (GPS), Geographic Information Systems (GIS) and remote sensing technology for surveying and mapping applications. Emphasis is on the use of the computers for solving typical field and office problems.

SET 200A. Introduction to Geomatics Lab. 1 credit, 3 contact hours (0;3;0).
Co-requisite: SET 200 or department permission. Field exercises in conjunction with the classroom exercises utilizing classical and electronic surveying instruments and COGO/CAD software.

SET 203. Introduction to Remote Sensing Science & Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisites or Corequisites: Computing Literacy GER. This course provides an introduction to remote sensing (RS), emphasizing the techniques that are used to monitor the Earth's surface. It will introduce the fundamentals of electromagnetic radiation (EMR), principles and concepts of RS, and EMR measurement by air-and space-borne optical, thermal, radar and LiDAR instruments, as well as Unmanned Aerial Vehicles (UAVs). The main theme will be how qualitative and quantitative information from RS data are acquired, processed, analyzed and utilized.

SET 207. Evidence and Procedures for Property Surveys. 3 credits, 3 contact hours (3;0;0).
Co-rerequisites: CE 200, SET 200 or permission of instructor. Introduction to surveying law and to the concept of evidence related to boundary locations as discoverable on the ground and through deeds or other written records. Understanding of the principles of property law, titles, land ownership, transfer of land ownership, deed descriptions, evidence recovery and conflict resolutions.

SET 220. Raster-based Geographic Information System. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Courses include CS 100 or CS 106 or CS 101 or CS 115. Pre or Corequisites: Satisfied by computer literacy GER. The course will focus on the fundamentals of the raster data model for geospatial analysis, visualization, and report generation. Course topics include Geographic Information System (GIS) operations as buffer, overlay, classification techniques, sampling theory, map algebra, and cartographic principles for data visualization and interpretation. Students are required to have basic computer skills.

SET 280. Marine Surveying. 4 credits, 6 contact hours (3;3;0).
Prerequisite: CE 200 or SET 200. Marine Surveying builds on the core competencies introduced in "Introduction to Geomatics":. This course focuses on computer generated solutions for nautical charts and water boundary delineations using imaging, optical, LiDAR, and acoustic observations via marine, airborne, and space-based platforms; to understand marine surveying technology for solutions on environmental problems; develop skills and techniques to enhance, interpret, and analyze acoustic measurements using computer-based methods.

SET 301. Route Surveying. 4 credits, 6 contact hours (3;3;0).
Co-requisites: CE 200, SET 200 or equivalent, or permission of instructor. Horizontal and vertical curves computation and layout with regard to highway design. Special emphasis on complex curves. Topics include control, positioning, error analysis, highway design problems, and layout. Concepts of right-of-way surveys. Also included is an introduction on the concepts of machine control.

SET 302. Geodetic Control Surveying. 4 credits, 6 contact hours (3;3;0).
Co-requisites: CE 200, SET 200 or equivalent, or permission of instructor. A study of the higher order methods and techniques of surveying such as Global Positioning System (GPS) with observations of Real-Time networks, 1st, 2nd and 3rd Orders of Accuracy along with the requisite computations to reduce these observations to measurements and the applications of these measurements to the State Plane Coordinate systems and the geoid.

SET 303. Photogrammetry and Aerial Photo Interpretation. 4 credits, 6 contact hours (3;3;0).
Prerequisites: CE 200 or SET 200 or equivalent. A review of the principles of photography, including the physical science of optics as related to the use of aerial photos, to engineering and land surveying projects. Includes the necessary mathematics of photogrammetry and the process of designing and establishing the required data for proper acquisition of photogrammetric information.

SET 304. Adjustment Computations I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 111 or equivalent. A course designed to give the student the necessary knowledge to reduce survey observations to measurements; to analyze the data to determine the relationship of adjusted measurements to the observations; to verify that the mathematical constraints have been met; and to introduce approximate and least squares adjustments of surveying observations.

SET 307. Boundaries and Adjacent Properties. 3 credits, 3 contact hours (3;0;0).
Prerequisites: SET 207 or equivalent, or permission of instructor. A course on legal principles regarding boundaries and the constructive solutions of the problems of boundary surveying by a consideration of deed descriptions and examples of their application to surveying.

SET 320. Vector-based Geographic Information System. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 100 or CS 101 or CS 106 or CS 115. Pre or Corequisites: Satisfied by computer literacy GER. This course, the second in the Geographic Information Systems (GIS) Specialization, will go in-depth on how to analyze vector spatial data and to use cartography techniques to communicate results. Topics include geometric and attribute descriptives of vector data models, vector topology, Entity Relational Diagrams, spatial queries using Structured Query Language (SQL) syntax, descriptive statistics, spatial analysis and visualization.

SET 360. Digital Surveying Methods. 3 credits, 4 contact hours (2;2;0).
Prerequisites: SET 200 and SET 200A or instructor permission. The goal of this course is that students will be taught skills in using robotic and digital geospatial data collection technologies for mapping using Computer Aided Drafting (CAD) methods. The course has three parts. Part 1 deals with data collection, where both analogue and digital data collectors of field observations are covered. Methods focus on approaches that minimized the contribution for operator and instrument errors on the observations. In part 2, emphasis is on data preparation, reductions, and processing for coordinate computations. Part 3 focuses on CAD methods for preparing as-built site plans, plat or survey diagram, survey work plan, CAD modeling capabilities to construct a Digital Elevation Model (DEM) or a Digital Surface Model (DSM), topographic mapping outputs, and construct GIS layers from survey data. The emphasis of this course is on hands-on exercises in the practice of geospatial data collection, handling instrumentation, data processing and data representation.

SET 401. Fundamentals Of Geodesy. 3 credits, 3 contact hours (3;0;0).
Prerequisite: SET 302. Geodesy and its relation to surveying and other disciplines. Topics include geometric, physical and satellite geodesy. Also includes the concept of map projection.

SET 403. Remote Sensing Principles for Geomatics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 200 or SET 200. Principles of remote sensing for Geomatics application build on the core competencies introduced in Introduction to Surveying. This course focuses on computer generated solutions from technologies used for the acquisition and production of geospatial data via terrestrial, airborne, and space-based platforms; to understand remote sensing technology for solutions on scientific environmental problems; develop skills and techniques to enhance, interpret, and analyze digital imagery using computer-based methods.

SET 404. Adjustment Computations II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: SET 304. Concepts of survey observations for adjustment and estimation models. A continuation of the theory of least squares and the mathematical weighting of observations. Also includes the statistical evaluation of least squares results with hands-on training using state-of-the-art industry standard software.

SET 407. Boundary Line Analysis. 4 credits, 6 contact hours (3;3;0).
Prerequisite: SET 307. Develops the analytical synthesis of real property law, land surveying procedures, and scenario development compatible with current case law decisions for the development of most probable scenarios of boundary location for the court's consideration.

SET 420. Geographic/Land Information Systems. 4 credits, 6 contact hours (3;3;0).
Prerequisites: SET 207 or permission of instructor. Geographic/Land Information System builds on the core competencies that were introduced in the course "Introduction to Surveying". This course focuses on understanding the fundamentals of Geographic/Land Information Systems (GIS/LIS) and Multi-Purpose Cadastres. Topics on LIS emphasize issues relating to the design, implementation, and maintenance of land records. Topics on GIS emphasize GIS data models (vector versus raster) and database development for applications in diverse fields like criminal justice, economics, and infrastructure. Students will learn practical skills on web-based mapping and GIS.

SET 423. Remote Sensing of the Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisite: SET 303. This course focuses on various aspects of remote sensing applications in the domain of natural resources. Students will have the opportunity to obtain hands-on experience through real-world applications of remote sensing technologies in the biosphere, the hydrosphere, the pedosphere, the atmosphere, and the built environment. Students will come out of this course with a mastery of a wide range of interpretation, measurement, environmental monitoring and mapping skills using remotely sensed data.

SET 433. Remote Sensing Digital Image Processing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: SET 303. This course introduces conceptual and practical aspects of digital image analysis from airborne and spaceborne earth-observing instruments, and provides up-to-date information on analytical methods used to analyze digital remote sensing data. The project-based course will emphasize the advanced techniques for remote sensing data processing and analysis. In-class exercises will give students hands-on experience in the fundamentals of digital image processing and information extraction techniques.

SET 440. Land Development. 3 credits, 4 contact hours (2;2;0).
Prerequisites: SET 207 and CE 321 or instructor permission. Understanding the process of development of land through the study of land use law, federal, state and municipal land use regulations, federal and state regulations regarding environmental issues and the administrative and statutory laws governing the preparation of land surveys; impart the ability to prepare a land survey from initial contact and the proposal phase to preliminary and final plan approval through a class project designed to cover all of these phases.

SET 460. GIS Data Integration and Decision Support. 3 credits, 3 contact hours (3;0;0).
Prerequisites: SET 200 or Department permission. This is the 3rd course of a 3-part sequence of a basic training program for a GIS analyst. GIS for decision support involves processes of analyzing and identifying patterns in geographic data and describing relationships between spatial features. This course introduces a number of techniques on analysis of spatial data and data integration through a combination of lectures and hands-on experiential learning. Students will work on a term project by applying GIS tools and geospatial analytical techniques to build a decision support system for a solution to a problem in their career field.

SET 490. Senior Project in Surveying. 2 credits, 2 contact hours (2;0;0).
Prerequisite: Senior standing. The student works on an individual surveying project guided by the department staff. The project should concentrate on a specific aspect of surveying, not necessarily on field measurements. Project includes library research, written report and oral presentation of findings.

SET 491. Special Projects in Surveying. 1 credit, 1 contact hour (0;0;1).
This course provides students with research experience in Geomatics/Surveying at the undergraduate level. Course content and scope of study will be approved by the coordinator of the SET program. Topics can include GPS data processing, marine surveying for bathymetric modeling and generalization, and geophysical surveying using gravity and topography data. Course outcomes include knowledge of advanced data processing, data analysis, and interpretation at the undergraduate level.

SET 492. Special Projects in Surveying. 2 credits, 2 contact hours (0;0;2).
This course provides students with research experience in Geomatics/Surveying at the undergraduate level. Course content and scope of study will be approved by the coordinator of the SET program. Topics can include GPS data processing, marine surveying for bathymetric modeling and generalization, and geophysical surveying using gravity and topography data. Course outcomes include knowledge of advanced data processing, data analysis, and interpretation at the undergraduate level.

SET 493. Special Projects in Surveying. 3 credits, 3 contact hours (0;0;3).
This course provides students with research experience in Geomatics/Surveying at the undergraduate level. Course content and scope of study will be approved by the coordinator of the SET program. Topics can include GPS data processing, marine surveying for bathymetric modeling and generalization, and geophysical surveying using gravity and topography data. Course outcomes include knowledge of advanced data processing, data analysis, and interpretation at the undergraduate level.

TMT 301. Digital Electronics for Telecommunications. 3 credits, 4 contact hours (2;2;0).
Studies the fundamentals of digital electronics including combinational and sequential logic. Emphasizes those signals and configurations commonly employed in telecommunication systems. Theory is reinforced in hardware and simulation laboratory exercises.

Biomedical Engineering

Objectives of Biomedical Engineering Program

The principal objective of our undergraduate program is to prepare students for productive careers in the field of biomedical engineering. As a department in New Jersey's technological research university, we anticipate that a significant number of our graduates will serve in the medical device and biotech industries in the state. But we also anticipate that many of our graduates will utilize their preparation in biomedical engineering to enter into other related fields such as medicine, dentistry, law, business or management.We expect our graduates to demonstrate effective leadership and to be prepared to work in culturally diverse environments. We also expect them to be able to use their multidisciplinary background to foster communication across professional and disciplinary boundaries and to remain mindful of the ethical and social implication of their work.We expect them to be able to integrate their fundamental knowledge in the basic sciences, mathematics, and engineering to address and solve a wide range of problems in medicine and biology. In keeping with the complex and continuously evolving nature of the field of biomedical engineering, we expect that most of our graduates will continue their formal education in advanced programs and that our alumni will engage in life-long learning.

Description of Biomedical Engineering Programs

Biomedical engineering students combine a study of fundamental physiological and biological fundamental processes with a study of engineering methods. Within the biomedical engineering program, there are a number of focus areas, which lead to specific program tracks for undergraduate study. The bioinstrumentation track utilizes electrical engineering methods extensively. The biomechanics track brings mechanics and mechanical engineering methods into play. The biomaterials and tissue engineering track employs tools from chemical engineering and materials science.

For students committed to pursuing a professional career in an area other than engineering, the Engineering Science Accelerated Programs for Pre-Health and Pre-Law offer challenging educational opportunities. These programs involve a concentration in Biomedical Engineering while also meeting the broad requirements for the degree of Bachelor of Science in Engineering Science. These non-accelerated programs have attenuated engineering course requirements and are designed to prepare the student upon graduation to pursue advanced education in a professional school in medicine, dentistry, optometry, physical therapy or law.

The program requires only three years of attendance at NJIT with subsequent completion of the program via courses taken during the first year of professional school.Examples of research activity within the biomedical engineering field include signal processing of electrocardiograms, electroencephalograms, electromyograms; design of clinical instrumentation (e.g., for ophthalmology); design and analysis of prosthetic devices such as knees, hips and heart valves; design of robotic techniques for rehabilitation; experimental testing of the control of eye movements and other skeletal motor control systems; gait and limb motion analysis; development of new biomaterials (including many containing living cells) for both hard tissues (bone and teeth) and soft tissues (muscle, skin, cartilage, blood vessels), biomechanical testing of myocardial and vascular tissue; modeling and simulation of cardiac and vascular dynamics; modeling and simulation of the function of other organs such as lungs and kidneys; clinical image processing; biomedical applications of MEMS (micro electro-mechanical systems). Research is conducted cooperatively between NJIT and neighboring medical institutions.

Mission of Biomedical Engineering

1. Educate undergraduate students for productive careers and life-long learning, especially in the health-related areas of industry, the professions, and government service
2. Educate biomedical engineering graduate students for employment in industry, health professions, government, or academe
3. Emphasize preparation for leadership roles for all levels of students, both undergraduate and graduate
4. Engage in research to support the advanced education of graduate students, maintain the intellectual vitality of the faculty, and expand the frontiers of knowledge in areas of importance to the state and the nation
5. Publish and present the results of our intellectual activities, resulted from both research and teaching advances
6. Serve our profession through membership and leadership in national and international societies
7. Serve our wider constituencies by offering our expertise to other health-related professionals, industries, and state and local communities

Program Educational Objectives

1. To prepare students for productive careers related broadly to biomedical engineering. It is anticipated that BME graduates will embark upon diverse career paths, serve the medical device/pharmaceutical/biotechnology industries, and use their education in a variety of related endeavors including medicine, dentistry, law, business, government, and other engineering/scientific fields.
2. While working within their selected career path, we expect that our alumni will demonstrate the following traits:
   a. **BME alumni are integrators:** We expect BME graduates to successfully and effectively integrate their fundamental knowledge of sciences, mathematics, liberal arts, and engineering analysis into actions that address and solve a wide range of problems, especially those related to medicine and biology.
   b. **BME alumni continue their professional growth:** We expect BME graduates to advance their skills through professional growth and development opportunities provided by participation in a professional society, continuing education, or graduate study in engineering or other professional fields.
   c. **BME alumni are engaged in service:** We expect BME graduates to engage themselves in service to their chosen professional societies as well as their local, national, or global communities.

Program Outcomes

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences.
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

The program is accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 - telephone (410)347-7700 http://abet.org.

NJIT Faculty

A

Adamovich, Sergei, Associate Professor

Alvarez, Tara L., Professor

Arinzeh, Treena L., Professor

B

Biswal, Bharat, Professor

C

Chandra, Namas, Professor

Chaudhry, Hans, Research Professor

Cho, Cheul, Assistant Research Professor

D

Di, Xin, Assistant Research Professor

F

Foulds, Richard A., Associate Professor

G

Georges Deveau, Penelope, University Lecturer

H

Haorah, James, Associate Professor

Hunter, William C., Professor

I

Ihlefeld, Antje, Assistant Professor

J

Jaffe, Michael, Research Professor

Jiang, Zhiguo, Research Professor

L

Lee, Eun Jung, Assistant Professor

Li, Xiaobo, Associate Professor

M

Mantilla, Bruno Antonio, University Lecturer

O

Ophir, Zohar, Research Professor

P

Perez-Castillejos, Raquel, Assistant Professor

Peringady, M. A. Muneer, Assistant Research Professor

Pfister, Bryan J., Chair

R

Reisman, Stanley, Professor Emeritus

S

Sahin, Mesut, Professor

Schesser, Joel, Senior University Lecturer

Skotak, Maciej, Assistant Research Professor

V

Van Buskirk, William C., Distinguished Professor Emeritus

Programs

Biomedical Engineering Minor (p. 541)

Biomedical Engineering Courses

BME 101. Introduction to Biomedical Engineering. 0 credits, 1 contact hour (1;0;0).
This course is open only to freshmen and new transfer students. This is seminar course to introduce freshmen to biomedical engineering field and multiple core career paths they can pursue . Faculty and recent BME graduates are invited to talk about their experience at their workplace and how they chose their career paths.

BME 105. Introduction to Human Physiology I. 2 credits, 2 contact hours (2;0;0).

BME 106. Introduction to Human Physiology II. 1 credit, 1 contact hour (1;0;0).

BME 111. Introduction to Physiology. 3 credits, 3 contact hours (3;0;0).
This course is open only to freshmen and transfer students. An overview of human physiology is presented as an introduction to subsequent core courses in the Biomedical Engineering curriculum. Not intended to be an exhaustive review of physiology, the course will instead emphasize key examples that highlight understanding of the interaction between the biomedical and engineering worlds.

BME 210. Processing Fund for Biol Signa. 3 credits, 4 contact hours (3;1;0).
Prerequisite: Sophomore Standing. This course will introduce the fundamentals of filtering and processing specifically designed for applications using biologically inspired signals. This course will provide an introduction to computation and data analysis using MATLAB - an industry standard programming and graphical environment that is employed in several core and elective courses in engineering. A major component of this course is the application of digital signal processing to biologically inspired signals using MATLAB.

BME 301. Electrical Fundamentals of Biomedical Engineering. 3 credits, 4 contact hours (2;2;0).
Prerequisites: Grade of C or higher in PHYS 121 and MATH 112. Course lectures and laboratories will address important issues for biomedical engineers at the introductory level; covering the origins of bio-electric signals and the instrumentation involved in collection of biopotentials from the electrodes to processing of the signals on the computer. Some other topics included are the transducers/sensors and modern engineering software used in bio-instrumentation. Laboratory work will provide hands-on experience in all of these areas. The course will also address practical issues in design of medical devices such as noise, resolution, linearity, and saturation. This course is offered in Studio format that involves the integration of lectures and labs into one highly participatory structure.

BME 302. Mechanical Fundamentals of Biomedical Engineering. 3 credits, 4 contact hours (3;1;0).
Prerequisites: Grade of C or higher in PHYS 121 and MATH 112. Course lectures and laboratories will address important issues covering the mechanical fundamentals that are important bases for later learning experiences. This course introduces the students to to engineering mechanics and how those principles are relevant to biomechanical issues. This course is offered in Studio format that involves the integration of lectures and labs into one highly participatory structure.

BME 303. Biological and Chemical Foundations of Biomedical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Grade of C or higher in CHEM 126 or CHEM 122. This course covers organic chemistry, biochemistry and cellular mechanics in sufficient depth to give biomedical engineering students a strong enough background for them to understand the introductory aspects of the discipline, which focus on the application of engineering principles to medicine and surgery.

BME 304. Material Fundamentals of Biomedical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: A Grade of C or higher in (CHEM 126 or CHEM 122) and PHYS 111.This course is an introduction to the field of biomaterials with an emphasis on the wound healing process and interactions between the human body and implanted devices fabricated from various types of biomaterials. The thrust of this course will be to illuminate the processes occurring at the tissue-biomaterial interface. Attention will be given to the biological events occurring at the molecular level on the surface of an implanted device. The nature of these surfaces and the physiological consequences of these processes will be examined in terms of how the body and functioning of the device are impacted.

BME 311. Co-op Work Experience. 3 credits, 3 contact hours (0;0;3).
Restriction: sophomore standing or above, approval of department, and permission of Career Development Services. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated by the co-op office and approved by the department. Mandatory participation in seminars and completion of a report.Note: Normal grading applies to this COOP Experience.

BME 321. Adv Mechanics for Biomed Engr. 3 credits, 3 contact hours (3;0;0).
Prerequisite:BME 302 with a grade of C or better This course provides an understanding of engineering mechanics, especially as applied to biomechanical systems. Students should be familiar with static equilibrium analysis and concepts of stress and strain. Course topics include method of sections, area moment of inertia, mechanical properties of materials, torsion, bending, stress transformation, Mohr’s circle, and deflection of beams.

BME 333. Biomedical Signals and Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 301, MATH 222, (BME 210 or BME 310). BME Tools such as the Laplace and Fourier Transforms, time-frequency analysis are introduced. Applications include signals and noise, processing of the ECG, mathematics of imaging and derivation of useful physiological parameters from input signals.

BME 351. Introduction to Biofluid Mechanics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 302, MECH 236 and (MECH 320 or BME 321). Introduction to the principles of fluid flow. Basic fluid principles, such as fluid properties, fluid statics, conservation of mass, momentum, and energy will be discussed and presented in BME context. Special attention will be given to the non-Newtonian nature of blood, viscous flow in arteries, unsteady flows, and to the fluidic output of the heart. The textbook material will be supplemented throughout the course to emphasize examples relative to BME.

BME 352. Thermal Science for Biomedical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 112, PHYS 111, CHEM 126, BME 111. Corequisites: MATH 211 OR MATH 213. Thermal Science is the field of study that includes aspects of thermodynamics, heat transfer, fluid flow, and mass transport that are important to biomedical engineering. This includes phase change of substances, energy, power, heating, and cooling. The course will cover fundamental concepts in each of these areas with specific attention to biomedical technologies and physiological processes. Analytical methods and computer simulation tools will be used in the course.

BME 372. Electronics of Medical Devices. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 111 and BME 301 with a C or better. The first of a two-semester sequence that covers the design of electronic circuits for Biomedical applications. This course covers basic operational amplifier circuits as well as the operation of semiconductor diodes and transistors. An introduction to digital logic circuits is also provided. Computer simulation as well as hands-on breadboarding of electronic circuits are used throughout the course to supplement the lectures.

BME 373. Biomedical Electronics II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: BME 372. This is a continuation of BME 372 emphasizing biomedical applications of oscillators, active filters, and wave-shaping circuits.

BME 382. Engineering Models of Physiological Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 111, BME 301, BME 302 and MATH 222 all with a C or better. Students learn to develop quantitative models of organs and organ systems from an engineering viewpoint. Students translate their understanding of physiological systems into models that evolve dynamically based on engineering block diagrams. Additional topics include: hierarchical structure, sensitivity analysis, parameter estimation, negative feedback control, and characteristic traits of models. Students will use models to gain insight into how a physiological system functions and to design a biomedical engineering device or procedure that interacts with the physiological system. Systems studied include the cardiovascular system, gas exchange in the lungs, nerve and muscle action potentials, and musculo-skeletal spinal reflex.

BME 383. Measurement Lab for Physiological Systems and Tissue. 3 credits, 4 contact hours (1;3;0).
Prerequisites: BME 302, (BME 210 or BME 310), (MATH 279 or MATH 333). Through laboratory experiences, students will apply engineering methods for measuring and interpretating the properties of physiological systems and biological tissues. Topics include measurements relevant to cardio-pulmonary, nerve and muscular systems.

BME 384. Biomechanics Laboratory. 3 credits, 4 contact hours (1;3;0).
Prerequisites: BME 302, MECH 236, BME 321, (MATH 279 or MATH 333), (CS 101 or BNFO 135 or CS 115 or BME 210). This course is an introduction to the experimental analysis of the biomechanics of human motion. Laboratory experiments include the application and integration of anatomical and mechanical concepts to a wide variety of activities. Students will develop basic competence in a systematic approach to the observation, analysis and evaluation of human movement in clinical, educational, and industrial environments.

BME 385. Cell and Biomaterial Engineering Laborarory. 3 credits, 4 contact hours (1;3;0).
Prerequisite: MATH 112, PHYS 121, BME 304 and (MATH 279 or MATH 333) all with a C or better. This laboratory course is designed to provide students with valuable hands-on experience in the field of cellular and biomaterial engineering. Experiments include biomaterial fabrication and characterization, mechanical testing of biomaterials, colorimetric protein assay, cell-based assay, the basics of cell culture techniques, the basics of light and electron microscopy, and image capture and analysis. A lecture on the principles of a given technique will be followed by laboratory activity.

BME 386. Biosensor and Data Acquisition Lab. 3 credits, 4 contact hours (2;2;0).
Prerequisites: BME 210 and BME 301. Laboratory exercises involve projects at all levels of a medical device system from sensors to data acquisition and data processing. The course will introduce measurements for different sensors with Biopac Amplifiers and Arduino Microprocessors. Circuits are constructed to condition the signals from sensors and convert them into a format that can be displayed or acquired into a computer. The final projects help to develop the skills to integrate various parts of a medical device system, collect and analyze data and troubleshoot a device.

BME 411. Co-op Work Experience. 0 credits, 0 contact hours (0;0;0).
Prerequisites: BME 311 and completion of sophomore year, approval of department, and permission of Career Development Services. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated by the co-op office and approved by the department. Mandatory participation in seminars and completion of a report. May count as BME or approved elective. Grade will now be issued as a letter grade.

BME 420. Advanced Biomaterials Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 302, BME 304, and (MTSE 301 or MTEN 201). The goal of this course is to understand material selection, important properties of materials for use in the body, and failure modes of applied biomaterials. The course will cover the structure and properties of materials used as biomaterials including metals, ceramics, synthetic polymers, and biopolymers. The structure of these materials will be explored to understand how it defines the behavior of a material. The bulk behavior of materials will be reviewed, including the generalized Hooke's Law, and new concepts will be introduced (including thermal strain, surface properties, and viscoelasticity). Students will be presented with problems of property characterization, failure analysis and performance testing. Students will work in teams to analyze a marketed implant or device using biomaterial(s) using the tool and concepts learned in the course.

BME 422. Biomaterials Characterization. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 112, PHYS 121, BME 304 and (MTSE 301 or MTEN 201) all with a C or better. The quantum mechanical origins of spectroscopy, the relationship of spectroscopic behavior to thermal characteristics of a material, and the differences in approach to the chemical and physical characterization of synthetic and biological polymers are discussed.

BME 427. Biotransport. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222 and (BME 303 or R120 102 or BIOL 201). This course is an introduction to transport phenomena in biological systems. The objective of this course is to gain knowledge of the basic principles of transport phenomena. The course will cover conservation relations in fluid transport with an emphasis on conservation of mass at the tissue and cellular levels. Topics will include fundamentals of mass transport and applications such as transport in porous media, transvascular transport and drug delivery.

BME 430. Fundamentals of Tissue Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 302, (BME 303 or R120 102 or BIOL 201), BME 304, MATH 222 and (MTSE 301 or MTEN 201). This course is an introduction to the field of tissue engineering as a therapeutic approach to treating damaged or diseased tissues in the biotechnology industry. In essence, new and functional living tissue can be fabricated by delivering cells, scaffolds, DNA, proteins, and/or protein fragments at surgery. This course will cover the advances in the fields of cell biology, molecular biology, material science and their relationship towards developing novel "tissue engineered" therapies.

BME 451. Biomechanics I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MECH 236; BME 321. Tensor analysis. Kinematics of continuous media. Stress. The elastic solid. Newtonian fluid. Conservation principles of mass, momentum and energy. Viscometric flows. Formulation of constitutive equations. Applications to the modeling of bone and other living tissues.

BME 452. Mechanical Behavior and Performance of Biomaterials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 302, BME 304, MATH 222, (MATH 279 or MATH 333), and BME 321. Biomaterial selection and performance is essential to the design and implementation of most any biomedical application. Students will learn about important properties of materials for use in the body and failure modes of applied biomaterials. Material behavior will be reviewed, including the generalized Hooke's Law, and new concepts will be introduced including thermal strain, surface properties, and viscoelasticity. Material biocompatibility will be introduced in regards to body responses including cell and tissue interaction, toxicity and safety.

BME 471. Principles of Medical Imaging. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 301, (BME 210 or BME 310). This is an introductory undergraduate course in biomedical imaging. This course will cover medical physics, instrumentation, data aquisition and processing to generate structural and functional images. A number of modalities including X-ray, Computer Tomography, Ultrasound, and magnetic resonance imaging systems are included. This course is an elective in the Bioinstrumentation track.

BME 472. FDA Regulation of Medical Devices. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 301. Restrictions: none. The course will teach the FDA regulatory process including design documentation and quality management system to attain FDA approval for medical devices. Statistical tests for the development of human randomized clinical trials and non-clinical bench testing of medical devices will be taught with safety standards for medical devices. A project will be assigned to teach students how to apply for FDA approval for a student-selected medical device.

BME 478. Introduction to CAD for Biomechanics. 4 credits, 6 contact hours (4;2;0).
Prerequisites: BME 302 and (MECH 320 or BME 321). Introduction to Computer Aided Designing and analysis as applied to biomedical engineering design programs. Topics include theoretical insight into the process of design and geometrical modeling and design using industry standard CAD (Computer Aided Design) software packages. The course will also include several projects involving the application of design principles to standard problems in biomedical design.

BME 489. Medical Instrumentation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: BME 301 and (BME 210 or BME 310). This course covers the hardware and instrumentation needed to measure variables from different physiological systems. The following topics will be taught: electrodes, sensors and transducers. Bioelectric amplifiers, electrical safety and computing. Applications include the study and design of instrumentation for measurement of the ECG, EEG, EMG, respiratory system, nervous system in general.

BME 491. Research and Independent Study I. 3 credits, 3 contact hours (0;0;3).
In depth research experience taught under the guidance of a professor typically within a laboratory. Approved requirements are needed for engineering credit. Research thesis required. Needs permission of professor.

BME 492. Research and Independent Study II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: BME 491. Approved requirements are needed for engineering credit. Research thesis required. Needs permission of professor.

BME 493. Honors Research Thesis I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: GPA 3.5, an appropriate research methods course and COM 313. Part of a two semester undergraduate research thesis. Students will learn how to formulate a hypothesis, design a scientific based experiment, analyze data using statistics, interpret data, and describe work within oral defense and written thesis.

BME 494. Honors Research Thesis II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: BME 393 Part of a two semester undergraduate research thesis. Students will learn how to formulate a hypothesis, design a scientific based experiment, analyze data using statistics, interprete data, and describe work within oral defense and written thesis.

BME 495. Capstone Design I. 2 credits, 4 contact hours (1;0;3).
Prerequisites: BME 372 or MTSE 301 or MTEN 201 or (MECH 236 and MECH 320) or (MECH 236 and BME 321) or BME 386. Restrictions: Senior Standing. The course introduces the student to the definition of design as well as introducing issues of intellectual property, bioethics and safety, and professional societies. The goal of this course is to provide students with the guidance to choose a capstone design topic and advisor conduct library/search engine background research and to prepare the design proposal for their chosen project.

BME 496. Capstone Design 2. 3 credits, 4 contact hours (1;3;0).
Prerequisite: BME 495. Implementation of the project approved in BME 495. This portion of the project includes library research, time and cost planning, oral and written reports, as well as construction, troubleshooting and demonstration of a working prototype.

BME 498. ST:. 3 credits, 3 contact hours (3;0;0).

B.S. in Biomedical Engineering

BME Tracks:

Medical Device and Imaging Track

(120 credits)

First Year		
1st Semester		**Credits**
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
ENGL 101	English Composition: Introduction to Academic Writing	3
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I	4
FED 101	Fundamentals of Engineering Design	2
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
BME 101	Introduction to Biomedical Engineering	0
MATH 112	Calculus II	4
CHEM 126	General Chemistry II	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
History and Humanities GER 200 level (p. 106)		3
BME 111	Introduction to Physiology	3
BME 301	Electrical Fundamentals of Biomedical Engineering	3
BME 303	Biological and Chemical Foundations of Biomedical Engineering	3
MATH 211	Calculus III A [1]	3
MATH 279	Statistics and Probability for Engineers [2]	2
	Term Credits	**17**
2nd Semester		
History and Humanities GER 300+ level (p. 108)		3
BME 210	Processing Fund for Biol Signa	3
BME 302	Mechanical Fundamentals of Biomedical Engineering	3
BME 304	Material Fundamentals of Biomedical Engineering	3
MATH 222	Differential Equations	4
	Term Credits	**16**

Third Year		
1st Semester		
History and Humanities GER 300+ level (p. 108)		3
BME 382	Engineering Models of Physiological Systems	3
MATH 337	Linear Algebra	3
BME 386	Biosensor and Data Acquisition Lab	3
BME 333	Biomedical Signals and Systems	3
	Term Credits	**15**
2nd Semester		
Engineering Elective [3]		3
BME 383	Measurement Lab for Physiological Systems and Tissue	3
BME 372	Electronics of Medical Devices	3
IE 492	Engineering Management	3
Engineering Elective [3]		3
	Term Credits	**15**
Fourth Year		
1st Semester		
BME 495	Capstone Design I	2
Engineering Elective [3]		3
Science or Engineering Elective [3,4]		3
Science or Engineering Elective [3,4]		3
BME 471	Principles of Medical Imaging	3
	Term Credits	**14**
2nd Semester		
BME 496	Capstone Design 2	3
Capstone HSS 4xx		3
BME 472	FDA Regulation of Medical Devices	3
Science or Engineering Elective [3,4]		3
	Term Credits	**12**
	Total Credits	**120**

1 Students can take MATH 213 (http://catalog.njit.edu/search/?P=MATH%20213) (Calculus III B) instead of MATH 211 (http://catalog.njit.edu/search/?P=MATH%20211).

2 Students can take MATH 333 (https://catalog.njit.edu/search/?P=MATH%20333) (Probability and Statistics) instead of MATH 279 (https://catalog.njit.edu/search/?P=MATH%20279).

3 Engineering Electives choices: BME 385,BME 420, BME 422,BME 427,BME 430,BME 321, BME351, BME 352, BME451, BME452, MECH 236 and BME 601, ENGR 3xx4xx, BME 491, BME 492, BME 651, BME 670, BME 671, BME 673, BME 674, BME 676, BME 678, BME 688, BME 698, OPSE 301, OPSE 310, OPSE 402, MET 304,MTEN 201

4 Science Elective Choices are: CHEM 244, CHEM 473, MATH 3xx/4xx, PHYS 350, PHYS 451, IE 335, IE 355, IE 449, IE 439, IE 455, Math 661, CS 350, IE 334, IE 335, IE 447, IE 455, IE 460, IE 463

The curriculum for B.S. in Biomedical Engineering – Medical Device and Imaging TRACK Co-op OPTION– CYCLE A

First Year		
1st Semester		**Credits**
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
ENGL 101	English Composition: Introduction to Academic Writing	3
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I	4
FED 101	Fundamentals of Engineering Design	2
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**

2nd Semester		
BME 101	Introduction to Biomedical Engineering	0
MATH 112	Calculus II	4
CHEM 126	General Chemistry II	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
History and Humanities GER 200 level (p. 106)		3
BME 111	Introduction to Physiology	3
BME 301	Electrical Fundamentals of Biomedical Engineering	3
BME 303	Biological and Chemical Foundations of Biomedical Engineering	3
MATH 211	Calculus III A [1]	3
MATH 279	Statistics and Probability for Engineers [2]	2
	Term Credits	**17**
2nd Semester		
History and Humanities GER 300+ level (p. 108)		3
BME 210	Processing Fund for Biol Signa	3
BME 302	Mechanical Fundamentals of Biomedical Engineering	3
BME 304	Material Fundamentals of Biomedical Engineering	3
MATH 222	Differential Equations	4
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**17**
Third Year		
1st Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
2nd Semester		
MATH 337	Linear Algebra	3
BME 372	Electronics of Medical Devices	3
BME 382	Engineering Models of Physiological Systems	3
BME 386	Biosensor and Data Acquisition Lab	3
History and Humanities GER 300 level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
2nd Semester		
BME 333	Biomedical Signals and Systems	3
BME 383	Measurement Lab for Physiological Systems and Tissue	3
Engineering Elective [3]		3
Engineering Elective [3]		3
IE 492	Engineering Management	3
	Term Credits	**15**
Fifth Year		
1st Semester		
BME 495	Capstone Design I	2
Science or Engineering Elective [3,4]		3
Science or Engineering Elective [3,4]		3

Engineering Elective [3]		3
BME 471	Principles of Medical Imaging	3
	Term Credits	**14**
2nd Semester		
BME 496	Capstone Design 2	3
Capstone HSS 4xx		3
BME 472	FDA Regulation of Medical Devices	3
Science and Engineering Elective [3,4]		3
	Term Credits	**12**
	Total Credits	**145**

1. Students can take MATH 213 (http://catalog.njit.edu/search/?P=MATH%20213) (Calculus III B) instead of MATH 211 (http://catalog.njit.edu/search/?P=MATH%20211).
2. Students can take MATH 333 (https://catalog.njit.edu/search/?P=MATH%20333) (Probability and Statistics) instead of MATH 279 (https://catalog.njit.edu/search/?P=MATH%20279).
3. Engineering Electives choices: BME 385,BME 420, BME 422,BME 427,BME 430,BME 321, BME351, BME 352, BME451, BME452, MECH 236 and BME 601, ENGR 3xx4xx, BME 491, BME 492, BME 651, BME 670, BME 671, BME 673, BME 674, BME 676, BME 678, BME 688, BME 698, OPSE 301, OPSE 310, OPSE 402, MET 304,MTEN 201
4. Science Elective Choices are: CHEM 244, CHEM 473, MATH 3xx/4xx, PHYS 350, PHYS 451, IE 335, IE 355, IE 449, IE 439, IE 455, Math 661, CS 350, IE 334, IE 335, IE 447, IE 455, IE 460, IE 463

The curriculum for B.S. in Biomedical Engineering – Medical Device and Imaging TRACK Co-op OPTION– CYCLE B

First Year		
1st Semester		**Credits**
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
ENGL 101	English Composition: Introduction to Academic Writing	3
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I	4
FED 101	Fundamentals of Engineering Design	2
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
BME 101	Introduction to Biomedical Engineering	0
MATH 112	Calculus II	4
CHEM 126	General Chemistry II	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
History and Humanities GER 200 level (p. 106)		3
BME 111	Introduction to Physiology	3
BME 301	Electrical Fundamentals of Biomedical Engineering	3
BME 303	Biological and Chemical Foundations of Biomedical Engineering	3
MATH 211	Calculus III A [1]	3
MATH 279	Statistics and Probability for Engineers [2]	2
	Term Credits	**17**
2nd Semester		
History and Humanities GER 300+ level (p. 108)		3
BME 210	Processing Fund for Biol Signa	3

BME 302	Mechanical Fundamentals of Biomedical Engineering	3
BME 304	Material Fundamentals of Biomedical Engineering	3
MATH 222	Differential Equations	4
	Term Credits	**16**
Third Year		
1st Semester		
History and Humanities GER 300+ level (p. 108)		3
BME 382	Engineering Models of Physiological Systems	3
MATH 337	Linear Algebra	3
BME 372	Electronics of Medical Devices	3
BME 386	Biosensor and Data Acquisition Lab	3
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**16**
2nd Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
Fourth Year		
1st Semester		
Engineering Elective [3]		3
Engineering Elective [3]		3
BME 333	Biomedical Signals and Systems	3
BME 383	Measurement Lab for Physiological Systems and Tissue	3
IE 492	Engineering Management	3
	Term Credits	**15**
2nd Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
Fifth Year		
1st Semester		
BME 495	Capstone Design I	2
BME 471	Principles of Medical Imaging	3
Science or Engineering Elective [3,4]		3
Science or Engineering Elective [3,4]		3
Engineering Elective [3]		3
	Term Credits	**14**
2nd Semester		
BME 496	Capstone Design 2	3
Science or Engineering Elective [3,4]		3
Capstone HSS 4xx		3
BME 472	FDA Regulation of Medical Devices	3
	Term Credits	**12**
	Total Credits	**145**

1. Students can take MATH 213 (http://catalog.njit.edu/search/?P=MATH%20213) (Calculus III B) instead of MATH 211 (http://catalog.njit.edu/search/?P=MATH%20211).
2. Students can take MATH 333 (https://catalog.njit.edu/search/?P=MATH%20333) (Probability and Statistics) instead of MATH 279 (https://catalog.njit.edu/search/?P=MATH%20279).
3. Engineering Electives choices: BME 385,BME 420, BME 422,BME 427,BME 430,BME 321, BME351, BME 352, BME451, BME452, MECH 236 and BME 601, ENGR 3xx4xx, BME 491, BME 492, BME 651, BME 670, BME 671, BME 673, BME 674, BME 676, BME 678, BME 688, BME 698, OPSE 301, OPSE 310, OPSE 402, MET 304,MTEN 201
4. Science Elective Choices are: CHEM 244, CHEM 473, MATH 3xx/4xx, PHYS 350, PHYS 451, IE 335, IE 355, IE 449, IE 439, IE 455, Math 661, CS 350, IE 334, IE 335, IE 447, IE 455, IE 460, IE 463

Biomaterials Track

(120 credits)

First Year		
1st Semester		**Credits**
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
ENGL 101	English Composition: Introduction to Academic Writing	3
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I	4
FED 101	Fundamentals of Engineering Design	2
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
CHEM 126	General Chemistry II	3
MATH 112	Calculus II	4
BME 101	Introduction to Biomedical Engineering	0
	Term Credits	**14**
Second Year		
1st Semester		
BME 303	Biological and Chemical Foundations of Biomedical Engineering	3
BME 304	Material Fundamentals of Biomedical Engineering	3
BME 111	Introduction to Physiology	3
MATH 211	Calculus III A [1]	3
MATH 279	Statistics and Probability for Engineers [2]	2
	Term Credits	**14**
2nd Semester		
History and Humanities GER 200 level (p. 106)		3
BME 210	Processing Fund for Biol Signa	3
BME 302	Mechanical Fundamentals of Biomedical Engineering	3
MATH 222	Differential Equations	4
BME 301	Electrical Fundamentals of Biomedical Engineering	3
	Term Credits	**16**
Third Year		
1st Semester		
History and Humanities GER 300+ level (p. 108)		3
CHEM 243	Organic Chemistry I	3
BME 352	Thermal Science for Biomedical Engineering	3
MTEN 201	Introductory Principles of Materials Engineering	3
BME 385	Cell and Biomaterial Engineering Laborarory	3
	Term Credits	**15**
2nd Semester		
IE 492	Engineering Management	3
BME 383	Measurement Lab for Physiological Systems and Tissue	3
BME 422	Biomaterials Characterization	3
BME 420	Advanced Biomaterials Science	3
History and Humanities GER 300 (p. 108)		3
	Term Credits	**15**

Fourth Year		
1st Semester		
BME 430	Fundamentals of Tissue Engineering	3
BME 382	Engineering Models of Physiological Systems	3
Science or Engineering Elective [3,4]		3
Science or Engineering Elective [3,4]		3
BME 495	Capstone Design I	2
	Term Credits	**14**
2nd Semester		
BME 427	Biotransport	3
Engineering Elective [3]		3
Engineering Elective [3]		3
BME 496	Capstone Design 2	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**120**

1. Students can take MATH 213 (http://catalog.njit.edu/search/?P=MATH%20213) (Calculus III B) instead of MATH 211 (http://catalog.njit.edu/search/?P=MATH%20211).
2. Students can take MATH 333 (https://catalog.njit.edu/search/?P=MATH%20333) (Probability and Statistics) instead of MATH 279 (https://catalog.njit.edu/search/?P=MATH%20279).
3. Engineering Electives choices: BME 372, BME 333, BME 386, BME 471, BME 472, BME 321, BME351, BME 352, BME451, BME452, MECH 236 and BME 601, ENGR 3xx4xx, BME 491, BME 492, BME 651, BME 670, BME 671, BME 673, BME 674, BME 676, BME 678, BME 688, BME 698, OPSE 301, OPSE 310, OPSE 402, MET 304,MTEN 201
4. Science Elective Choices are: CHEM 244, CHEM 473, MATH 3xx/4xx, PHYS 350, PHYS 451, IE 335, IE 355, IE 449, IE 439, IE 455, Math 661, CS 350, IE 334, IE 335, IE 447, IE 455, IE 460, IE 463

The curriculum for B.S. in Biomedical Engineering – BIOMATERIALS CO-OP TRACK – CYCLE A

First Year		
1st Semester		**Credits**
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
ENGL 101	English Composition: Introduction to Academic Writing	3
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I	4
FED 101	Fundamentals of Engineering Design	2
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
CHEM 126	General Chemistry II	3
MATH 112	Calculus II	4
BME 101	Introduction to Biomedical Engineering	0
	Term Credits	**14**
Second Year		
1st Semester		
BME 303	Biological and Chemical Foundations of Biomedical Engineering	3
BME 304	Material Fundamentals of Biomedical Engineering	3
BME 111	Introduction to Physiology	3

MATH 211	Calculus III A [1]	3
MATH 279	Statistics and Probability for Engineers [2]	2
	Term Credits	**14**
2nd Semester		
History and Humanities GER 200 level (p. 106)		3
BME 210	Processing Fund for Biol Signa	3
BME 302	Mechanical Fundamentals of Biomedical Engineering	3
MATH 222	Differential Equations	4
BME 301	Electrical Fundamentals of Biomedical Engineering	3
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**17**
Third Year		
1st Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
2nd Semester		
History and Humanities GER 300 (p. 108)		3
BME 352	Thermal Science for Biomedical Engineering	3
MTEN 201	Introductory Principles of Materials Engineering	3
CHEM 243	Organic Chemistry I	3
BME 385	Cell and Biomaterial Engineering Laborarory	3
	Term Credits	**15**
Fourth Year		
1st Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
2nd Semester		
Humanities and Social Science Senior Seminar GER (p. 112)		3
BME 382	Engineering Models of Physiological Systems	3
IE 492	Engineering Management	3
BME 420	Advanced Biomaterials Science	3
BME 422	Biomaterials Characterization	3
	Term Credits	**15**
Fifth Year		
1st Semester		
BME 495	Capstone Design I	2
BME 383	Measurement Lab for Physiological Systems and Tissue	3
BME 430	Fundamentals of Tissue Engineering	3
Science or Engineering Elective [3,4]		3
Science or Engineering Elective [3,4]		3
	Term Credits	**14**
2nd Semester		
BME 496	Capstone Design 2	3
BME 427	Biotransport	3
Engineering Elective [3]		3
Engineering Elective [3]		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**145**

The curriculum for B.S. in Biomedical Engineering – BIOMATERIALS CO-OP TRACK – CYCLE B

First Year		
1st Semester		**Credits**
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
ENGL 101	English Composition: Introduction to Academic Writing	3
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I	4
FED 101	Fundamentals of Engineering Design	2
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
CHEM 126	General Chemistry II	3
MATH 112	Calculus II	4
BME 101	Introduction to Biomedical Engineering	0
	Term Credits	**14**
Second Year		
1st Semester		
BME 303	Biological and Chemical Foundations of Biomedical Engineering	3
BME 304	Material Fundamentals of Biomedical Engineering	3
BME 111	Introduction to Physiology	3
MATH 211	Calculus III A [1]	3
MATH 279	Statistics and Probability for Engineers [2]	2
	Term Credits	**14**
2nd Semester		
History and Humanities GER 200 level (p. 106)		3
BME 210	Processing Fund for Biol Signa	3
BME 302	Mechanical Fundamentals of Biomedical Engineering	3
MATH 222	Differential Equations	4
BME 301	Electrical Fundamentals of Biomedical Engineering	3
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**17**
Third Year		
1st Semester		
History and Humanities GER 300+ level (p. 108)		3
CHEM 243	Organic Chemistry I	3
BME 352	Thermal Science for Biomedical Engineering	3
MTEN 201	Introductory Principles of Materials Engineering	3
BME 385	Cell and Biomaterial Engineering Laborarory	3
	Term Credits	**15**
2nd Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
Fourth Year		
1st Semester		
BME 382	Engineering Models of Physiological Systems	3
IE 492	Engineering Management	3
BME 420	Advanced Biomaterials Science	3
BME 422	Biomaterials Characterization	3

History and Humanities GER 300 (p. 108)		3
	Term Credits	**15**
2nd Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
Fifth Year		
1st Semester		
BME 495	Capstone Design I	2
BME 383	Measurement Lab for Physiological Systems and Tissue	3
BME 430	Fundamentals of Tissue Engineering	3
Science or Engineering Elective [3,4]		3
Science or Engineering Elective [3,4]		3
	Term Credits	**14**
2nd Semester		
BME 496	Capstone Design 2	3
BME 427	Biotransport	3
Engineering Elective [3]		3
Engineering Elective [3]		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**145**

Biomechanics Track

(120 credits)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I	4
FED 101	Fundamentals of Engineering Design	2
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
CHEM 126	General Chemistry II	3
MATH 112	Calculus II	4
BME 101	Introduction to Biomedical Engineering	0
	Term Credits	**14**
Second Year		
1st Semester		
History and Humanities GER 200 level (p. 106)		3
BME 111	Introduction to Physiology	3
MATH 211	Calculus III A [1]	3
BME 210	Processing Fund for Biol Signa	3
BME 302	Mechanical Fundamentals of Biomedical Engineering	3

MATH 279	Statistics and Probability for Engineers [2]	2
	Term Credits	**17**
2nd Semester		
History and Humanities GER 300+ level (p. 108)		3
BME 304	Material Fundamentals of Biomedical Engineering	3
BME 301	Electrical Fundamentals of Biomedical Engineering	3
BME 303	Biological and Chemical Foundations of Biomedical Engineering	3
MATH 222	Differential Equations	4
	Term Credits	**16**
Third Year		
1st Semester		
History and Humanities GER 300+ level (p. 108)		3
BME 382	Engineering Models of Physiological Systems	3
BME 321	Adv Mechanics for Biomed Engr	3
MATH 337	Linear Algebra	3
MECH 236	Dynamics	2
	Term Credits	**14**
2nd Semester		
BME 351	Introduction to Biofluid Mechanics	3
BME 384	Biomechanics Laboratory	3
BME 478	Introduction to CAD for Biomechanics	4
IE 492	Engineering Management	3
Science or Engineering Elective [3,4]		3
	Term Credits	**16**
Fourth Year		
1st Semester		
Science or Engineering Elective [3,4]		3
BME 451	Biomechanics I	3
BME 495	Capstone Design I	2
BME 383	Measurement Lab for Physiological Systems and Tissue	3
Engineering Elective [3]		3
	Term Credits	**14**
2nd Semester		
BME 452	Mechanical Behavior and Performance of Biomaterials	3
BME 496	Capstone Design 2	3
Engineering Elective [3]		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**12**
	Total Credits	**120**

1. Students can take MATH 213 (http://catalog.njit.edu/search/?P=MATH%20213) (Calculus III B) instead of MATH 211 (http://catalog.njit.edu/search/?P=MATH%20211).
2. Students can take MATH 333 (https://catalog.njit.edu/search/?P=MATH%20333) (Probability and Statistics) instead of MATH 279 (https://catalog.njit.edu/search/?P=MATH%20279).
3. Engineering Electives Choices: BME 372, BME 333, BME 386, BME 471, BME 472, BME 385,BME 420, BME 422,BME 427,BME 430 ENGR 3xx4xx, BME 491, BME 492, BME 651, BME 670, BME 671, BME 673, BME 674, BME 676, BME 678, BME 688, BME 698, OPSE 301, OPSE 310, OPSE 402, MET 304,MTEN 201
4. Science Elective Choices are: CHEM 244, CHEM 473, MATH 3xx/4xx, PHYS 350, PHYS 451, IE 335, IE 355, IE 449, IE 439, IE 455, Math 661, CS 350, IE 334, IE 335, IE 447, IE 455, IE 460, IE 463

The curriculum for B.S. in Biomedical Engineering – BIOMECHANICS CO-OP TRACK – CYCLE A

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I	4
FED 101	Fundamentals of Engineering Design	2
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
CHEM 126	General Chemistry II	3
MATH 112	Calculus II	4
BME 101	Introduction to Biomedical Engineering	0
	Term Credits	**14**
Second Year		
1st Semester		
History and Humanities GER 200 level (p. 106)		3
BME 111	Introduction to Physiology	3
BME 301	Electrical Fundamentals of Biomedical Engineering	3
BME 303	Biological and Chemical Foundations of Biomedical Engineering	3
MATH 211	Calculus III A [1]	3
MATH 279	Statistics and Probability for Engineers [2]	2
	Term Credits	**17**
2nd Semester		
History and Humanities GER 300+ level (p. 108)		3
BME 210	Processing Fund for Biol Signa	3
BME 302	Mechanical Fundamentals of Biomedical Engineering	3
BME 304	Material Fundamentals of Biomedical Engineering	3
MATH 222	Differential Equations	4
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**17**
Third Year		
1st Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
2nd Semester		
MATH 337	Linear Algebra	3
MECH 236	Dynamics	2
BME 321	Adv Mechanics for Biomed Engr	3
Science or Engineering Electives [3,4]		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**14**

Fourth Year		
1st Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
2nd Semester		
BME 351	Introduction to Biofluid Mechanics	3
BME 382	Engineering Models of Physiological Systems	3
BME 384	Biomechanics Laboratory	3
BME 478	Introduction to CAD for Biomechanics	4
IE 492	Engineering Management	3
	Term Credits	**16**
Fifth Year		
1st Semester		
BME 383	Measurement Lab for Physiological Systems and Tissue	3
BME 451	Biomechanics I	3
BME 495	Capstone Design I	2
Science or Engineering Elective [3,4]		3
Engineering Elective [3]		3
	Term Credits	**14**
2nd Semester		
BME 496	Capstone Design 2	3
BME 452	Mechanical Behavior and Performance of Biomaterials	3
Engineering Elective [3]		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**12**
	Total Credits	**145**

The curriculum for B.S. in Biomedical Engineering – BIOMECHANICS CO-OP TRACK – CYCLE B

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I	4
FED 101	Fundamentals of Engineering Design	2
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
CHEM 126	General Chemistry II	3
MATH 112	Calculus II	4
BME 101	Introduction to Biomedical Engineering	0
	Term Credits	**14**
Second Year		
1st Semester		
History and Humanities GER 200 level (p. 106)		3

BME 111	Introduction to Physiology	3
BME 301	Electrical Fundamentals of Biomedical Engineering	3
BME 303	Biological and Chemical Foundations of Biomedical Engineering	3
MATH 211	Calculus III A [1]	3
MATH 279	Statistics and Probability for Engineers [2]	2
	Term Credits	**17**
2nd Semester		
History and Humanities GER 300+ level (p. 108)		3
BME 210	Processing Fund for Biol Signa	3
BME 302	Mechanical Fundamentals of Biomedical Engineering	3
BME 304	Material Fundamentals of Biomedical Engineering	3
MATH 222	Differential Equations	4
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**17**
Third Year		
1st Semester		
ENGR 210	Career Planning Seminar for En	1
MATH 337	Linear Algebra	3
MECH 236	Dynamics	2
BME 321	Adv Mechanics for Biomed Engr	3
Science or Engineering Elective [3,4]		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
Fourth Year		
1st Semester		
BME 351	Introduction to Biofluid Mechanics	3
BME 382	Engineering Models of Physiological Systems	3
BME 384	Biomechanics Laboratory	3
BME 478	Introduction to CAD for Biomechanics	4
IE 492	Engineering Management	3
	Term Credits	**16**
2nd Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
Fifth Year		
1st Semester		
BME 383	Measurement Lab for Physiological Systems and Tissue	3
BME 451	Biomechanics I	3
BME 495	Capstone Design I	2
Science or Engineering Electibe [3,4]		3
Engineering Elective [3]		3
	Term Credits	**14**
2nd Semester		
BME 496	Capstone Design 2	3
BME 452	Mechanical Behavior and Performance of Biomaterials	3
Engineering Elective [3]		3

Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**12**
	Total Credits	**146**

Pre-Health Option

Students planning to apply to Medical and Dental schools will follow one of the above tracks with specific selections and substitutions to fulfill Medical School admissions guidelines.

The following should be taken as Advanced Science Electives:

Code	Title	Credits
CHEM 473	Biochemistry	3
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry I Laboratory	2

The following should be taken as History and Humanities GER courses:

Code	Title	Credits
STS 221	Introduction to Sociology	3
PSY 359	Foundations of Cyberpsychology	3

The following should substitute for BME 303:

Code	Title	Credits
R120 102	General Biology II	4
or R120 201	Foundations Of Biology	
R120 101	General Biology	4
or BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	
or BIOL 206	Foundations of Biology: Ecology and Evolution Lab	

General Education Requirements “Refer to the General Education Requirements for specific information for GER courses"

Accelerated B.S. in Biomedical Engineering Option, Pre-Health

Accelerated B.S. in Biomedical Engineering Option, Pre-Health (120 credits)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
MATH 111	Calculus I	4
FED 101	Fundamentals of Engineering Design	2
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
BME 101	Introduction to Biomedical Engineering	0
MATH 112	Calculus II	4
CHEM 126	General Chemistry II	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
BME 111	Introduction to Physiology	3
	Term Credits	**17**

Summer		
MATH 279	Statistics and Probability for Engineers [2]	2
CHEM 243	Organic Chemistry I	3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**8**
Second Year		
1st Semester		
MATH 211	Calculus III A [1]	3
BME 301	Electrical Fundamentals of Biomedical Engineering	3
BME 302	Mechanical Fundamentals of Biomedical Engineering	3
BME 304	Material Fundamentals of Biomedical Engineering	3
BIOL 205	Foundations of Biology: Ecology and Evolution Lecture	3
BIOL 206	Foundations of Biology: Ecology and Evolution Lab	1
CHEM 244	Organic Chemistry II	3
CHEM 244A	Organic Chemistry II Laboratory	2
	Term Credits	**21**
2nd Semester		
MATH 222	Differential Equations	4
CHEM 473	Biochemistry	3
History and Humanities GER 300+ level (p. 108)		3
BME 210	Processing Fund for Biol Signa	3
BME 491	Research and Independent Study I	3
BME 303	Biological and Chemical Foundations of Biomedical Engineering	3
	Term Credits	**19**
Third Year		
1st Semester		
BME 382	Engineering Models of Physiological Systems	3
BME 495	Capstone Design I	2
Advanced Engineering Elective **		3
Advanced Engineering Elective **		3
Advanced Engineering Elective **		3
Advanced Engineering Elective **		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**20**
2nd Semester		
BME 383	Measurement Lab for Physiological Systems and Tissue	3
IE 492	Engineering Management	3
Advanced Engineering Elective **		3
Advanced Engineering Elective **		3
BME 496	Capstone Design 2	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**18**
	Total Credits	**120**

**Advanced Engineering Elective: Technical elective courses with sufficient engineering content: Generally any 300-level or higher courses with prefix BME, ME, CHE, EE, OPSE (excluding MECH320); ECE251 and ECE252 are allowed; chosen in consultation with advisor

1. Students can take MATH 213 (http://catalog.njit.edu/search/?P=MATH%20213) (Calculus III B) instead of MATH 211 (http://catalog.njit.edu/search/?P=MATH%20211).
2. Students can take MATH 333 (https://catalog.njit.edu/search/?P=MATH%20333) (Probability and Statistics) instead of MATH 279 (https://catalog.njit.edu/search/?P=MATH%20279).

See the General Education Requirements (https://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/) **"Refer to the General Education Requirements for specific information for GER courses"**

Biomedical Engineering Minor

Requires a minimum of 18 credits of Biomedical Engineering courses:

Code	Title	Credits
BME 111	Introduction to Physiology	3
BME 301	Electrical Fundamentals of Biomedical Engineering	3
BME 302	Mechanical Fundamentals of Biomedical Engineering	3
Select three of the following:		9
BME 210	Processing Fund for Biol Signa	
BME 304	Material Fundamentals of Biomedical Engineering	
BME 3XX or BME 4XX	Upper-division BME course	
Total Credits		**18**

Chemical and Materials Engineering

Chemical engineers use chemistry, biology, physics and math in an integrated engineering mode in order to manufacture materials and products to modern society. They are involved with the full scale of processes, from the laboratory bench to the pilot plant and eventually to the manufacturing facility. The academic training of chemical engineers provides a strong background for a variety of areas, including;

- Process Design
- Pharmaceutical Engineering
- Production Engineering
- Research and Development
- Marketing/Technical Sales
- Environmental and Waste Management
- Safety

At present, chemical engineers are involved in areas such as producing more effective pharmaceuticals and more durable plastics, developing, biotechnology, genetic engineering applications, and producing electronic materials. They are also involved in the more traditional areas of petroleum refining and chemical manufacturing. A Chemical engineer may choose to work in a variety of industries which include chemicals, pharmaceuticals, food, energy, and environmental control. A chemical engineering degree also serves as a good preparation for law, business, or medical school.

The Mission of the Department is to:

1. Educate undergraduate students for employment in industry and the pursuit of graduate studies;
2. Educate graduate students for employment in industry, government, or academe;
3. Educate students, both undergraduate and graduate, for leadership roles;
4. Engage in research to support the advanced education of graduate students, maintain the intellectual vitality of the faculty, and expand the frontiers of knowledge in areas of importance to the state and nation;
5. Publish and present the results of our intellectual activities, resulting from both research as well as teaching advances;
6. Serve our profession through membership and leadership on national and international societies, journals and editorial boards; and
7. Serve our wider constituencies by offering our expertise to industries, state and local communities, and pre-college students and teachers.

Chemical Engineering Program Education Objectives

Engineering Practice

Graduates of our program are successfully engaged in the practice of chemical engineering within industry, academe and government working in a wide array of technical specialties including but not limited to process and plant design operations.

Professional Growth

Graduates of our program advance their skills through professional growth and development activities such as graduate study in engineering or complimentary disciplines, and continuing education; some graduates will transition into other professional fields such as business, law and medicine through further education.

Service

Graduates of our program perform service to the society and the engineering profession through participation in professional societies, government, civic organizations, and humanitarian endeavors.

Chemical Engineering Program Outcomes

Graduates of the Otto H. York Department of Chemical and Materials Engineering will have:

- an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- an ability to communicate effectively with a range of audiences
- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

This program is accredited by the Engineering Accreditation Commission of ABET, http://abet.org.

Advisement

All students are required to see their advisor at least once each semester immediately prior to formal registration for the following semester(s). Registration holds are removed following the meeting. All undergraduates must schedule their appointments online using Map-Works, to see their undergraduate advisor, Gordana Obuskovic.

Freshman Advisement

Some freshmen are assigned courses (CHEM 121 Fundamentals of Chemical Principles I-CHEM 122 Fundamentals of Chemical Principles II;ENGL 090 General Skills in the English Language -HUM 099 -HUM 100) and/or lightened credit loads. It is particularly important for these students to see their advisor to plan their courses for subsequent semesters. Completing pre-requisites for sophomore courses may involve attending summer sessions and/or spending an additional semester at NJIT.

NJIT Faculty

A

Armenante, Piero M., Distinguished Professor

Axe, Lisa, Professor

B

Baltzis, Basil C., Professor

Barat, Robert B., Professor Emeritus

Basuray, Sagnik, Associate Professor

Bilgili, Ecevit A., Professor

C

Chintersingh, Kerri-lee, Assistant Professor

Cimino, Richard, Senior University Lecturer

D

Dave, Rajesh N., Distinguished Professor

Dreyzin, Edward L., Distinguished Professor

G

Gogos, Costas, Distinguished Research Professor

Gor, Gennady, Assistant Professor

Guvendiren, Murat, Assistant Professor

K

Khusid, Boris, Professor

Kimmel, Howard, Professor Emeritus

L

Loney, Norman, Professor Emeritus

M

McEnnis, Kathleen, Assistant Professor

Molodetsky, Irina, Senior University lecturer

P

Pfeffer, Robert, Distinguished Professor Emeritus

R

Reid, Nellone, Senior University Lecturer

S

Schoenitz, Mirko, Associate Research Professor

Sebastian, Donald H., Professor

Simon, Laurent, Professor

Sirkar, Kamalesh K., Distinguished Professor

T

Tomkins, Reginald P.T., Professor Emeritus

V

Venerus, David, Professor

Voronov, Roman S., Associate Professor

W

Wang, Xianqin, Professor

X

Xu, Xiaoyang, Associate Professor

Y

Young, Joshua, Assistant Professor

Z

Zhao, Mark, Assistant Professor

- Chemical Engineering - B.S. (p. 547)
- Materials Engineering - B.S. (p. 553)

- Chemistry Minor (p. 552) (for Chemical Engineering majors)
- Materials Engineering Minor (p. 552)

Chemical and Materials Engineering Courses

CHE 101. Introduction to Chemical Engineering. 1 credit, 1 contact hour (1;0;0).
Pre or Corequisite: CHEM 125. Restriction: CHE students only. An introduction to the field of chemical engineering and to the Otto H. York Department of Chemical and Materials Engineering. Topics include the curriculum, student professional societies (AIChE Student Chapter), undergraduate research opportunities, cooperative education, and learning more about the chemical engineering profession and career pathways. The course also introduces basic engineering calculations as well as processes and their variables.

CHE 201. Material and Energy Balances. 4 credits, 5 contact hours (4;0;1).
Prerequisites: CHEM 126, MATH 112. Pre or Corequisites: CHE 101. Corequisites: CHE 230. This course covers the basic principles of material and energy balances for a variety of chemical engineering systems. Basic unit operations and simple designs of chemical processes are introduced.

CHE 210. Chemical Process Calculations I. 2 credits, 3 contact hours (2;0;1).
Prerequisites: CHEM 126, MATH 112. Analysis of chemical processes is introduced, emphasizing steady and unsteady-state mass and species balances. This course uses primarily chemistry and algebra to determine, for a wide variety of processes and applications, the flow and concentrations of different chemical species.

CHE 230. Chemical Engineering Thermodynamics I. 3 credits, 4 contact hours (3;0;1).
Prerequisites: CHEM 126, MATH 112, PHYS 111. Corequisite MATH 211 (or MATH 213). The Fundamentals of thermodynamics are applied to chemical engineering processes. Thermophysical properties and their engineering correlations are covered. Applications include chemical engineering and related fields such as environmental and biomedical engineering.

CHE 240. Chemical Process Calculations II. 2 credits, 3 contact hours (2;0;1).
Prerequisites: CHE 210 and CHE 230. This course covers the basic principles of energy balances for a variety of engineering systems. Combined with material from other sophomore courses, simple designs of chemical processes are considered. The course also introduces chemical process simulation software.

CHE 260. Fluid Flow. 3 credits, 4 contact hours (3;0;1).
Prerequisites: CHE 201 or CHE 210, CHE 230. Corequisite: MATH 222. This course considers the principles of molecular and turbulent transport of momentum, particularly as they apply to pressure drop calculations in piping systems, packed columns, and other flow devices. Flow around submerged objects is also considered.

CHE 312. Chemical Process Safety. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHE 342, CHE 370. Corequisites: CHE 349, MTEN 201 or CHE 375. A study of the technical fundamentals of chemical process safety: includes impact of chemical plant accidents and concepts of societal and individual risk; hazards associated with chemicals and other agents used in chemical plants, including toxic, flammable and reactive hazards: concepts of inherently safer design; control and mitigation of hazards to prevent accidents, including plant procedures and designs; major regulations that impact safety of chemical plants; consequences of chemical plant incidents due to acute and chronic chemical release and exposures; hazard identification procedures; introduction to risk assessment.

CHE 342. Chemical Engineering Thermodynamics II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHE 230, MATH 211 (or MATH 213), CHEM 236. The principles and methods developed in Chemical Engineering Thermodynamics I are extended to multicomponent systems, and used to treat phase and chemical equilibrium as well as such applications as chemical reactors and refrigeration systems.

CHE 349. Kinetics and Reactor Design. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHE 342, CHE 370, MATH 222, CHEM 236. Derive and solve species and energy balances for single chemical reactors; introduces heterogeneous catalysis, non-ideal reactors as ideal reactor combinations, and special topics such as polymeric or biochemical reactions.

CHE 360. Separation Processes I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHE 342, CHE 370. This is the first course in separations, examines traditional methods and technologies by which chemical engineers separate and purify mixtures. Emphasis here is on strippers, absorbers, distillations, and extractions.

CHE 365. Chemical Engineering Computing. 3 credits, 4 contact hours (2;2;0).
Prerequisites: CHE 370, CS 115 co-requisite: CHE 360. Introduction to basic concepts of computational methods for solving chemical engineering problems and performing process simulations. Topics include common numerical techniques encountered in chemical engineering, for the solution of linear and nonlinear algebraic equations and ordinary differential equations, differentiation/integration, optimization and interpolation/regression of data. Students will be exposed to modern computational software and commercial chemical processes simulators.

CHE 370. Heat and Mass Transfer. 4 credits, 4 contact hours (4;0;0).
Prerequisites: CHE 201 or CHE 240, CHE 260, MATH 222. The principles of heat and mass transfer in chemical engineering systems are covered. Steady and unsteady heat transfer is examined, with emphasis on the heat exchanger design. Mass transfer by steady and unsteady molecular diffusion, and turbulent convective mass transfer is studied.

CHE 375. Structure, Properties and Processing of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126, PHYS 121 or PHYS 122, MATH 112. This course introduces the principles of materials engineering from the perspective of structure-property-processing relationships. Instead of covering different types of materials separately, this course will use the principles common to engineering of all important materials as an underlying theme. These are atomic/molecular structure, nanoscale, morphology, principles of phase transformation, structure development during processing, and property dependence on structure. All these topics will be introduced through the paradigm of comparing metals, ceramics and polymers. Besides single component systems, advanced materials such as multiphase and/or multicomponent systems (e.g. composites and gels) and nanomaterials will be discussed based on these principles. An integral part of this course will be the criteria for selection of materials for specific end-use conditions and customer specifications, which can incorporate various engineering standards and multiple constraints such as public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

CHE 380. Introduction to Biotechnology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 122 or CHEM 126. Basic principles of molecular biotechnology with selected examples of applications.

CHE 396. Chemical Engineering Laboratory I. 3 credits, 5 contact hours (0;5;0).
Prerequisites: CHE 370, COM 313. Corequisite: MATH 225A. In this first course in chemical engineering capstone laboratory, experiments are conducted in the areas of fluid mechanics and heat transfer. Bench and pilot-scale equipment is used. Oral and written reports are prepared by the students.

CHE 402. ST:. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Junior or senior standing in chemical engineering. Combined laboratory and lecture course emphasizing photonics and laser applications in chemical engineering.

CHE 415. Introduction to 3D Printing. 3 credits, 4 contact hours (2;2;0).
Prerequisites: Junior standing or higher. This course introduces 3D printing technologies including history and basics of 3D printing, currently available 3D printing methods and printable materials as well as current and emerging applications of 3D printing. Students will get a general idea on the major players in 3D printing industry and global effects of 3D printing. The course will be composed of a lecture and a hands-on laboratory session, during which students will create a 3D design and print a functional prototype.

CHE 427. Biotransport. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHE 230 and MATH 222. Introduction to basic concepts of transport phenomena as applied to biological systems. Topics include the structure and composition of the human body, the properties of the blood and its flow in the cardiovascular system, and the body as a heat source and as a series of compartments involved in the mass transfer of materials (such as those in the kidneys and lungs). Students learn to analyze solute transport in biological systems and apply it to the design of biomedical devices.

CHE 444. Introduction to Polymer Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHE 370. Introduction to the basic concepts of polymer engineering. Topics covered include rheology, heat transfer, and kinetics of polymerization reactors.

CHE 460. Separation Processes II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CHE 360. This second course in separations examines non-traditional methods and technologies such as fixed-bed processes, membranes, crystallization, and mechanical separations.

CHE 472. Process and Plant Design. 4 credits, 4 contact hours (4;0;0).
Prerequisites: CHE 312, CHE 349, CHE 360, CHE 365, IE 492, MTEN 201 or CHE 375. A capstone course in the chemical engineering program that incorporates various engineering standards and multiple constraints such as public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. This class is divided into four- to six-student groups in the design process. Each group must solve an open-ended plant design problem, including process–equipment specification while considering various engineering standards and constraints. They write a project report and present their project to a wide audience (open to public) at the end of the semester.

CHE 473. Mathematical Methods in Chemical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222, CHE 349, CHE 360, and CHE 370. An introduction to the use of differential equations to solve chemical engineering problems.

CHE 476. Introduction to Biochemical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 245, CHE 349. Corequisite: CHE 349. The application of chemical engineering to biochemical processes. Topics include enzyme reactions, dynamics of microbial populations, fermentation equipment, bioreactor design, and sterilization.

CHE 489. Process Dynamics and Control. 3 credits, 4 contact hours (3;0;1).
Prerequisites: CHE 349, CHE 365. This course is an introduction to chemical process dynamics and control. Topics include analysis of the dynamics of open-loop systems, the design of control systems, and the dynamics of closed-loop systems. Control techniques and methodologies, used by practicing chemical engineers, are emphasized.

CHE 490. Special Topics in Chemical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Junior or senior standing and approval of the CHE Program Director. Restrictions: Restricted to majors in NCE only. The study of novel, contemporary, and/or advanced topics in an area of chemical engineering not regularly covered in any other CHE course. The precise topics to be covered in the course will be announced in the semester prior to the offering of the course.

CHE 491. Research and Independent Study I. 3 credits, 3 contact hours (0;0;3).
Restriction: senior standing in chemical engineering, agreement of a department faculty advisor, and approval of the associate chairperson for undergraduate studies. Normally a GPA greater than 3.0 is required to participate in the course. Provides the student with an opportunity to work on a research project under the individual guidance of a member of the department. A written report is required for course completion.

CHE 492. Research and Independent Study II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: CHE 491. A continuation of CHE 491.

CHE 495. Chemical Engineering Laboratory I. 2 credits, 5 contact hours (0;5;0).
Prerequisites: FED 101, CHE 312, CHE 360, CHE 370, COM 313, MATH 225. In this first course in chemical engineering capstone laboratory, experiments are conducted in the areas of fluid mechanics and heat transfer. Bench and pilot-scale equipment is used. Oral and written reports are prepared by the students.

CHE 496. Chemical Engineering Laboratory II. 3 credits, 6 contact hours (0;6;0).
Prerequisites: CHE 349, CHE 489, CHE 495, CHEM 339. In this second course in chemical engineering capstone laboratory, experiments are conducted in the areas of mass transfer, separations, reaction engineering, and process dynamics and control. Bench and pilot-scale equipment is used. Oral and written reports are prepared by the students.

MTEN 101. Introduction to Materials Engineering. 1 credit, 1 contact hour (1;0;0).
This course provides an introduction to the field of materials engineering and to the Otto H. York Department of Chemical and Materials Engineering. Topics include the program curriculum, student professional societies, undergraduate research and cooperative education (co-op) opportunities, and learning about materials engineering profession and career pathways. Also included are lectures by MTEN faculty integrated with research laboratory tours and hands-on research experience.

MTEN 201. Introductory Principles of Materials Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126, PHYS 121 or PHYS 122, MATH 112. This course introduces the basic concepts of Materials Engineering, with introductory topics including structure, property, performance, and processing of materials. This course focuses on conventional materials including metallic materials and their alloys, ceramics, polymers, and composites. Relationship between structure and material properties, such as mechanical, electronic, thermal, optical, magnetic, and electrochemical, are investigated.

MTEN 205. Mechanical Behavior of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 or MATH 213, MTEN 201 and MECH 234. The course will introduce the fundamentals of the mechanical behavior of materials. The principles of stress, strain will be introduced. The elements of elasticity, plasticity, will be discussed in depth. The concept of crystal geometry, different lattice defects, work hardening will be taught. Furthermore, the fundamentals of plastic deformation of polycrystalline materials, dislocation theory, and fracture will be discussed in detail. The course will include written and oral presentation of team projects on analysis of relevant peer-reviewed papers on the latest development of the field.

MTEN 301. Thermodynamics of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211 or MATH 213, PHYS 234, MTEN 205. Laws of thermodynamics and their correlation with molecular phenomena describing materials systems in equilibrium. Applications to properties, reactions and phase equilibria in materials. Thermodynamic foundation, interpretation and utilization of binary phase diagrams. Contemporary software for phase diagram calculation. Thermodynamic principles describing liquid and solid solutions, chemical reactions, and order-disorder phase transitions.

MTEN 305. Materials Characterization Methods. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MATH 211 or MATH 213, PHYS 234, CHEM 243, MTEN 201. This course gives an introduction to instrumentation for characterization of material structures and compositions and methods for measuring a wide range of material properties such as mechanical, electrical, thermal. Principles of microscopic imaging and the major branches of microscopy: optical, electron and scanning will be discussed. Principles of X-ray diffraction and X-ray, IR, UV, electron and ion spectroscopies will be introduced by considering interaction of materials with electromagnetic radiation, electrons, and ions. Principles of thermal analysis in which the properties of materials are studied as they change with temperature will be introduced. Characterization of hardness, strength, electrical conductivity will be discussed. Students will learn operation of analytical instrumentation and interpretation of experimental data at the NJIT Materials Characterization facility and CME undergraduate laboratory. The course will include written and oral presentation of team projects on analysis of peer-reviewed papers on specific techniques and equipment for materials characterization.

MTEN 310. Transport Phenomena in Materials I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222, PHYS 234, CHEM 243, MTEN 205. This course introduces the concepts of transport phenomena and develops the balance equations for the transport of mass, momentum, and energy. Classical force-flux relations that include Newton's law of viscosity and Fourier's law are considered. These equations, along with suitable boundary conditions, are applied to fluid mechanics and heat transfer problems relevant to materials characterization and processing. This includes laminar flows of both Newtonian and non-Newtonian fluids, conduction in solids, convective heat transfer, and phase change in single-component materials.

MTEN 311. Transport Phenomena in Materials II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MTEN 301 and MTEN 310. This course continues the development and application of the equations of transport phenomena and includes balance equations for transport at interfaces. Classical constitutive equations that include Fick's law and the Nernst-Planck equation as well as expressions for both homogeneous and heterogeneous chemical reaction are considered. These equations, along with suitable boundary conditions, are applied to multi-component and charged systems that are relevant to materials characterization and processing. This includes diffusion, chemical reaction, charge and coupled transport, and phase change in multi-component materials.

MTEN 395. Materials Engineering Laboratory I. 3 credits, 6 contact hours (0;6;0).
Prerequisites: FED 101, MTEN 301, MTEN 305, MTEN 310, MATH 333. This course introduces modern materials characterization equipment, techniques and methods for qualitative and quantitative analysis of materials properties, methods of presenting collected data. Course emphasizes structure-properties relationships via the measuring properties of different classes of materials. This course includes physical, mechanical, thermal, electrical and optical properties measurements. Techniques for direct micro- and macrostructural analysis include X-Ray diffraction, optical and electron imaging.

MTEN 410. Soft Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MTEN 301 (or CHE 230 or ME 311 or BME 352) and MTEN 310 (or CHE 260 or ME 304 or BME 427). This course is an introduction to soft materials such as polymers, colloids, liquid crystals, gels, and biomaterials. The course will cover the structure, properties, and applications of soft materials. Specific topics will include kinetics in material synthesis/growth, assembly, phase behavior, phase transitions, dynamics, characterization techniques, and applications.

MTEN 450. Materials Engineering Design. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MTEN 311, MTEN 395, MATH 333. An advanced course focusing on the selection of materials to solve engineering problems, and processing, structure, property, and performance tradeoffs. Families of materials and their properties and how selection software can be used to optimize selection of the best material for a variety of applications given one or more constraints will be the main focus. Students will learn how processing influences material selection, and optimize selection with cost, health, safety, failure, and environmental effects. Finally, we will discuss recent advances in material databases.

MTEN 460. Materials Processing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MTEN 395. This course gives an introduction to fundamentals of material processing. Specifically, this course will deal with metals, polymers, and ceramics. The course will follow the processing and manufacturing of these materials from vapor and melt (or, liquid phase) to solid. Start-up material will be powder, solutions and dispersion. The effects of a particular processing technology on the final product structure, shape and properties will be described. Conventional and advanced manufacturing approaches will be discussed.

MTEN 490. Special Topics in Materials Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MTEN 311. Special topics related to materials engineering are covered in areas such as biomaterials, ceramics, electronic materials, energetic materials, metals and alloys, and polymeric materials.

MTEN 491. Research & Independent Study I. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing in materials engineering, agreement of a department faculty advisor, and approval of the associate chairperson for undergraduate studies. Normally a GPA greater than 3.0 is required to participate in the course. Provides the student with an opportunity to work on a research project under the individual guidance of a member of the department. A written report is required for course completion.

MTEN 492. Research and Independent Study II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MTEN 491. Restriction: junior or senior standing in materials engineering, agreement of a department faculty advisor, and approval of the undergraduate advisor. Normally a GPA greater than 3.0 is required to participate in the course. Provides the student with an opportunity to work on a research project under the guidance of a CME department faculty. A written report is required for course completion.

MTEN 496. Materials Engineering Laboratory II. 3 credits, 6 contact hours (0;6;0).
Prerequisite: MTEN 395. This course offers students hands on experience to synthesize and characterize a diverse set of material samples. Students will be establishing synthesis/structure/properties relationships for metal alloys with emphasis on shape memory alloys, composite materials with emphasis on filled silicones, and porous materials with focus on zeolites. Students will learn how the synthesis and processing affect the material crystallinity and properties; they will measure the processing characteristics of powders, and prepare and characterize gels.

B.S. in Chemical Engineering

(120 credits)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3

PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
CHE 101	Introduction to Chemical Engineering	1
CHEM 126	General Chemistry II	3
CS 115	Introduction to Computer Science in C++	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**18**
Second Year		
1st Semester		
CHE 201	Material and Energy Balances	4
CHE 230	Chemical Engineering Thermodynamics I	3
MATH 211	Calculus III A	3
History and Humanities GER 200 level (p. 106)		3
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**14**
2nd Semester		
CHE 260	Fluid Flow	3
CHEM 236	Physical Chemistry for Chemical Engineers	4
CHEM 243	Organic Chemistry I	3
CHEM 244A Organic Chemistry I Laboratory		2
MATH 222	Differential Equations	4
	Term Credits	**16**
Third Year		
1st Semester		
CHE 342	Chemical Engineering Thermodynamics II	3
CHE 370	Heat and Mass Transfer	4
CHEM 339	Analytical/Physical Chem Lab for Chemical Engineers	2
MATH 225	Survey of Probability and Statistics *	1
MTEN 201	Introductory Principles of Materials Engineering	3
	Term Credits	**13**
2nd Semester		
CHE 312	Chemical Process Safety	3
CHE 349	Kinetics and Reactor Design	3
CHE 360	Separation Processes I	3
CHE 365	Chemical Engineering Computing	3
COM 313	Technical Writing	3
	Term Credits	**15**
Fourth Year		
1st Semester		
CHE 489	Process Dynamics and Control	3
CHE 495	Chemical Engineering Laboratory I	2
IE 492	Engineering Management	3
Technical Elective 1 [1]		3
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
	Term Credits	**14**
2nd Semester		
CHE 472	Process and Plant Design	4

CHE 496	Chemical Engineering Laboratory II	3
Technical Elective 2 [1]		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**13**
	Total Credits	**120**

CoOp Option A Track

(144 credits)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
CHE 101	Introduction to Chemical Engineering	1
CHEM 126	General Chemistry II	3
CS 115	Introduction to Computer Science in C++	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**18**
Second Year		
1st Semester		
CHE 201	Material and Energy Balances	4
CHE 230	Chemical Engineering Thermodynamics I	3
MATH 211	Calculus III A	3
History and Humanities GER 200 level (p. 106)		3
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**14**
2nd Semester		
CHE 260	Fluid Flow	3
CHEM 236	Physical Chemistry for Chemical Engineers	4
CHEM 243	Organic Chemistry I	3
CHEM 244A Organic Chemistry I Laboratory		2
MATH 222	Differential Equations	4
	Term Credits	**16**
Third Year		
1st Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
2nd Semester		
CHE 342	Chemical Engineering Thermodynamics II	3
CHE 370	Heat and Mass Transfer	4
CHEM 339	Analytical/Physical Chem Lab for Chemical Engineers	2

MATH 225	Survey of Probability and Statistics *	1
MTEN 201	Introductory Principles of Materials Engineering	3
	Term Credits	**13**
Fourth Year		
1st Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
2nd Semester		
CHE 312	Chemical Process Safety	3
CHE 349	Kinetics and Reactor Design	3
CHE 360	Separation Processes I	3
CHE 365	Chemical Engineering Computing	3
COM 313	Technical Writing	3
	Term Credits	**15**
Fifth Year		
1st Semester		
CHE 489	Process Dynamics and Control	3
CHE 495	Chemical Engineering Laboratory I	2
IE 492	Engineering Management	3
Technical Elective 1 [1]		3
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
	Term Credits	**14**
2nd Semester		
CHE 472	Process and Plant Design	4
CHE 496	Chemical Engineering Laboratory II	3
Technical Elective 2 [1]		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**13**
	Total Credits	**144**

CoOp Option B Track

(144 credits)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
CHE 101	Introduction to Chemical Engineering	1
CHEM 126	General Chemistry II	3
CS 115	Introduction to Computer Science in C++	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3

PHYS 121A	Physics II Lab	1
	Term Credits	**18**
Second Year		
1st Semester		
CHE 201	Material and Energy Balances	4
CHE 230	Chemical Engineering Thermodynamics I	3
MATH 211	Calculus III A	3
History and Humanities GER 200 level (p. 106)		3
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**14**
2nd Semester		
CHE 260	Fluid Flow	3
CHEM 236	Physical Chemistry for Chemical Engineers	4
CHEM 243	Organic Chemistry I	3
CHEM 244A Organic Chemistry I Laboratory		2
MATH 222	Differential Equations	4
	Term Credits	**16**
Third Year		
1st Semester		
CHE 342	Chemical Engineering Thermodynamics II	3
CHE 370	Heat and Mass Transfer	4
CHEM 339	Analytical/Physical Chem Lab for Chemical Engineers	2
MATH 225	Survey of Probability and Statistics *	1
MTEN 201	Introductory Principles of Materials Engineering	3
	Term Credits	**13**
2nd Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
Fourth Year		
1st Semester		
CHE 312	Chemical Process Safety	3
CHE 349	Kinetics and Reactor Design	3
CHE 360	Separation Processes I	3
CHE 365	Chemical Engineering Computing	3
COM 313	Technical Writing	3
	Term Credits	**15**
2nd Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
Fifth Year		
1st Semester		
CHE 489	Process Dynamics and Control	3
CHE 495	Chemical Engineering Laboratory I	2
IE 492	Engineering Management	3
Technical Elective 1 [1]		3
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
	Term Credits	**14**
2nd Semester		
CHE 472	Process and Plant Design	4
CHE 496	Chemical Engineering Laboratory II	3
Technical Elective 2 [1]		3

Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**13**
	Total Credits	**144**

1 Technical Electives: Student must complete 6 credits of technically oriented subject-related courses approved by his or her advisor. Acceptable subjects include, but are not limited to:
(1) CHE 491 (http://catalog.njit.edu/search/?P=CHE%20491) Research and Independent Study I and CHE 492 (http://catalog.njit.edu/search/?P=CHE%20492) Research and Independent Study II

(2) Courses taken within a Minor requirements

(3) Graduate level course taken within BS/MS or BS/PHD program

(4) Courses in ACCT 200:699 or BME 300:699 or CE 300:699 or CHE 300:699 or CHEM 300:699 or CPT 300:499 or ECE 200:699 or ENE 200:699 or ENTR 400:500 or EM 600:699 or EPS300:699 or EVSC300:699 or FIN 200:699 or HRM 300:699 or MATH 300:699 or MGMT 300:699 or ME 300:699 or MRKT 300:499 or MTEN 300:699 or MTSE 300:699 or NANO 488 or OM 375 or PHB 600:699 or PHEN 500:699 or PHYS 200:699 (**)

* Students must take Math 225 (Special Section for CHE, CHEM and BIOC majors only) as a corequisite of CHEM 339.

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses"

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses"

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Chemistry Minor (for Chemical Engineering majors)

Code	Title	Credits
Select four of the following:		11-12
CHEM 222	Analytical Chemistry	
CHEM 336	Quantum Chemistry	
CHEM 360	Environmental Chemistry I	
CHEM 361	Environmental Chemistry II	
CHEM 412	Inorganic Chemistry	
CHEM 473	Biochemistry	
CHEM 480	Instrumental Analysis	
CHEM 491	Research and Independent Study I	
CHEM 474	Biochemistry II	
Total Credits		**11-12**

Materials Engineering Minor

Minor in Materials Engineering (Student must select 5 courses for a total of 15 credits).

Code	Title	Credits
ME 215	Engineering Materials and Processes [1]	3
ME 438	Introduction to Physical Metallurgy	3
ME 470	Engineering Properties of Plastics	3
ME 490	Mechanical Engineering Project A	3
MTEN 201	Introductory Principles of Materials Engineering	3
MTSE 301	Principles of Material Science and Engineering	3
EVSC 325	Energy and Environment	3

BME 304	Material Fundamentals of Biomedical Engineering	3
BME 420	Advanced Biomaterials Science	3
BME 422	Biomaterials Characterization	3
BME 491	Research and Independent Study I	3
CE 360	Sustainable Civil Engr Mat	3
CE 490	Civil Engineering Projects	3
CHE 375	Structure, Properties and Processing of Materials	3
CHE 415	Introduction to 3D Printing	3
CHE 444	Introduction to Polymer Engineering	3
CHE 491	Research and Independent Study I	3
ENGR 301	Engineering Applications of Data Science	3

[1] Except for students majoring in ME.

Materials Engineering Program - B.S.

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
CHEM 126	General Chemistry II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
MTEN 101	Introduction to Materials Engineering	1
	Term Credits	**15**
Second Year		
1st Semester		
MTEN 201	Introductory Principles of Materials Engineering	3
MECH 234	Engineering Mechanics	2
CHEM 243	Organic Chemistry I	3
PHYS 234	Physics III	3
MATH 211	Calculus III A	3
	Term Credits	**14**
2nd Semester		
MTEN 205	Mechanical Behavior of Materials	3
CS 115	Introduction to Computer Science in C++	3
History and Humanities GER 200 level (p. 106)		3
ENGR 210	Career Planning Seminar for En	1
MATH 222	Differential Equations	4
	Term Credits	**14**

Third Year		
1st Semester		
MTEN 301	Thermodynamics of Materials	3
MTEN 310	Transport Phenomena in Materials I	3
MTEN 305	Materials Characterization Methods	3
COM 313	Technical Writing	3
MATH 333	Probability and Statistics	3
	Term Credits	**15**
2nd Semester		
MTEN 311	Transport Phenomena in Materials II	3
MTEN 395	Materials Engineering Laboratory I	3
BME 304	Material Fundamentals of Biomedical Engineering	3
ME 438	Introduction to Physical Metallurgy	3
ENGR 301	Engineering Applications of Data Science	3
	Term Credits	**15**
Fourth Year		
1st Semester		
MTEN 410	Soft Materials	3
MTEN 496	Materials Engineering Laboratory II	3
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
Technical Elective [1]		3
Technical Elective [1]		3
	Term Credits	**15**
2nd Semester		
MTEN 450	Materials Engineering Design	3
MTEN 460	Materials Processing	3
IE 492	Engineering Management	3
Technical Elective [1]		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**120**

Co-op Option Cycle A

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
CHEM 126	General Chemistry II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
MTEN 101	Introduction to Materials Engineering	1
	Term Credits	**15**

Second Year		
1st Semester		
MTEN 201	Introductory Principles of Materials Engineering	3
MECH 234	Engineering Mechanics	2
CHEM 243	Organic Chemistry I	3
PHYS 234	Physics III	3
MATH 211	Calculus III A	3
	Term Credits	**14**
2nd Semester		
MTEN 205	Mechanical Behavior of Materials	3
CS 115	Introduction to Computer Science in C++	3
History and Humanities GER 200 level (p. 106)		3
ENGR 210	Career Planning Seminar for En	1
MATH 222	Differential Equations	4
	Term Credits	**14**
Third Year		
1st Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
2nd Semester		
MTEN 301	Thermodynamics of Materials	3
MTEN 310	Transport Phenomena in Materials I	3
MTEN 305	Materials Characterization Methods	3
COM 313	Technical Writing	3
MATH 333	Probability and Statistics	3
	Term Credits	**15**
Fourth Year		
1st Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
2nd Semester		
MTEN 311	Transport Phenomena in Materials II	3
MTEN 395	Materials Engineering Laboratory I	3
BME 304	Material Fundamentals of Biomedical Engineering	3
ME 438	Introduction to Physical Metallurgy	3
ENGR 301	Engineering Applications of Data Science	3
	Term Credits	**15**
Fifth Year		
1st Semester		
MTEN 410	Soft Materials	3
MTEN 496	Materials Engineering Laboratory II	3
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering [1]	3
Technical Elective [1]		3
Technical Elective [1]		3
	Term Credits	**15**
2nd Semester		
MTEN 450	Materials Engineering Design	3
MTEN 460	Materials Processing	3
IE 492	Engineering Management	3
Technical Elective [1]		3

Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**144**

Co-op Option Cycle B

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
CHEM 126	General Chemistry II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
MTEN 101	Introduction to Materials Engineering	1
	Term Credits	**15**
Second Year		
1st Semester		
MTEN 201	Introductory Principles of Materials Engineering	3
MECH 234	Engineering Mechanics	2
CHEM 243	Organic Chemistry I	3
PHYS 234	Physics III	3
MATH 211	Calculus III A	3
	Term Credits	**14**
2nd Semester		
MTEN 205	Mechanical Behavior of Materials	3
CS 115	Introduction to Computer Science in C++	3
History and Humanities GER 200 level (p. 106)		3
ENGR 210	Career Planning Seminar for En	1
MATH 222	Differential Equations	4
	Term Credits	**14**
Third Year		
1st Semester		
MTEN 301	Thermodynamics of Materials	3
MTEN 310	Transport Phenomena in Materials I	3
MTEN 305	Materials Characterization Methods	3
COM 313	Technical Writing	3
MATH 333	Probability and Statistics	3
	Term Credits	**15**
2nd Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**

Fourth Year		
1st Semester		
MTEN 311	Transport Phenomena in Materials II	3
MTEN 395	Materials Engineering Laboratory I	3
BME 304	Material Fundamentals of Biomedical Engineering	3
ME 438	Introduction to Physical Metallurgy	3
ENGR 301	Engineering Applications of Data Science	3
	Term Credits	**15**
2nd Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
Fifth Year		
1st Semester		
MTEN 410	Soft Materials	3
MTEN 496	Materials Engineering Laboratory II	3
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
Technical Elective [1]		3
Technical Elective [1]		3
	Term Credits	**15**
2nd Semester		
MTEN 450	Materials Engineering Design	3
MTEN 460	Materials Processing	3
IE 492	Engineering Management	3
Technical Elective [1]		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**144**

Students must earn a 2.0 minimum GPA and must meet appropriate departmental regulations. These include an average GPA of 2.0 in all materials engineering courses.

1 Technical Electives: Students must complete 9 credits of technically oriented, subject-related courses approved by his or her advisor. At least 6 credits must be taken from the following: BME 300:699 or CE 300:699 or CHE 300:699 or ECE 300:699 or ME 300:699 with advisor approval. Other acceptable courses include, but are not limited to:
(1) MTEN 491 Research and Independent Study I and MTEN 492 Research and Independent Study II
(2) Courses taken to satisfy Minor requirements
(3) Graduate level course taken within BS/MS or BS/PHD program
(4) Courses in ACCT 200:699 or BME 300:699 or CE 300:699 or CHE 300:699 or CHEM 300:699 or CPT 300:499 or ECE 200:699 or ENE 200:699 or ENGR 200:699 or ENTR 400:500 or EM 600:699 or EPS300:699 or EVSC300:699 or FIN 200:699 or HRM300:699 or MATH 300:699 or MGMT 300:699 or ME 300:699 or MRKT 300:499 or MTSE 300:699 or NANO 488 or OM 375 or PHB 600:699 or PHEN 500:699 or PHYS 200:699 (**)

Note (**) only one 200 level course is allowed in a case a 300 level course needs a 200 level course as a prerequisite.

Civil and Environmental Engineering

Civil engineering is about the planning, design, construction and operation of facilities essential to modern life, ranging from bridges to transit systems. Civil engineers are problem solvers, meeting the challenges of community planning, water supply, structures, traffic congestion, energy needs, pollution, and infrastructure improvements. Societal needs, economic conditions and public safety are paramount in the work accomplished by civil engineers. High-tech tools such as computer aided design (CAD), geographical information systems (GIS) and 3-D computer modeling are a necessity in all areas of civil engineering. Civil engineers are sought by both private companies and public agencies for a variety of professional positions. Many work for engineering consulting firms or construction companies as design engineers, field engineers and project managers. They also join government agencies to oversee transportation, water supply, environmental protection, and resource management. Graduates are equally prepared to pursue MS and Ph.D. degrees in allied fields, as well as business, management and law degrees.

The Mission of Civil Engineering

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Program Educational Objectives

Our program educational objectives are reflected in the achievements of our recent alumni.

1. **Engineering Practice:** Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward practical, sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.
2. **Professional Growth:**Alumni will advance their technical and interpersonal skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.
3. **Service:** Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Student Outcomes

Our student outcomes are what students are expected to know and be able to do by the time of their graduation.

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

This program is accredited by the Engineering Accreditation Commission of ABET, http://abet.org.

NJIT Faculty

A

Adams, Matthew, Assistant Professor

Axe, Lisa B., Professor, Chemical Engineering (Joint Faculty)

B

Bagheri, Sima, Professor Emeritus

Bandelt, Matthew, Assistant Professor

Borgaonkar, Ashish, Assistant Professor, Engineering Technology (Joint Faculty)

Boufadel, Michel, Professor

C

Castro, Eduardo-Senior University Lecturer

Chien, I Jy, Steven, Professor

Cianci, Andrew, Senior University Lecturer

D

Daniel, Janice R., Professor

Dauenheimer, Edward G., Professor Emeritus

Dimitrijevic, Branislav, Assistant Professor

Ding, Yuan, Associate Professor

Dresnack, Robert, Professor Emeritus

G

Greenfeld, Joshua S., Professor Emeritus

H

Hsieh, Hsin-Neng, Professor Emeritus

K

Karaa, Fadi A., Associate Professor

Khera, Raj P., Professor Emeritus

Kolawole, Oladoyin , Assistant Professor

Konon, Walter, Professor

L

Lee, Joyoung, Associate Professor

M

Mahgoub, Mohamed, Associate Professor, Engineering Technology (Joint Faculty)

Marhaba, Taha F., Professor

Meegoda, Jay N, Professor

Milano, Geraldine, Senior University Lecturer

O

Olenik, Thomas J., Associate Professor

P

Pennock, William, Assistant Professor

Potts, Laramie, Associate Professor, Engineering Technology (Joint Faculty)

R

Raghu, Dorairaja, Professor Emeritus

S

Saadeghvaziri, Mohamad A., Professor

Saigal, Sunil, Distinguished Professor

Salek, Franklin, Professor Emeritus

Santos, Stephanie R, Senior University Lecturer

Schuring, John, R., Professor Emeritus

Spasovic, Lazar, Professor

W

Washington, David, Associate Professor, Engineering Technology (Joint Faculty)

Wecharatana, Methi, Professor

Z

Zhang, Wen, Associate Professor

- Civil Engineering - B.S. (p. 563)
- Environmental Engineering Minor (p. 569)
- Geosystems Minor (p. 569)

Civil and Environmental Engineering Courses

CE 101. CE Computer Aided Design. 1 credit, 2 contact hours (0;2;0).
Co-requisite or CE CAD teaches students the use of basic tools, such as Autocad software, used in the preparation of Civil Engineering contract documents. Autocad is a widely used computer program for generating engineering drawings.

CE 200. Surveying. 2 credits, 3 contact hours (2;1;0).
Prerequisite: MATH 111 or ENGR 101. Angle and distance measurement; leveling; topographic mapping; traverse and area computations; horizontal and vertical curves; cross sections; triangulation; state plane coordinates; global positioning system. Emphasis on the use of the computer for solving typical field and office problems. Lab should be taken concurrently.

CE 200A. Surveying Laboratory. 1 credit, 3 contact hours (0;3;0).
Corequisite: CE 200. Field exercises in conjunction with the classroom exercises in CE 200 utilizing classical and electronic instruments and COGO/CAD software.

CE 210. Construction Materials and Procedures. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENGL 101. Introduction to construction management organization, contracts, construction safety, engineering economics, and engineering ethics. Studies current practices of heavy construction including soil and rock excavation productivity, and building construction materials and procedures. Field trips to construction sites provide opportunities to directly view many of the practices.

CE 260. Civil Engineering Methods. 2 credits, 3 contact hours (2;1;0).
Prerequisites: ENGL 101, CE 101, CE 200, CE 200A. Provides students with in-depth experience in computer applications in civil engineering and with written and oral communication.

CE 307. Geometric Design for Highways. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CE 200, CE 200A. Highway design based on a study of traffic distribution, volume, and speed with consideration for the predictable future. Analysis of elements of at-grade intersections and interchanges and the geometrics of highway design and intersection layout with advanced curve work including compound and transition curves.

CE 311. Co-op Work Experience I. 0 credits, 0 contact hours (0;0;0).
Restriction: completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a -report.

CE 320. Fluid Mechanics. 3 credits, 4 contact hours (3;1;0).
Prerequisites: MECH 235 with a grade of C or better, MATH 112 and PHYS 111/PHYS 111A. Corequisite: MECH 236. This course is designed to present the fundamental laws relating to the static and dynamic behavior of fluids. The emphasis is placed on applications dealing with the flow of water and other incompressible fluids. These include flow in pipe systems and natural channels.

CE 320A. Hydraulics Laboratory. 1 credit, 3 contact hours (0;3;0).
Prerequisite or corequisite: CE 320. Explores the principles of fluid mechanics through laboratory experiments. Investigates various hydraulic phenomena with both physical and computer models. Demonstrates basic civil engineering design principles for pipe networks, open channel systems, and ground water regimes.

CE 321. Water Resources Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 200, CE 200A, MATH 279 or MATH 305. Training in methods of developing water supplies and the means to treat supplies for consumptive use. Covers hydrologic techniques such as surface and ground water yield, hydrograph and routing analyses, and probabilistic methods related to hydrologic studies.

CE 322. Hydraulic Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 320, CE 321. The objective is to provide the tools required to design water distribution systems, storm drains, and sanitary sewers. Examines related hydrologic and hydraulic techniques.

CE 332. Structural Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MECH 237 with a grade of C or better. A working knowledge of free body diagrams, equilibrium conditions for force systems and moments. The primary objective is an understanding of the various methods of analyzing determinate and indeterminate beams, frames, and trusses encountered in practice.

CE 333. Reinforced Concrete Design. 2 credits, 3 contact hours (2;1;0).
Prerequisite: CE 332. The student must have a working knowledge of structural analysis including determinate and indeterminate beams and frames. Primary objectives include the following: to acquaint the student with the properties of concrete and steel and with the behavior of reinforced concrete as a structural material; also, to develop methods for the design of reinforced concrete structural members such as beams, slabs, footings, and columns. Both ultimate strength design and working stress method will be studied.

CE 341. Soil Mechanics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MECH 237 with a grade of C or better or equivalent. Corequisite: CE 341A. A study of soil types and properties is made with the objective of developing a basic understanding of soil behavior. The methods of subsurface investigation and compaction are presented. Fundamentals pertaining to permeability, seepage, consolidation, and shear strength are introduced. Settlement analysis is also presented. Lab must be taken concurrently.

CE 341A. Soil Mechanics Laboratory. 1 credit, 3 contact hours (0;3;0).
Corequisite: CE 341. Students perform basic experiments in soil mechanics.

CE 342. Geology. 3 credits, 3 contact hours (3;0;0).
Restriction: Sophomore status. Studies science of geology with emphasis on physical geological processes. Stresses the principle of uniformity of process in the context of rock and soil formation, transformation, deformation, and mass movement. Includes aspects of historical geology and geomorphology.

CE 350. Transportation Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 200, CE 200A. A study of the principal modes of transportation, with emphasis on the planning, design and construction of facilities for modern transportation systems.

CE 351. Intro To Transportation System. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 200, CE 200A, CE 350 A study of the principal modes of transportation, with emphasis on the planning, design and construction of facilities for modern transportation systems.

CE 360. Sustainable Civil Engr Mat. 3 credits, 3 contact hours (3;0;0).
Prerequistes: CHEM 121 or 125 and MECH 237 (with a grade of C or better) This course will provide instruction on engineering materials used in the construction of civil engineering projects. Additionally, the fundamentals of sustainability and sustainable design within the context of civil engineering will be discussed. The engineering properties of aggregates, wood, metal, portland cement concrete and asphaltic concrete and design of these materials will be covered. These materials will be used to discuss sustainability concepts and design within civil engineering.

CE 381. Geomorphology. 3 credits, 3 contact hours (3;0;0).
This is a course in geomorphology, the study of landforms and the contemporary processes that create and modify them. The course will emphasize earth surface processes and quantitative analysis of landform change. Lectures will stress geomorphic principles and two field-based problems will enable students to apply these principles to contemporary geomorphic problems in engineering and management with a focus on the natural environment.

CE 406. Remote Sensing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 234. Principles of remote sensing are covered including general concepts, data acquisition procedures, data analysis and role of remote sensing in terrain investigations for civil engineering practices.

CE 410. Construction Scheduling and Estimating. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CE 210. Quantity take off, cost estimate and CPM computer analysis of typical building or highway projects. A study is made of construction project organization, contract requirements and management control techniques with an introduction to computer applications.

CE 412. Construction Codes and Specifications. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CE 210. Code and specification aspects of engineered construction. Topics include professional ethics, contracts, specifications, bidding procedures, building codes such as B.O.C.A. and New Jersey Uniform Construction Code, Energy Code Provisions, construction safety, and the impact of the EPA on construction.

CE 413. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: CE 311 or equivalent, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience. Mandatory participation in seminars and completion of requirements including a report and/or project.Note: Normal grading applies to this COOP Experience.

CE 414. Engineered Construction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 210, CE 332, CE 341. Design, erection, and maintenance of temporary structures and procedures used to construct an engineering project. Business practices, codes, design philosophies, construction methods, hardware, inspection, safety, and cost as they pertain to engineered construction projects.

CE 431. Construction Materials Lab. 1 credit, 3 contact hours (0;3;0).
Prerequisites: CE 210, MECH 237 with a grade of C or better, CE 210. This course provides an understanding of the basic properties of construction materials, and presents current field and laboratory standards and testing requirements for these materials. Students select a material or component assembly for testing, design a testing procedure, and present their results.

CE 432. Steel Design. 2 credits, 3 contact hours (2;1;0).
Prerequisite: CE 332. A working knowledge of structural analysis including determinate and indeterminate beams and frames is essential. The development of current design procedures for structural steel elements and their use in multistory buildings, bridges, and industrial buildings.

CE 443. Foundation Design. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 341, CE 341A. Site investigation, selection of foundation types and basis for design, allowable loads, and permissible settlements of shallow and deep foundations. Computations of earth pressure and design of retaining walls.

CE 450. Urban Planning. 3 credits, 3 contact hours (3;0;0).
Prerequisite: junior engineering standing. Introduction to urban planning, its principles, techniques, and use. Topics include development of cities, planning of new towns, redevelopment of central cities, and land use and transportation planning.

CE 461. Professional Practice in CEE. 3 credits, 3 contact hours (3;0;0).
Develop an understanding of the process to become a licensed professional engineer and familiarize the students with the professional practice of engineering including codes of ethics and professional business practices and to provide an adequate background for the Fundamentals of Engineering.

CE 465. Green and Sustainable Civil Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 210 and Junior standing. Designed to teach students currently available approaches that incorporate renewable energy and sustainable development concepts in civil engineering projects. This will include various methods of planning, design, and evaluation which promote increased energy efficiency and sustainable use of materials. Cost estimating and life cycle planning will also be included. The course will encourage students to look beyond the information in the course, to come up with additional methodologies which may not currently be in use.

CE 485. Special Topics in Civil Engineering. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in an area of civil engineering not regularly covered in any other CE course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course.

CE 490. Civil Engineering Projects. 3 credits, 3 contact hours (0;0;3).
Restriction: senior standing in civil engineering and approval of the department. Work on an individually selected project, guided by the department faculty advisor. The project may include planning, research (library or laboratory), engineering reports, statistical or analytical investigations, and designs. Any of these may follow class-inspired direction or the student may select his or her own topic. The project must be completed and professionally presented by assigned due dates for appropriate review and recording of accomplishment.

CE 491. Research Exper-Civil Engr. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Junior standing, agreement of a department faculty advisor, and approval of the associate chairperson for undergraduate studies. This course provides the student with an opportunity to work on a research project under the individual guidance of a member of the department. A written report is required for course completion. Open to students with a GPA of 3.0 or higher.

CE 494. Civil Engineering Design I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 210, CE 260, CE 320, CE 321, CE 350, CE 341 , CE 341A and senior standing in civil engineering. Simulates the submission and acceptance process normally associated with the initial design phases for a civil engineering project. Familiarizes students with the preparation of sketch plats, preliminary engineering design, and a related environmental assessment. Requirements include written submittals and oral presentations in defense of the project.

CE 495. Civil Engineering Design II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 333, CE 432, CE 443. Pre or Corequisite: CE 494. Provides students with the type of design experience they would receive if engaged in civil and environmental engineering design practice including incorporating engineering standards and multiple constraints. Students can select from these design areas: structures, geotechnical engineering, transportation and planning, and sanitary and environmental engineering.

CE NEXT. Civil Engineering Next Generation Professional Practice Seminar. 0 credits, 1 contact hour (0;0;1).
Restrictions: Civil and Environmental Engineering Junior and Senior students only. CE Next Gen is a non-credit elective course that introduces students to several soft skills that will enhance their ability to succeed in the field of civil and environmental engineering. Students will develop skills in communication, relationship building, public speaking, business etiquette, time management, negotiating, interviewing and presentation. The course will also help students improve their self-confidence, emotional intelligence, and interpersonal skills. Students will engage in a variety of in- class activities, homework, group projects, and presentations throughout the semester. The group projects will provide a platform to focus on the skills learned and connect skillsets.

ENE 262. Introduction to Environmental Engineering. 3 credits, 4 contact hours (3;1;0).
Prerequisites: CHEM 126, MATH 112, and PHYS 121. To introduce students to the integrated science, engineering, design and management concepts of engineered environmental systems. The course will cover environmental regulations and standards, environmental parameters, mass balance and natural systems, water quality management, water and wastewater treatment, air pollution control, noise pollution, and solid and hazardous waste management. Background material and laboratories in the environmental sciences and management areas will be covered. Group term papers and presentations will be required.

ENE 360. Water and Waste Water Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENE 262 and junior standing. Training in the methods used for water pollution control. Topics include the chemical, physical, and biological processes that occur in waste treatment design and in receiving waters; modeling schemes to determine allowable loadings in various bodies of water; and waste treatment processes used for water pollution control.

ENE 361. Solid and Hazardous Waste Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENE 262 and junior standing. Exposure to the area of air pollution control, solid waste disposal, and radioactive waste disposal. Topics include the chemistry of contaminated atmospheres; the influence on meteorological conditions of dispersion of pollutants; abatement processes used in the control of emissions; classification and nature of solid waste, and solid waste disposal techniques; sources and methods for the disposal of radioactive contaminants; and related health effects.

ENE 362. Pollution Prevention. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126, MATH 111. Restriction: Junior Standing. This course presents pollution prevention concepts and principles, terminologies, life cycle impact approaches, and management strategies. It will also serve as a community based service learning course. The course introduces available improvement techniques for industrial pollution prevention and control and examines specific applications to industries biological, chemical, physical, and thermal techniques.

ENE 465. Sustainable Environmental Infrastructure. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENE 262. Environmental engineering concerns itself with preserving and restoring the quality of water, air, and soil. This course will examine drinking water, stormwater, wastewater, solid waste, and soil remediation activities from the perspective of sustainability, highlighting proven approaches. Sustainability will be framed within the Envision certification and Life Cycle Analysis (LCA) approach, with consideration of environmental justice issues.

ENE 485. Special Topics in Environmental Engineering. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in an area of environmental engineering not regularly covered in any other ENEcourse. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course.

ENE 490. Senior Project. 3 credits, 3 contact hours (0;0;3).

ENE 491. Research Experience in ENE. 3 credits, 3 contact hours (3;0;0).

MECH 234. Engineering Mechanics. 2 credits, 2 contact hours (2;0;0).
Prerequisites: PHYS 111, MATH 112. A course for industrial, materials and mechanical engineering students in which the equilibrium of particles and rigid bodies subject to concentrated and distributed forces is studied.

MECH 235. Statics. 3 credits, 4 contact hours (3;0;1).
Prerequisites: PHYS 111, MATH 112. Available for CE students only. Provides an understanding of equilibrium of particles and rigid bodies subject to concentrated and distributed forces.

MECH 236. Dynamics. 2 credits, 2 contact hours (2;0;0).
Prerequisites: MECH 234 or MECH 235 with a grade of C or better or MECH 320 and MATH 112, PHYS 111/PHYS 111A. Provides an understanding of the mathematics of the motion of particles and rigid bodies, and of the relation of forces and motion of particles.

MECH 237. Strength Of Materials. 3 credits, 4 contact hours (3;1;0).
Prerequisites: MECH 234 or MECH 235 with a grade of C or better and MATH 112, PHYS111/PHYS 111A. A working knowledge of statics with emphasis on force equilibrium and free body diagrams. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions. Lab should be taken concurrently.

MECH 320. Statics and Strength of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 111, MATH 112. For chemical engineering and electrical engineering majors. Statics provides an understanding of the equilibrium of particles and rigid bodies, including simple machines, trusses, and frictional forces. Mechanics of materials covers pressure vessels, thermal stresses, torsion of shafts, stresses and deflection in beams, and column action.

B.S. in Civil Engineering

(120 credits minimum)

First Year		
1st Semester		**Credits**
CS 101	Computer Programming and Problem Solving	3
CHEM 125	General Chemistry I	3
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
FYS SEM	First-Year Student Seminar	0
CHEM 125A	General Chemistry Lab I	1
	Term Credits	**16**
2nd Semester		
CHEM 126	General Chemistry II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1

CE 101	CE Computer Aided Design	1
	Term Credits	**15**
Second Year		
1st Semester		
CE 200	Surveying	2
CE 200A	Surveying Laboratory	1
MATH 211	Calculus III A	3
MATH 279	Statistics and Probability for Engineers	2
MECH 235	Statics	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**15**
2nd Semester		
CE 210	Construction Materials and Procedures	3
CE 260	Civil Engineering Methods	2
MATH 322	Differential Equations for Applications	3
MECH 237	Strength Of Materials	3
ENE 262	Introduction to Environmental Engineering	3
	Term Credits	**14**
Third Year		
1st Semester		
CE 320	Fluid Mechanics	3
CE 320A	Hydraulics Laboratory	1
CE 321	Water Resources Engineering	3
CE 332	Structural Analysis	3
MECH 236	Dynamics	2
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**15**
2nd Semester		
CE 333	Reinforced Concrete Design	2
CE 341	Soil Mechanics	3
CE 341A	Soil Mechanics Laboratory	1
CE 350	Transportation Engineering	3
CE 360	Sustainable Civil Engr Mat	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
CE 431	Construction Materials Lab	1
CE 432	Steel Design	2
CE 443	Foundation Design	3
CE 494	Civil Engineering Design I	3
CE Elective [1]		3
300-level GER: Select one of the following:		3
COM 339	Practical Journalism	
COM 312	Oral Presentations	
COM 319	Technical, Professional and Scientific Writing for Publication	
COM 337	Photojournalism	
COM 316	Creative Writing	
	Term Credits	**15**
2nd Semester		
CE 495	Civil Engineering Design II	3

CE Designated Elective [1]		3
Science Elective [2]		3
IE 492	Engineering Management	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**120**

Co-op Option A Track

(145 credits minimum)

First Year		
1st Semester		**Credits**
CS 101	Computer Programming and Problem Solving	3
CHEM 125A	General Chemistry Lab I	1
CHEM 125	General Chemistry I	3
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
CHEM 126	General Chemistry II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
CE 101	CE Computer Aided Design	1
	Term Credits	**15**
Second Year		
1st Semester		
CE 200	Surveying	2
CE 200A	Surveying Laboratory	1
MATH 211	Calculus III A	3
MATH 279	Statistics and Probability for Engineers	2
MECH 235	Statics	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**15**
2nd Semester		
CE 210	Construction Materials and Procedures	3
CE 260	Civil Engineering Methods	2
MATH 322	Differential Equations for Applications	3
MECH 237	Strength Of Materials	3
ENE 262	Introduction to Environmental Engineering	3
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**15**
Summer		
CO-OP I		
	Term Credits	**0**

Third Year		
1st Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
2nd Semester		
CE 320	Fluid Mechanics	3
CE 320A	Hydraulics Laboratory	1
CE 321	Water Resources Engineering	3
CE 332	Structural Analysis	3
MECH 236	Dynamics	2
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**15**
Summer		
CO-OP II		
	Term Credits	**0**
Fourth Year		
1st Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
2nd Semester		
CE 333	Reinforced Concrete Design	2
CE 341	Soil Mechanics	3
CE 341A	Soil Mechanics Laboratory	1
CE 350	Transportation Engineering	3
CE 360	Sustainable Civil Engr Mat	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fifth Year		
1st Semester		
CE 431	Construction Materials Lab	1
CE 432	Steel Design	2
CE 443	Foundation Design	3
CE 494	Civil Engineering Design I	3
CE Elective		3
Select one of the following:		3
COM 339	Practical Journalism	
COM 312	Oral Presentations	
COM 319	Technical, Professional and Scientific Writing for Publication	
COM 313	Technical Writing	
COM 316	Creative Writing	
	Term Credits	**15**
2nd Semester		
CE 495	Civil Engineering Design II	3
CE Designated Elective [1]		3
Science Elective [2]		3
IE 492	Engineering Management	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**145**

Co-op Option B Track

(145 credits minimum)

First Year		
1st Semester		**Credits**
CE 101	CE Computer Aided Design	1
CS 101	Computer Programming and Problem Solving	3
CHEM 125	General Chemistry I	3
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
CHEM 126	General Chemistry II	3
CHEM 124		
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
	Term Credits	**14**
Second Year		
1st Semester		
CE 200	Surveying	2
CE 200A	Surveying Laboratory	1
MATH 211	Calculus III A	3
MATH 279	Statistics and Probability for Engineers	2
MECH 235	Statics	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**15**
2nd Semester		
CE 210	Construction Materials and Procedures	3
CE 260	Civil Engineering Methods	2
MATH 322	Differential Equations for Applications	3
MECH 237	Strength Of Materials	3
ENE 262	Introduction to Environmental Engineering	3
	Term Credits	**14**
Third Year		
1st Semester		
CE 320	Fluid Mechanics	3
CE 320A	Hydraulics Laboratory	1
CE 321	Water Resources Engineering	3
CE 332	Structural Analysis	3
MECH 236	Dynamics	2
History and Humanities GER 200 level (p. 106)		3
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**16**
2nd Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**

Summer		
CO-OP I		
	Term Credits	**0**
Fourth Year		
1st Semester		
CE 333	Reinforced Concrete Design	2
CE 341	Soil Mechanics	3
CE 341A	Soil Mechanics Laboratory	1
CE 350	Transportation Engineering	3
CE 360	Sustainable Civil Engr Mat	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
2nd Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
Summer		
CO-OP II		
	Term Credits	**0**
Fifth Year		
1st Semester		
CE 431	Construction Materials Lab	1
CE 432	Steel Design	2
CE 443	Foundation Design	3
CE 494	Civil Engineering Design I	3
CE Elective		3
Select one of the following:		3
COM 339	Practical Journalism	
COM 312	Oral Presentations	
COM 319	Technical, Professional and Scientific Writing for Publication	
COM 313	Technical Writing	
COM 316	Creative Writing	
	Term Credits	**15**
2nd Semester		
CE 495	Civil Engineering Design II	3
CE Designated Elective [1]		3
Science Elective [2]		3
IE 492	Engineering Management	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**144**

[1] Student must choose one of the following: CE 307, CE 351, CE 410, CE 414, CE 450, EnE 360, EnE 361

[2] Biology, Geology, Geomorphology only

GER Electives

Refer to the **General Education Requirement** section of this catalog for further information on GER electives.

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Environmental Engineering Minor

Code	Title	Credits
Select five of the following:		15
CE 320	Fluid Mechanics	
CE 321	Water Resources Engineering	
CE 322	Hydraulic Engineering	
ENE 262	Introduction to Environmental Engineering	
ENE 360	Water and Waste Water Engineering	
ENE 361	Solid and Hazardous Waste Engineering	
ENE 362	Pollution Prevention	
Other courses approved by the minor coordinator.		
Total Credits		**15**

Geosystems Minor

Code	Title	Credits
CE 342	Geology	3
R460 311	Geologic Field Problems	3
Select one of the following:		3-4
R460 206 & R460 207	Env Geology and Env Geology Lab	
EVSC/CE 381	Geomorphology	
Select six to eight credits from the following: [1]		6-8
R460 314	Stratigraphy	
R460 320	Structural Geology	
R460 323	Rocks and Minerals	
R460 331	Oceanography	
R460 206 & R460 207	Env Geology and Env Geology Lab	
R460 401	Intro Geochemistry	
R460 406	Applied Geophys	
R460 427	Hydrogeology	
CE 321	Water Resources Engineering	
CE 341 & 341A	Soil Mechanics and Soil Mechanics Laboratory	
CE 381	Geomorphology	
CE 506	Remote Sensing of Environment	
CE 602	Geographic Information System (depending on space available)	
CE 644	Geology in Engineering	
SET 420	Geographic/Land Information Systems	
EPS/STS 380	Policy Issues in the Coastal Environment	
EVSC 381	Geomorphology	
STS 382	Geographical Perspectives on the Environment	
Total Credits		**15-18**

[1] Courses required for the BS degree in CE, CHEM, EVSC, or ET are not acceptable as elective courses for the Geosystems minor.

Electrical and Computer Engineering

Electrical engineering is a diversified and challenging profession concerned with the design, development, fabrication, and control of the electrical devices upon which our technological society so largely depends. Electrical engineers utilize their knowledge of devices and systems design in a multitude of areas. These include electronic circuits and devices, computers, energy conversion and distribution (including novel energy sources, solar, tidal, wind), control systems (robotics), electro-optics (lasers, sensors), and communication systems (radio, TV, cellular telephones).

The curriculum provides a broad education in mathematics, the physical sciences, humanities, and social sciences. Upon this foundation is built a depth of understanding in electrical engineering and related fields. In the senior year, students may emphasize an area of interest by selecting from a broad range of electives, including a systems pair in communications, control, computers, solid state, bio-electronics or microwave/optics.

The program seeks to produce an electrical engineer who can think analytically and creatively, work effectively, and communicate clearly with others. Electrical engineering graduates may enter industry in professional engineering work or pursue advanced studies in electrical engineering or a related field, such as biomedical engineering. They may also use their electrical engineering background as the basis for further study in a different field such as law or medicine.

The curriculum, as described below, is for students entering NJIT as freshmen in the Fall of 2007 or thereafter. Students entering before that date may have a different program and should consult the department to learn which curriculum applies.

The interdisciplinary profession of computer engineering has evolved over the last decades. Computer engineering professionals develop, design, and test computer systems. They understand both computer hardware and software and possess enough engineering breadth to design computer systems for a variety of applications. Economics and Internet flexibility have led to the widespread use of computer engineering technology. The career potential for graduates with this knowledge has been strong for many years. Computer engineering consists of basic electrical engineering and computer science curricula combined with a set of special courses in computer systems. Computer engineering students will have a broad engineering background combined with in-depth knowledge of computer hardware, software, and application tradeoffs, and the basic modeling techniques representing the computing process.

The core subject areas of computer engineering are discrete mathematics, fundamentals of computing, data structures, system software and software engineering, computing languages, operating systems, logic design, digital systems design, computer architecture, interfacing and communications. Students graduating from NJIT with a Bachelor of Science in Computer Engineering and a good academic record will be able to pursue further study leading to advanced degrees in computer engineering, electrical engineering, or computer science.

The curriculum, as described below, is for students entering NJIT as freshmen in the Fall of 2007 or thereafter. Students entering before that date may have a different program and should consult the department to learn which curriculum applies.

The Mission Statement

The Mission of the Helen and John C. Hartmann Department of Electrical and Computer Engineering at NJIT is to provide an outstanding academic and research experience to students and to prepare them to meet the needs and challenges of the 21st Century. The mission is extended to the commitment of providing state-of-the-art interactive education through innovation, cutting-edge research with real-world experience promoting industry-university partnerships and life-long learning.

NJIT Faculty

A

Abdi, Ali, Professor

Akansu, Ali N., Professor

Angizi, Shaahin, Assistant Professor

Ansari, Nirwan, Distinguished Professor

B

Bar-Ness, Yeheskel, Distinguished Professor Emeritus

C

Carpinelli, John D., Professor

Carr, William N., Professor Emeritus

Cornely, Roy H., Professor Emeritus

D

Dhawan, Atam P., Distinguished Professor

F

Feknous, Mohammed, University Lecturer

Frank, Joseph Associate Professor Emeritus

Friedland, Bernard, Distinguished Professor

G

Ge, Hongya, Associate Professor

Grebel, Haim, Professor

H

Haddad, Richard A., Professor Emeritus

Haimovich, Alexander M., Distinguished Professor

Han, Tao, Associate Professor

Hou, Sui-Hoi Edwin, Associate Professor

Hubbi, Walid, Associate Professor

K

Kam, Moshe, Professor and Dean of NCE

Khreishah, Abdallah, Associate Professor

Klapper, Jacob, Professor Emeritus

Kliewer, Joerg, Associate Professor

Ko, Dong-Kyun, Assistant Professor

L

Liu, Qing, Assistant Professor

Liu, Xuan, Assistant Professor

M

Manzhura, Oksana Yu, University Lecturer

Meyer, Andrew U., Professor Emeritus

Misra, Durgamadhab, Professor

N

Netto, Marcos, Assistant Professor

Nguyen, Hieu, Assistant Professor

Niver, Edip, Professor

P

Pong, Philip, Associate Professor

R

Raj, Ratna, University Lecturer

Rojas-Cessa, Roberto, Professor

Rosenstark, Solomon, Professor Emeritus

S

Savir, Jacob, Distinguished Professor

Shi, Yun-Qing, Professor

Sohn, Kenneth S., Professor Emeritus

Sosnowski, Marek, Professor

T

Tsybeskov, Leonid, Professor and Chair

W

Wang, Cong, Assistant Professor

Whitman, Gerald, Professor

Z

Zhou, Mengchu, Distinguished Professor

Ziavras, Sotirios G., Professor

Programs

- Computer Engineering - B.S. (p. 577)
- Electrical Engineering - B.S. (p. 583)

- Computer Engineering Minor (p. 590) (not for Electrical Engineering or Computer Science majors)
- Computer Engineering Minor (p. 591) (for Electrical Engineering majors)
- Electrical Engineering Minor (p. 591) (not for Electrical Engineering or Computer Science majors)
- Electrical Engineering Minor (p. 591) (for Computer Engineering majors)

Electrical and Computer Engineering Courses

ECE 101. Introduction to Electrical and Computer Engineering. 0 credits, 1 contact hour (0;0;1).
Familiarize students with various disciplines, career opportunities and curricula in electrical and computer enginneering. Invited speakers include faculty and industrial representatives.

ECE 231. Circuits and Systems I. 3 credits, 4 contact hours (4;0;0).
Prerequisites: PHYS 122 and MATH 112. The basic concepts of electric circuit theory and system analysis. Topics include basic circuit elements, loop and node analysis, network theorems, sinusoidal steady-state analysis, power, resonance, mutual inductance, and ideal transformers.

ECE 232. Circuits and Systems II. 3 credits, 4 contact hours (4;0;0).
Prerequisite: ECE 231. Corequisite: MATH 222. A continuation of circuits and systems with special emphasis on transient response. Topics include Laplace transform analysis, transfer functions, convolution, Bode diagrams, and Fourier series.

ECE 251. Digital Design. 3 credits, 4 contact hours (4;0;0).
Prerequisite: PHYS 122. The design of combinational and sequential logic circuits used in digital processing systems and computers. Basic register transfer operations are covered. Topics include Boolean algebra, minimization techniques and the design of logic circuits such as adders, comparators, decoders, multiplexers, counters, arithmetic logic units, and memory systems.

ECE 252. Microprocessors. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 251. An introduction to microprocessor system organization and assembly language programming. The course covers the architecture, instruction set and assembly language of a specific microprocessor. Other topics included are memory organization, input/output interfacing, interrupt processing as well as exception processing. The problems associated with the design of a single board computer are also covered. Students receiving degree credit for CIS 453 cannot receive degree credit for ECE 352. Co-listed as COE 252.

ECE 271. Electronic Circuits I. 3 credits, 4 contact hours (3;0;1).
Prerequisite: ECE 231. Corequisite: ECE 232. The electronic devices, junction diodes, bipolar transistors and field-effect transistors, are introduced and studied based on semiconductor physics models. The study then continues with analysis and design of main digital electronic circuits (NMOS and CMOS) inverters and logic gates, MOS memory and storage circuits) and with introduction to analog electronic circuits such as simple one transistor amplifiers.

ECE 291. Electrical Engineering Laboratory I. 1 credit, 3 contact hours (0;3;0).
Prerequisites: ECE 231, ENGL 101. Corequisites: ECE 232. Laboratory work in the areas covered in ECE 231, ECE 232. Assembling, testing and analysis of basic analog circuits. Emphasis electronic measurement techniques, instrumentation and data analysis. Simulations of dc, ac, and transient circuit response on the personal computer.

ECE 3. ECE Technical Elective. 3 credits, 3 contact hours (3;0;0).**

ECE 310. Co-op Work Experience I. 0 credits, 0 contact hours (0;0;0).
Restriction: completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report.

ECE 321. Random Signals and Noise. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 232. Corequisite: ECE 333. Random processes occurring in electrical engineering. An introduction to probability and random variables is followed by stochastic processes and noise. Topics include auto- and cross-correlation functions, power spectral density, response of linear systems to random signals, and noise figure calculations.

ECE 333. Signals and Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 232, MATH 222. A continuation of circuits and systems. Topics include signal models, system representations and properties, convolution, Fourier transform, sampling, z-transform, and an introduction to IIR and FIR filter design.

ECE 342. Energy Conversion. 4 credits, 5 contact hours (3;2;0).
Prerequisites: ECE 231, ECE 291. Magnetic materials and design of singly- and multiply-excited magnetic circuits. Applications to electromechanical energy converters. Transformers, and the steady-state performance of dc and ac motors, and generators. Integrated laboratory involves experiments with ac and dc electric motors, generators, and transformers.

ECE 353. Computer Organization and Architecture. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 252. Emphasizes the hardware design of computer systems. Topics include register transfer logic, central processing unit design, microprogramming, ALU design, pipelining, vector processing, micro-coded arithmetic algorithms, I/O organization, memory organization and multiprocessing.

ECE 354. Digital Test. 2 credits, 2 contact hours (2;0;0).
Prerequisites: ECE 251 or equivalent, MATH 333 or equivalent. Covers theory and practice related to test technology. Topics include fault modeling, test generation, fault simulation, design for testability, fault diagnosis, built-in self-test, scan design, and many others. Surveys several industrial design for testability structures.

ECE 361. Electromagnetic Fields. 3 credits, 4 contact hours (3;0;1).
Prerequisites: ECE 231, MATH 213 and MATH 222. The study of static electric and magnetic fields, basic laws of electrostatics (Coulomb's and Gauss's laws), scalar electric potential, electrostatic force and energy; basic laws of magnetostatics (Biot–Savart and Ampere's laws), magnetostatic force and energy, vector magnetic potential; fundamental meaning of capacitance, resistance and inductance in terms of electric and magnetic fields. Characterization of materials (conductors, dielectrics, magnetic materials). Laws of electromagnetic fields from Poisson's and Laplace's to Maxwell's equations.

ECE 362. Electromagnetic Waves Propagation. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 361. Maxwell's equations solutions, reflection and refraction of plane waves in dielectric and conducting media, transmission lines; transients and frequency domain solutions in lossy and lossless lines, Smith chart and its applications, parallel plate and rectangular waveguides.

ECE 368. Signal Transmission. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 232, ECE 251. This course is not for EE majors. Signal transmission both within and between digital systems. Topics include the telegrapher's equations, wave propagation, lattice diagrams, transients in digital systems, crosstalk, proper termination for high-speed logic, and the transmission characteristics of various interconnecting geometries.

ECE 372. Electronic Circuits II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 232, ECE 271. Principles of MOSFET and BJT small signal amplifiers: Q point design, input and output impedance, gain, and signal range limitations for different single stage configurations. Design of analog integrated circuits including differential amplifiers, current sources, active loads. Transistor high frequency models, Miller effect, and frequency response of multistage amplifiers. Feedback in multistage amplifiers. Design and analysis of nonlinear circuits based on comparators. Design and analysis of signal generators.

ECE 374. Electronic Device I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 271. This course addresses electronic devices on a fundamental level. Topics include semiconductors, structure and properties of p/n junction, Schottky barrier, BJT, MOS, MOS FET, semiconductor optoelectronics.

ECE 375. Introduction to Semiconductor Devices. 4 credits, 5 contact hours (3;2;0).
Prerequisites: ECE 271, ECE 291. This course addresses electronic devices on a fundamental level. Topics include major semiconductor properties, p/n junction, Schottky barrier, BJT, MOSFET and optoelectronics devices. Integrated laboratory involves measurements and simulations of semiconductor device characteristics.

ECE 392. Electrical Engineering Laboratory II. 2 credits, 3 contact hours (0;3;0).
Prerequisites: ECE 271, and ECE 291. Co-requisite: ECE 372. Laboratory work in the areas covered in ECE 232, ECE 271 and ECE 372. Design, computer simulation, testing and performance analysis of analog and digital electronic circuits.

ECE 394. Digital Systems Lab. 1 credit, 3 contact hours (0;3;0).
Prerequisites: ECE 251, ECE 271 and ECE 291. Experiments emphasize digital design from basic electronic circuits to complex logic. Topics include switching speed, basic sequential circuits, the arithmetic/logic unit, and computer memories.

ECE 395. Microprocessor Laboratory. 2 credits, 4 contact hours (0;4;0).
Prerequisites: ECE 291, ECE 252. In this laboratory the students are expected to learn to apply their theoretical knowledge of both the hardware and software aspects of microprocessors. To attain this objective the students are required to construct a microprocessor based single board computer (SBC), with adequate interfacing capabilities to be able to perform some useful control tasks. Programming of the device is done in assembly language. Some of the experiments that follow the construction project deal with software while others deal with the problems of interfacing of microprocessors.

ECE 405. Electrical Engineering Principles. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 121 or PHYS 122 and Junior standing. (No credit for ECE students.) For non-electrical engineering majors. Topics include basic dc and ac circuits, basic electronics, an introduction to electromechanical energy conversion and control theory.

ECE 410. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ECE 310, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience. Mandatory participation in seminars and completion of requirements that include a report and/or project. May count as EE or approved elective. Note: Normal grading applies to this COOP Experience.

ECE 414. Electrical and Computer Engineering Project I. 1 credit, 1 contact hour (1;0;0).
Prerequisites: ECE 353, ECE 368, ECE 394 and ECE 395, or ECE 321, ECE 341 or ECE 342, ECE 372, ECE 392. With the instructor's approval, some of these courses can be taken as co-requisites. Student teams prepare and submit technical proposals for the senior design ("capstone") project to be completed the following semester in ECE 416 or ECE 417. Discussion of issues related to the engineering profession, including such topics as: intellectual property, sources of technical information, engineering codes and standards, professional organizations, professional registration. Required of all ECE students.

ECE 416. Electrical and Computer Engineering Project II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 414. Continuation and completion of the project based on the proposal approved in ECE 414. Progress of the project is monitored by the instructor with demonstrations and presentations at given due dates of the regularly scheduled course. An oral presentation and demonstration of the project by the student team must be given and a written report submitted at the end of the course. Successful projects are approved for the presentation at the Senior Design Project Workshop in the presence of students, faculty and industry representatives.

ECE 417. Electrical & Computer Engineering Project II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: ECE 414. Faculty adviser approval required. Continuation and completion of the project based on the proposal approved in ECE 414 guided by a faculty or a faculty and industrial mentors with meetings scheduled as needed. A formal written report is presented to the faculty advisor at the end of the course. An oral presentation of a successful project is made at the Senior Design Project Showcase attended by students, faculty, and industry representatives.

ECE 418. Independent Study. 3 credits, 3 contact hours (0;0;3).
Requirements: senior standing or approval of the associate chairperson for undergraduate studies, a GPA greater than 3.0, and agreement of a faculty advisor. Provides the student with an opportunity to work on a research project under individual guidance of a faculty. The required work and intellectual challenge correspond to at least those of other senior ECE courses. A written report is required for the course completion.

ECE 421. Digital Data Communication. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 232, MATH 333, or ECE 321. Topics include signal classification, correlation, spectral analysis, noise, signal transmission through linear systems, principles of digital data transmission, AM, FM and pulse modulations, sampling and digitalization of signals, inter-symbol interference and equalization, channel capacity, data compression techniques, error detection and correction methods.

ECE 422. Computer Communications Networks. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 321 or MATH 333. Introduction to the fundamental concepts of computer communication networks. Topics include the OSI reference model, the physical, data link, network, and transport layers, TCP/IP, LANs (including token ring, token bus, and ethernet), ALOHA, routing and flow control.

ECE 423. Data Communications Networking Devices. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 421 or ECE 481. Provides a working knowledge of data communication networking devices, including modems, routers, multiplexers, switches, and concentrators and are used as building blocks in the implementation, modification, or optimization of data communications networks. Emphasizes device design, functionality and physical layer protocols.

ECE 424. Optical Communication Network. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 232 and either ECE 321 or MATH 333. Focuses on digital optical networks, architecture, modulation techniques, and detection noise. Related topics are wireless communication, infrared link, and CATV. Computer simulations of network systems are done with commercial software packages.

ECE 425. Wireless Communication Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 481 or ECE 421. Introduction to wireless system design and engineering. Develops an understanding and appreciation of the wireless engineering problems such as cellular layout design, resource allocation, mobility management, capacity and performance and signaling load calculations. Introduces physical layer building blocks such as modulation, synchronization, coding, diversity, equalization, and spreading.

ECE 429. Computer Communications Lab. 2 credits, 4 contact hours (0;4;0).
Prerequisite: ECE 422. Experiments with different protocols and standards used in the TCP/IP computer communications, including Ethernet/802.3 standard, Address Resolution Protocol (ARP), Internet Protocol (IP), Transport Control Protocol (TCP), User Datagram Protocol (UDP), and others. Exercises with network measurements and virtualization tools, and configurations of some commercial routers are included.

ECE 431. Introduction to Feedback Control Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 333, or ECE 232 and MATH 337. Concept of feedback control. Typical feedback control systems. System dynamics by Laplace transform and state space methods. Stability definition and assessment: Routh-Hurwitx criteria. Graphical stability methods: Root locus, Nyquist and Bode plots. Performance evaluation and simulation. Matlab/Simulink used extensively. A good background in Laplace transform and linear (matrix) algebra highly desirable.

ECE 432. Advanced Control Systems and Robotics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 431. Study of control systems with an emphasis on the modern control theories based on state space methods. Modeling and analysis of dynamic systems, feedback and feedforward control strategies, observers, and computer-based control systems. An introduction to optimal control, which is the foundation of advanced intelligent control methods such as model predictive control and reinforcement learning. The topics covered in the course are illustrated with applications in robotics.

ECE 435. Medical Imaging Instrumentation and Data Acquisition Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 231, ECE 252 and ECE 333. Three-Dimensional medical imaging modalities including X-ray Computer Tomography, Magnetic Resonance Imaging, Single Photon Emission Computer Tomography, Positron Emission Tomography, and Ultrasound utilizes advanced highly integrated electronic sensors, fast processor-based computers, and advanced signal proessing and reconstruction methods.

ECE 436. Bio Control Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 431. This course provides an introduction to dynamic and control in biological systems, with particular emphasis on engineering aspects of biological oscillators/waves. A combination of theoretical and simulation tools will be applied to analyze the qualitative and quantitative properties of selected biological systems. Feedback and control mechanisms in selected biological systems will be introduced. Real time signal acquisition and processing are also adressed.

ECE 439. Control Systems Laboratory. 2 credits, 4 contact hours (0;4;0).
Prerequisite: ECE 431. Laboratory work in the design and synthesis of control systems, closely coordinated with the control systems elective.

ECE 441. Power Electronics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 373. Electronic devices and circuits used to energize various apparatus and systems. Topics include circuits, freewheeling diodes, thyristors, firing and commutation of silicon-controlled rectifiers, converters, dc choppers, and power supplies.

ECE 442. Power Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 341 or ECE 342. Introduction to power plants and power networks. Topics include transmission line parameters, system modeling, economic operations of power systems, load flow studies, short circuit analysis, and power system stability.

ECE 443. Renewable Energy Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 231 and ECE 271. This course presents the various sources of renewable energy including wind, solar, and biomass as potential sources of energy and investigates the contribution they can make to the energy profile of the nation. The technology used to harness these resources will be presented. Discussions of economic,environment, and social policies are integral components of the course.

ECE 449. Power Systems Laboratory. 2 credits, 4 contact hours (0;4;0).
Pre or Corequisite: ECE 442. Laboratory work in the design and synthesis of power systems, closely coordinated with the power systems elective.

ECE 451. Advanced Computer Architecture. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 353. This course focuses on advanced concepts in computer systems design, and the interaction between hardware and software components at various levels (i.e., hardware/software codesign). It introduces common performance measures and tradeoffs used by hardware and software designers to facilitate comparative analysis. The main topics are power wall and memory wall technology challenges, pipelining, multicore architecture, advanced memory technologies with an emphasis on non-volatile memories, introduction to parallel computing, domain-specific architectures (i.e., FPGA, ASIC), and an introduction to analog and digital in-memory computing.

ECE 452. High Performance Computer Architecture. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 451. The course focuses on recent advances and topics of current active research in the field of computer architecture. It includes new computing paradigms such as brain-inspired non-von Neumann architectures, heterogeneous computing systems, and parallel machine learning accelerator architectures. It also covers topics related to hybrid memory systems, architectures of emerging memory technologies, rowhammer and secure and reliable memory systems, and memory consistency.

ECE 453. Introduction to Discrete Event Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ECE 251 or CS 251 or equivalent, and MATH 333 or ECE 321 or equivalent. Introduces logical models, timed models, and stochastic timed models of discrete event systems. Applies petri net methodology to the modeling of computer systems, flexible manufacturing systems, communication networks, and robotics. Contrasts the approaches of simulation, elementary queueing theory, and Markov processes.

ECE 457. Digital Image Processing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 333. An introduction to the fundamental techniques for digital image processing. Covers human visual sstems, image sensing and acquisition, image sampling and quantization, 1-D and 2-D systems, image enhancement, image restoration, image degradation, features extraction, and image segmentation.

ECE 459. Advanced Computer Systems Design Lab. 2 credits, 4 contact hours (0;4;0).
Prerequisites: ECE 451, ECE 495. Corequisite: ECE 452. Design laboratory component of the advanced computer systems technical track offered to COE majors in the senior year. Experiments emphasize advanced CPU design concepts, such as RISC approaches and exception handling, multiprocessor and systolic array computers, and FPGAs. Develop software programs to test the capabilities of these hardware designs.

ECE 461. Microwave and Integrated Optics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 362. The analysis and design of microwave transistor amplifiers and oscillators using scattering parameter techniques. Topics include transmission line theory, scattering parameters, matching networks, signal flow graphs, amplifier design considerations (power gain stability, noise and band width), and negative resistance oscillator design.

ECE 462. RF/Fiber Optics Systems Elective. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 362. Topics include dielectric waveguides and optical fibers, semiconductor optical sources and detectors; rf/microwave modulation and demodulation of an optical carrier; design concepts in optical transmitters and receivers; and usage of CAD software tools for rf/microwave simulations.

ECE 463. Optoelectronics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 374. The course addresses electronic and optoelectronics device concepts. Topics include optical materials, semiconductor materials, light propagination in waveguide, solar cell, LED and modulation of light.

ECE 469. RF/Microwave and Fiber Optics Systems Laboratory. 2 credits, 4 contact hours (0;4;0).
Corequisite: ECE 462. Laboratory work in characterization of RF/microwave transmission structures and optical fibers, sources and detectors, spectral and time domain (OTDR) measurements in micro-waves and optics. Experiments in microwave and fiber optic links. Usage of CAD software tools for RF/microwave simulations.

ECE 472. Pulse Techniques. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 373. Topics in electronics including linear and non-linear operational-amplifier circuits, the frequency compensation of operational-amplifiers, higher-order active filters including switched-capacitor designs, waveform generators, multi-vibrators, timers, waveshapers, converters, and other selected topics.

ECE 475. VLSI Circuits. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 372. Topics include MOSFETs, their characteristics and use in analog and digital circuit design, static and dynamic circuits; memory cells; differential stages; symbolic layout of NMOS and CMOS circuits; fundamentals of silicon processing technology and associated design rules and methodology; calculation of chip performance including power, speed and area; logic arrays.

ECE 481. Digital Communications Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 321. An introduction to digital communications systems and modulation and techniques, along with simulation experiments of communications systems and techniques in Matlab/Simulink. Description of AM and FM modulations, sampling and digitalization of signals, baseband and carrier-modulated digital transmission, signal detection in noise, inter-symbol interference and equalization, channel capacity, data compression techniques, error detection and correction methods.

ECE 482. Communications Systems Elective. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECE 481. A continuation of the study of communications systems with selected topics from different areas of communications theory such as sampled-data communications, information theory and noise.

ECE 489. Communications Systems Laboratory. 2 credits, 4 contact hours (0;4;0).
Prerequisite: ECE 421. The laboratory experiments are designed using Matlab/Simulink and Software Defined Radio (SDR). The major lab tasks include time and frequency domain analysis of AM and FM signals, generation and detection of digitally modulated waveforms such as BPSK, QPSK, 16QAM and 64QAM which are widely used in wireless communication networks. Through the experiments, students learn how to use Matlab/Simulink to control the SDR, to assess and combat the impairments due to noise and interference, and become familiar with instruments such as spectrum analyzers, audio analyzers and noise generators.

ECE 492. Electrical Engineering Laboratory III A. 1 credit, 3 contact hours (0;3;0).
Prerequisites: ECE 341, ECE 392. Restrictions: For Electrical Engineering majors only. A senior laboratory with experiments in power and energy conversion, including ac and dc electric motors, generators, and transformers.

ECE 493. Electrical Engineering Laboratory III B. 1 credit, 3 contact hours (0;3;0).
Prerequisites: ECE 374, ECE 392. Restrictions: For Electrical Engineering majors only. A senior laboratory with experiments involving semiconductor and optoelectronic devices. Characteristics of diodes, transistors, solar cells, and semiconductor sensors are measured using computer-controlled instrumentation.

ECE 494. Electrical Engineering Laboratory III. 2 credits, 3 contact hours (1;2;0).
Prerequisites: ECE 341, ECE 374, ECE 392. A senior laboratory with experiments in two distinct areas: A) power and energy conversion, and B)semiconductor devices. Part A involves experiments with full size ac and dc electric motors, generators, and transformers. In part B characteristics of diodes, transistors and solar cells are measured using computer controlled instrumentation.

ECE 495. Computer Engineering Design Lab. 3 credits, 5 contact hours (1;4;0).
Prerequisites: ECE 353, ECE 394. Preparation for putting into practice the concepts learned in ECE 353. Emphasizes hardware design and debugging. Topics include combinational and sequential logic design using CAD tools, design based upon PLA/PLD devices, computer interface design using hardware and software, and an open-ended design project such as a central processing unit design.

ECE 498. Special Topics in Electrical and Computer Engineering. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in an area of electrical and computer engineering not regularly covered in any other ECE course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course.

B.S. in Computer Engineering

(120 credit minimum)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
CS 115	Introduction to Computer Science in C++	3
MATH 112	Calculus II	4
PHYS 122	Electricity & Magntsm ECE Appl	3
PHYS 121A	Physics II Lab	1
ECE 101	Introduction to Electrical and Computer Engineering	0
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
CS 116	Introduction to Computer Science II in C++.	3
ECE 231	Circuits and Systems I	3
ECE 251	Digital Design	3
MATH 222	Differential Equations	4
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
ECE 232	Circuits and Systems II	3
ECE 252	Microprocessors	3
ECE 271	Electronic Circuits I	3
ECE 291	Electrical Engineering Laboratory I	1
MATH 213	Calculus III B	4
	Term Credits	**14**
Third Year		
1st Semester		
CS 280	Programming Language Concepts	3
ECE 368	Signal Transmission	3
ECE 395	Microprocessor Laboratory	2
MATH 326	Discrete Analysis for Computer Engineers	3
MATH 333	Probability and Statistics	3
	Term Credits	**14**
2nd Semester		
CS 332	Principles of Operating Systems	3
MATH 340 or MATH 337	Applied Numerical Methods or Linear Algebra	3

ECE 353	Computer Organization and Architecture	3
ECE 394	Digital Systems Lab	1
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
Select one of the following:		3
MGMT 390	Principles of Business	
IE 492	Engineering Management	
ECON 201	Economics	
ECON 265	Microeconomics	
ECON 266	Macroeconomics	
	Term Credits	**16**
Fourth Year		
1st Semester		
ECE 414	Electrical and Computer Engineering Project I	1
ECE 495	Computer Engineering Design Lab	3
COE Track Elective I		3
COE Track Elective II		3
Technical Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
ECE 416 or ECE 417	Electrical and Computer Engineering Project II or Electrical & Computer Engineering Project II	3
COE Track Laboratory Elective		2
COE Track Elective III		3
Technical Elective		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
	Total Credits	**120**

Computer Engineering Tracks

The computer Engineering technical tracks are designed to provide in-depth study in a specialty area. Students at the fourth year of the curriculum must choose one of the available tracks. Courses are listed below. Students may take alternative courses but must see their academic advisor for approval.

Code	Title	Credits
Computer Engineering Tracks - Select one of the following:		
1. Advanced Computer Systems Track		
ECE 451	Advanced Computer Architecture	
ECE 452	Advanced Computer Architecture II	
ECE 453 or IS 461	Introduction to Discrete Event Systems Systems Simulation	
ECE 459	Advanced Computer Systems Design Lab	
2. Computer Communications Track		
ECE 421	Digital Data Communication	
ECE 422	Computer Communications Networks	
ECE 425	Wireless Communication Systems	
ECE 429	Computer Communications Lab	

Computer Engineering Technical Electives - 3 courses

The ECE Elective must be a 300 or 400 level ECE course or an advisor approved upper level engineering, science or mathematics course. Elective courses cannot cover the same material as other courses taken by the student. For example, a CS course covering the same material as an ECE course taken by the student cannot count as a technical elective. .Courses from the Engineering Technology Department are generally not approved as ECE electives.

Co-op

Co-op courses bearing degree credit replace a technical elective or another course approved by the faculty advisor in the student's major department. In Computer Engineering, ECE 310 Co-op Work Experience I is taken for zero credits, and ECE 410 Co-op Work Experience II is taken for 3 degree credits, upon acceptance by the faculty co-op advisor of an approved proposal.

CoOp Option A Track

(145 credits minimum)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
CS 115	Introduction to Computer Science in C++	3
MATH 112	Calculus II	4
PHYS 122	Electricity & Magntsm ECE Appl	3
PHYS 121A	Physics II Lab	1
ECE 101	Introduction to Electrical and Computer Engineering	0
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
CS 116	Introduction to Computer Science II in C++.	3
ECE 231	Circuits and Systems I	3
ECE 251	Digital Design	3
MATH 222	Differential Equations	4
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
ECE 232	Circuits and Systems II	3
ECE 252	Microprocessors	3
ECE 271	Electronic Circuits I	3
ECE 291	Electrical Engineering Laboratory I	1
MATH 213	Calculus III B	4
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**15**
Summer		
CO-OP I		
	Term Credits	**0**
Third Year		
1st Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
2nd Semester		
CS 280	Programming Language Concepts	3
ECE 368	Signal Transmission	3

ECE 395	Microprocessor Laboratory	2
MATH 326	Discrete Analysis for Computer Engineers	3
MATH 333	Probability and Statistics	3
	Term Credits	**14**
Summer		
CO-OP II		
	Term Credits	**0**
Fourth Year		
1st Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
2nd Semester		
CS 332	Principles of Operating Systems	3
MATH 340 or MATH 337	Applied Numerical Methods or Linear Algebra	3
ECE 353	Computer Organization and Architecture	3
ECE 394	Digital Systems Lab	1
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
Select one of the following:		3
MGMT 390	Principles of Business	
IE 492	Engineering Management	
ECON 201	Economics	
ECON 265	Microeconomics	
ECON 266	Macroeconomics	
	Term Credits	**16**
Fifth Year		
1st Semester		
ECE 414	Electrical and Computer Engineering Project I	1
ECE 495	Computer Engineering Design Lab	3
COE Track Elective I		3
COE Track Elective II		3
Technical Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
ECE 416 or ECE 417	Electrical and Computer Engineering Project II or Electrical & Computer Engineering Project II	3
COE Track Laboratory Elective		2
COE Track Elective III		3
Technical Elective		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
	Total Credits	**145**

Computer Engineering Tracks

The computer Engineering technical tracks are designed to provide in-depth study in a specialty area. Students at the fourth year of the curriculum must choose one of the available tracks. Courses are listed below. Students may take alternative courses but must see their academic advisor for approval.

Code	Title	Credits
Computer Engineering Tracks - Select one of the following:		
1. Advanced Computer Systems Track		
ECE 451	Advanced Computer Architecture	
ECE 452	Advanced Computer Architecture II	

ECE 453	Introduction to Discrete Event Systems
or IS 461	Systems Simulation
ECE 459	Advanced Computer Systems Design Lab
2. Computer Communications Track	
ECE 421	Digital Data Communication
ECE 422	Computer Communications Networks
ECE 425	Wireless Communication Systems
ECE 429	Computer Communications Lab

Computer Engineering Technical Electives - 3 courses

The ECE Elective must be a 300 or 400 level ECE course or an advisor approved upper level engineering, science or mathematics course. Elective courses cannot cover the same material as other courses taken by the student. For example, a CS course covering the same material as an ECE course taken by the student cannot count as a technical elective. .Courses from the Engineering Technology Department are generally not approved as ECE electives.

CoOp Option B Track

(145 credits minimum)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
CS 115	Introduction to Computer Science in C++	3
MATH 112	Calculus II	4
PHYS 122	Electricity & Magntsm ECE Appl	3
PHYS 121A	Physics II Lab	1
ECE 101	Introduction to Electrical and Computer Engineering	0
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
CS 116	Introduction to Computer Science II in C++.	3
ECE 231	Circuits and Systems I	3
ECE 251	Digital Design	3
MATH 222	Differential Equations	4
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
ECE 232	Circuits and Systems II	3
ECE 252	Microprocessors	3
ECE 271	Electronic Circuits I	3
ECE 291	Electrical Engineering Laboratory I	1
MATH 213	Calculus III B	4
	Term Credits	**14**

Third Year		
1st Semester		
CS 280	Programming Language Concepts	3
ECE 368	Signal Transmission	3
ECE 395	Microprocessor Laboratory	2
MATH 326	Discrete Analysis for Computer Engineers	3
MATH 333	Probability and Statistics	3
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**15**
2nd Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
Summer		
CO-OP I		
	Term Credits	**0**
Fourth Year		
1st Semester		
CS 332	Principles of Operating Systems	3
MATH 340	Applied Numerical Methods	3
ECE 353	Computer Organization and Architecture	3
ECE 394	Digital Systems Lab	1
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
Select one of the following:		3
MGMT 390	Principles of Business	
IE 492	Engineering Management	
ECON 201	Economics	
ECON 265	Microeconomics	
ECON 266	Macroeconomics	
	Term Credits	**16**
2nd Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
Summer		
CO-OP II		
	Term Credits	**0**
Fifth Year		
1st Semester		
ECE 414	Electrical and Computer Engineering Project I	1
ECE 495	Computer Engineering Design Lab	3
COE Track Elective I		3
COE Track Elective II		3
Technical Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**16**
2nd Semester		
ECE 416 or ECE 417	Electrical and Computer Engineering Project II or Electrical & Computer Engineering Project II	3
COE Track Laboratory Elective		2
COE Track Elective III		3
Technical Elective		3

Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
	Total Credits	**145**

Computer Engineering Tracks

The computer Engineering technical tracks are designed to provide in-depth study in a specialty area. Students at the fourth year of the curriculum must choose one of the available tracks. Courses are listed below. Students may take alternative courses but must see their academic advisor for approval.

Code	Title	Credits
Computer Engineering Tracks - Select one of the following:		
1. Advanced Computer Systems Track		
ECE 451	Advanced Computer Architecture	
ECE 452	Advanced Computer Architecture II	
ECE 453	Introduction to Discrete Event Systems	
or IS 461	Systems Simulation	
ECE 459	Advanced Computer Systems Design Lab	
2. Computer Communications Track		
ECE 421	Digital Data Communication	
ECE 422	Computer Communications Networks	
ECE 425	Wireless Communication Systems	
ECE 429	Computer Communications Lab	

Computer Engineering Technical Electives - 3 courses

The ECE Elective must be a 300 or 400 level ECE course or an advisor approved upper level engineering, science or mathematics course. Elective courses cannot cover the same material as other courses taken by the student. For example, a CS course covering the same material as an ECE course taken by the student cannot count as a technical elective. .Courses from the Engineering Technology Department are generally not approved as ECE electives.

Refer to the General Education Requirements (p. 105) section of this catalog for further information on electives.

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Electrical Engineering

(120 credit minimum)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
CS 115	Introduction to Computer Science in C++	3
MATH 112	Calculus II	4
PHYS 122	Electricity & Magntsm ECE Appl	3
PHYS 121A	Physics II Lab	1
ECE 101	Introduction to Electrical and Computer Engineering	0

ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
PHYS 234	Physics III	3
ECE 231	Circuits and Systems I	3
ECE 251	Digital Design	3
MATH 222	Differential Equations	4
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
ECE 232	Circuits and Systems II	3
ECE 252	Microprocessors	3
ECE 271	Electronic Circuits I	3
ECE 291	Electrical Engineering Laboratory I	1
MATH 213	Calculus III B	4
	Term Credits	**14**
Third Year		
1st Semester		
ECE 333	Signals and Systems	3
ECE 361	Electromagnetic Fields	3
ECE 372	Electronic Circuits II	3
ECE 395	Microprocessor Laboratory	2
ECE 392	Electrical Engineering Laboratory II	2
Select one of the following:		3
MGMT 390	Principles of Business	
IE 492	Engineering Management	
ECON 201	Economics	
ECON 265	Microeconomics	
ECON 266	Macroeconomics	
	Term Credits	**16**
2nd Semester		
ECE 321	Random Signals and Noise	3
ECE 362	Electromagnetic Waves Propagation	3
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
ECE 342	Energy Conversion	4
ECE 375	Introduction to Semiconductor Devices	4
	Term Credits	**17**
Fourth Year		
1st Semester		
ECE 414	Electrical and Computer Engineering Project I	1
ECE Track Elective I		3
ECE Track Elective II		3
Technical Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**13**
2nd Semester		
ECE 416 or ECE 417	Electrical and Computer Engineering Project II or Electrical & Computer Engineering Project II	3
ECE Track Laboratory Elective		2
Technical Elective		3
Technical Elective		3

Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
	Total Credits	**120**

Electrical Engineering Track and Track Laboratory

Students should select one track. Courses are listed below. Students may take alternatives courses but must see their academic advisor for approval.

Code	Title	Credits
Electrical Engineering Tracks - Select one of the following:		
1. Computer Systems Track		
ECE 353	Computer Organization and Architecture	
ECE 451	Advanced Computer Architecture	
ECE 495	Computer Engineering Design Lab	
2. Controls Track		
ECE 431	Introduction to Feedback Control Systems *	
ECE 432	Advanced Control Systems and Robotics	
ECE 439	Control Systems Laboratory	
3. Electronic, Microwave and Photonic Devices Track		
ECE 461	Microwave and Integrated Optics	
ECE 462	RF/Fiber Optics Systems Elective **	
ECE 469	RF/Microwave and Fiber Optics Systems Laboratory	
4. Power Track		
ECE 443	Renewable Energy Systems	
ECE 442	Power Systems Elective **	
ECE 449	Power Systems Laboratory	
5. Telecommunications & Networking Track		
ECE 421	Digital Data Communication	3
ECE 422	Computer Communications Networks *	
or ECE 425	Wireless Communication Systems	
Telecommunications & Networking Track Lab		
ECE 429	Computer Communications Lab	
or ECE 489	Communications Systems Laboratory	

* Prerequisite for track lab
** Co-requisite for track lab

Electrical Engineering Technical Electives - 3 courses

The ECE Elective must be a 300 or 400 level ECE course or an advisor approved upper level engineering, science or mathematics course. Elective courses cannot cover the same material as ECE courses taken by the student. For example Math 333 is not allowed as an elective since ECE 321, covering similar topics, is in the EE curriculum. Similarly ECE 368 and ECE 421 are not electives in the EE program. Courses from the Engineering Technology Department are generally not approved as ECE electives.

Co-op

Co-op courses bearing degree credit replace an elective or another course approved by the faculty advisor in the student's major department. In electrical engineering, ECE 310 Co-op Work Experience I is taken for zero credits, and ECE 410 Co-op Work Experience II is taken for 3 degree credits.

CoOp Option A Track

(145 credits minimum)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3

MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
CS 115	Introduction to Computer Science in C++	3
MATH 112	Calculus II	4
PHYS 122	Electricity & Magntsm ECE Appl	3
PHYS 121A	Physics II Lab	1
ECE 101	Introduction to Electrical and Computer Engineering	0
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
PHYS 234	Physics III	3
ECE 231	Circuits and Systems I	3
ECE 251	Digital Design	3
MATH 222	Differential Equations	4
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
ECE 232	Circuits and Systems II	3
ECE 252	Microprocessors	3
ECE 271	Electronic Circuits I	3
ECE 291	Electrical Engineering Laboratory I	1
MATH 213	Calculus III B	4
ENGR 210	Career Planning Seminar for En	1
	Term Credits	**15**
Summer		
CO-OP I		
	Term Credits	**0**
Third Year		
1st Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
2nd Semester		
ECE 333	Signals and Systems	3
ECE 361	Electromagnetic Fields	3
ECE 372	Electronic Circuits II	3
ECE 395	Microprocessor Laboratory	2
Select one of the following:		3
MGMT 390	Principles of Business	
IE 492	Engineering Management	
ECON 201	Economics	
ECON 265	Microeconomics	
ECON 266	Macroeconomics	
	Term Credits	**14**
Summer		
CO-OP II		
	Term Credits	**0**

Fourth Year		
1st Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
2nd Semester		
ECE 321	Random Signals and Noise	3
ECE 362	Electromagnetic Waves Propagation	3
ECE 392	Electrical Engineering Laboratory II	2
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
ECE 342	Energy Conversion	4
ECE 375	Introduction to Semiconductor Devices	4
	Term Credits	**19**
Fifth Year		
1st Semester		
ECE 414	Electrical and Computer Engineering Project I	1
ECE Track Elective I		3
ECE Track Elective II		3
Technical Elective		3
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**13**
2nd Semester		
ECE 416 or ECE 417	Electrical and Computer Engineering Project II or Electrical & Computer Engineering Project II	3
ECE Track Laboratory Elective		2
Technical Elective		3
Technical Elective		3
Humanities and Social Science Senior Seminar GER (p. 114)		3
	Term Credits	**14**
	Total Credits	**145**

Electrical Engineering Track and Track Laboratory

Students should select one track. Courses are listed below. Students may take alternatives courses but must see their academic advisor for approval.

Code	Title	Credits
Electrical Engineering Tracks - Select one of the following:		
1. Computer Systems Track		
ECE 353	Computer Organization and Architecture	
ECE 451	Advanced Computer Architecture	
ECE 495	Computer Engineering Design Lab	
2. Controls Track		
ECE 431	Introduction to Feedback Control Systems *	
ECE 432	Advanced Control Systems and Robotics	
ECE 439	Control Systems Laboratory	
3. Electronic, Microwave and Photonic Devices Track		
ECE 461	Microwave and Integrated Optics	
ECE 462	RF/Fiber Optics Systems Elective **	
ECE 469	RF/Microwave and Fiber Optics Systems Laboratory	
4. Power Track		
ECE 443	Renewable Energy Systems	
ECE 442	Power Systems Elective **	
ECE 449	Power Systems Laboratory	
5. Telecommunications & Networking Track		

ECE 421	Digital Data Communication	3
ECE 422	Computer Communications Networks *	
or ECE 425	Wireless Communication Systems	
Telecommunications & Networking Track Lab		
ECE 429	Computer Communications Lab	
or ECE 489	Communications Systems Laboratory	

* Prerequisite for track lab
** Co-requisite for track lab

Electrical Engineering Technical Electives - 3 courses

The ECE Elective must be a 300 or 400 level ECE course or an advisor approved upper level engineering, science or mathematics course. Elective courses cannot cover the same material as ECE courses taken by the student. For example, Math 333 is not allowed as an elective since ECE 321, covering similar topics, is in the EE curriculum. Similarly, ECE 368 is not an elective in the EE program. Courses from the Engineering Technology Department are generally not approved as ECE electives.

CoOp Option B Track

(145 credits minimum)

First Year		
1st Semester		**Credits**
CHEM 125	General Chemistry I	3
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
CS 115	Introduction to Computer Science in C++	3
MATH 112	Calculus II	4
PHYS 122	Electricity & Magntsm ECE Appl	3
PHYS 121A	Physics II Lab	1
ECE 101	Introduction to Electrical and Computer Engineering	0
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**14**
Second Year		
1st Semester		
PHYS 234	Physics III	3
ECE 231	Circuits and Systems I	3
ECE 251	Digital Design	3
MATH 222	Differential Equations	4
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
ECE 232	Circuits and Systems II	3
ECE 252	Microprocessors	3
ECE 271	Electronic Circuits I	3
ECE 291	Electrical Engineering Laboratory I	1
MATH 213	Calculus III B	4
	Term Credits	**14**

Third Year		
1st Semester		
ECE 333	Signals and Systems	3
ECE 361	Electromagnetic Fields	3
ECE 372	Electronic Circuits II	3
ECE 395	Microprocessor Laboratory	2
Select one of the following:		3
MGMT 390	Principles of Business	
IE 492	Engineering Management	
ENGR 210	Career Planning Seminar for En	1
ECE 392	Electrical Engineering Laboratory II	2
	Term Credits	**17**
2nd Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
Summer		
CO-OP I		
	Term Credits	**0**
Fourth Year		
1st Semester		
ECE 362	Electromagnetic Waves Propagation	3
ECE 342	Energy Conversion	4
ECE 375	Introduction to Semiconductor Devices	4
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
ECE 321	Random Signals and Noise	3
	Term Credits	**17**
2nd Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
Summer		
CO-OP II		
	Term Credits	**0**
Fifth Year		
1st Semester		
ECE 414	Electrical and Computer Engineering Project I	1
ECE Track Elective I		3
ECE Track Elective II		3
Technical Elective		3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**13**
2nd Semester		
ECE 416 or ECE 417	Electrical and Computer Engineering Project II or Electrical & Computer Engineering Project II	3
ECE Track Laboratory Elective		2
Technical Elective		3
Technical Elective		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
	Total Credits	**145**

Electrical Engineering Track and Track Laboratory

Students should select one track. Courses are listed below. Students may take alternatives courses but must see their academic advisor for approval.

Code	Title	Credits
Electrical Engineering Tracks - Select one of the following:		
1. Computer Systems Track		
ECE 353	Computer Organization and Architecture	
ECE 451	Advanced Computer Architecture	
ECE 495	Computer Engineering Design Lab	
2. Controls Track		
ECE 431	Introduction to Feedback Control Systems *	
ECE 432	Advanced Control Systems and Robotics	
ECE 439	Control Systems Laboratory	
3. Electronic, Microwave and Photonic Devices Track		
ECE 461	Microwave and Integrated Optics	
ECE 462	RF/Fiber Optics Systems Elective **	
ECE 469	RF/Microwave and Fiber Optics Systems Laboratory	
4. Power Track		
ECE 443	Renewable Energy Systems	
ECE 442	Power Systems Elective **	
ECE 449	Power Systems Laboratory	
5. Telecommunications & Networking Track		
ECE 481	Digital Communications Systems *	
ECE 422	Computer Communications Networks *	
or ECE 425	Wireless Communication Systems	
Telecommunications & Networking Track Lab		
ECE 429	Computer Communications Lab	
or ECE 489	Communications Systems Laboratory	

* Prerequisite for track lab
** Co-requisite for track lab

Electrical Engineering Technical Electives - 3 courses

The ECE Elective must be a 300 or 400 level ECE course or an advisor approved upper level engineering, science or mathematics course. Elective courses cannot cover the same material as ECE courses taken by the student. For example, Math 333 is not allowed as an elective since ECE 321, covering similar topics, is in the EE curriculum. Similarly, ECE 368 is not an elective in the EE program. Courses from the Engineering Technology Department are generally not approved as ECE electives.

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Computer Engineering Minor

(17 credits)

For all majors except Electrical Engineering.

Code	Title	Credits
ECE 231	Circuits and Systems I	3
ECE 251	Digital Design	3
ECE 252	Microprocessors	3
ECE 291	Electrical Engineering Laboratory I	1
ECE 353	Computer Organization and Architecture	3
ECE 394	Digital Systems Lab	1

ECE 495	Computer Engineering Design Lab	3
Total Credits		**17**

Computer Engineering Minor (for Computer Science majors)

Code	Title	Credits
ECE 231	Circuits and Systems I	3
or ECE 271	Electronic Circuits I	
ECE 291	Electrical Engineering Laboratory I	1
ECE 252	Microprocessors	3
ECE 353	Computer Organization and Architecture	3
ECE 394	Digital Systems Lab	1
ECE 395	Microprocessor Laboratory	2
ECE 495	Computer Engineering Design Lab	3
Total Credits		**16**

Computer Engineering Minor (for Electrical Engineering majors)

Code	Title	Credits
CS 116	Introduction to Computer Science II in C++.	3
CS 332	Principles of Operating Systems	3
ECE 353	Computer Organization and Architecture	3
ECE 394	Digital Systems Lab	1
ECE 495	Computer Engineering Design Lab	3
Total Credits		**13**

Electrical Engineering Minor

Open to all other majors except Electrical Engineering and Computer Engineering majors.

Code	Title	Credits
ECE 231	Circuits and Systems I	3
ECE 232	Circuits and Systems II	3
ECE 271	Electronic Circuits I	3
ECE 291	Electrical Engineering Laboratory I	1
Select two of the following:		6
ECE 333	Signals and Systems	
ECE 341	Energy Conversion	
ECE 361	Electromagnetic Fields I	
ECE 372	Electronic Circuits II	
ECE 374	Electronic Device I	
Total Credits		**16**

Electrical Engineering Minor (for Computer Engineering majors)

Code	Title	Credits
ECE 333	Signals and Systems	3
ECE 341	Energy Conversion	3
ECE 361	Electromagnetic Fields I	3
ECE 372	Electronic Circuits II	3
ECE 374	Electronic Device I	3
Total Credits		**15**

Mechanical and Industrial Engineering

Mechanical Engineering is concerned with the design, development, manufacture, and operation of a wide variety of energy conversion and machine systems. Mechanical engineers employ their knowledge of materials, system design and control, production methods, and mechanics to design traditional systems (such as aircraft, automobiles, engines, robots, energy-generation plants, pumps and valves, machines and household appliances), as well as systems utilizing new technologies (such as biomedical and nano devices), to meet design specifications for performance, economy, and ease of use while complying to safety and environmental protection requirements.

The mechanical engineering program strives to develop mechanical engineering graduates who can achieve fulfilling careers in the areas of engineering practice, professional growth and service. The expectations of the accomplishments and characteristics of their career in these areas are the objectives of the ME program.

The educational preparation necessary for attainment of these objectives can only be realized through the curriculum, the instructional process and related activities of the educational program.The first two years of the curriculum provide a foundation in mathematics and science for the mechanical engineering courses offered in the third year.

The fourth year utilizes the knowledge acquired during the first three years to develop professional skills in applied areas such as thermal and fluid engineering, and systems design and control. Project courses are offered in the fourth year. CAD/CAM systems are used extensively throughout the curriculum.

The mechanical engineering curriculum prepares the student for professional work as well as graduate study in engineering or in other areas such as science, mathematics, management, medicine, law and business.

The curriculum as described below is for students entering NJIT in the fall of 2006 or after that date. Students entering before that date generally have a different program and should consult the department to learn which curriculum applies.

The Industrial Engineering curriculum prepares engineers to design, improve, install, and operate the integrated systems of people, materials, and facilities needed by industry, commerce, and society. Industrial engineers solve problems which arise in the management of systems by applying the principles of engineering science, product and process design, work analysis, human factors principles, and operations research. Industrial engineering leads to a wide variety of professional opportunities in manufacturing, service, research and development and public service enterprises, and to graduate study in industrial engineering, engineering management, business administration, law and other fields.

The industrial engineering curriculum combines three professional areas of practice: product and production process design, work analysis, and engineering management science. Students are also offered exposure to the more specialized areas of automated manufacturing systems, information systems, quality assurance, and safety engineering. In the freshman and sophomore years, the program concentrates on mathematics, physical science, and engineering science, an adequate background in these being essential to the courses presented in the later years. The courses stress fundamental principles and concepts which develop gradually and eventually culminate in a system design dealing with real engineering and management situations in an industrial commercial or public service enterprise.

The curriculum as described here is for students entering NJIT as freshmen in the fall of 2007 or after that date. Students entering before that date may have a different program and should consult the department to learn which curriculum applies.

Missions

The Mission of Mechanical Engineering

To educate mechanical engineering graduates to help the state and the country in general to stay competitive at the cutting edge of technology, to serve the profession of engineering, to become leaders in business, academia, industry, and the community and to engage in a lifetime of learning and achievement to benefit mankind.

The Mission of Industrial Engineering

The mission of the department is to

- provide for all our students an environment conducive to learning and personal growth;
- educate a diverse undergraduate and graduate student body for successful employment in industry and the pursuit of advanced studies;
- prepare students, both undergraduate and graduate, for future managerial and leadership roles;
- engage in research to support the advanced education of graduate students, maintain the intellectual vitality of the faculty, and expand the frontiers of knowledge in areas of importance to the state and nation;
- serve our profession through membership and leadership on national and international societies, and editorial boards, and
- serve our community by offering our expertise to industries, state and local constituencies, and pre-college students and teachers.

Educational Objectives

Mechanical Engineering Program Educational Objectives

The current mechanical engineering program educational objectives are:

- Graduates will meet or exceed the expectations of employers of mechanical engineers.
- Qualified graduates will pursue advanced study if they so desire.
- Graduates will pursue leadership positions in their profession and/or communities

Industrial Engineering Program Educational Objectives

1. Program graduates use the fundamental principles and major areas of Industrial Engineering in their professional practice.

2. Program graduates are life-long learners, pursuing graduate education, and professional growth in Industrial Engineering and related fields.

3. Program graduates pursue diverse career paths in a variety of industries.

Student Outcomes

ME Student Outcomes

Students from the ME program will attain (by the time of graduation):

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

3. an ability to communicate effectively with a range of audiences

4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

This program is accredited by Engineering Accreditation Commission of ABET, http://abet.org

Industrial Engineering Student Outcomes

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social and economic factors

(3) An ability to communicate effectively with a range of audiences

(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and social contexts

(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

(6) An ability to conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions

(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

This program is accredited by Engineering Accreditation Commission of ABET, http://abet.org (http://abet.org/)

NJIT Faculty

A

Abdel-Malek, Layek, Professor

Abdou, George, Associate Professor

B

Bengu, Golgen, Associate Professor

Bladikas, Athanassios, Associate Professor

Buyuktahtakin-Toy, Esra, Associate Professor

C

Cai, Wenbo, Assistant Professor

Chen, Rong-Yaw, Professor Emeritus

Chester, Shawn A., Assistant Professor

D

Das, Sanchoy K., Professor

Datta, Dibakar, Assistant Professor

Droughton, John V., Professor Emeritus

F

Fenster, Saul K., Professor Emeritus

Fischer, Ian S., Professor

Florio, Pasquale J., Professor Emeritus

H

Harnoy, Avraham, Professor Emeritus

Hatch, C., Richard, Professor Emeritus

J

Ji, Zhiming, Professor

K

Kirchner, Robert P., Professor Emeritus

Koplik, Bernard, Professor Emeritus

Kountouras, Harry V., Senior University Lecturer

L

Lee, Eon Soo, Assistant Professor

Linden, Martin J., Professor Emeritus

Lu, Lu, Assistant Professor

M

Mani, Balraj Subra, University Lecturer

Marras, Simone, Assistant Professor

Moon, Swapnil, University Lecturer

N

Nadimpalli, Siva P.V., Assistant Professor

Narh, Kwabena A., Professor

R

Ranky, Paul, Professor

Rao, I. Joga, Professor

Rosato, Anthony D., Professor

S

Samardzic, Veljko, University Lecturer

Singh, Pushpendra, Professor

Sodhi, Rajpal Singh, Professor

T

Tricamo, Stephen J., Professor

W

Wilson, Charles E., Professor Emeritus

Wolf, Carl, Professor Emeritus

Z

Zhu, Chao, Professor

Programs

Mechanical and Industrial Engineering Courses

IE 101. Introduction to Industrial Engineering. 1 credit, 2 contact hours (1;1;0).
An Introduction to the field of Industrial Engineering, the functions performed by industrial engineers, career paths and opportunities in the field, introduction to the student and senior professional societies, and initiation of a mentoring program.

IE 203. Applications of Computer Graphics in Industrial Engineering. 2 credits, 3 contact hours (1;2;0).
Restriction: sophomore standing. Methods, tools and technologies of networked, graphical/visual communication systems with an industrial engineering focus. Lean and sustainable green enterprise, product, process, service and shop floor level visual factory management systems. Provides analytical and practical knowledge of computer graphics in IE, including graphical standards necessary to meet the requirements of today?s practice. Introduction of modern web-based software tools and systems.

IE 224. Production Process Design. 3 credits, 4 contact hours (2;2;0).
Restriction: sophomore standing. Introduction to the theory and practice of manufacturing processes. Study covers the fabrication of metallic, plastic, and electrical products, operation of NC and other automatic equipment, and economics of the design and production process.

IE 310. Co-op Work Experience I. 0 credits, 0 contact hours (0;0;0).
Restriction: junior standing, approval of co-op faculty advisor, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their aca-demic program. Work assignments facilitated by the co-op office and approved by the co-op faculty advisor. Mandatory participation in seminars and completion of a report.

IE 331. Applied Statistical Methods. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 211. A presentation of statistical analysis techniques and their applications. Topics include the statistical measures describing data, frequency distributions, probability distributions, sampling parameter estimation, hypothesis testings, regression analyses, and analyses of variance. Special emphasis on their application to industrial fields.

IE 334. Engineering Economy and Capital Investment. 3 credits, 3 contact hours (3;0;0).
Restriction: junior standing. Introduction to the principles of engineering economics for utilization and evaluation of capital investments, including time value of money, depreciation, cost of capital, life cycle cost, net present value, and payback. Consideration of decisions involving multiple choice replacement, uncertainty, and risk.

IE 335. Engineering Cost Analysis and Control. 3 credits, 3 contact hours (3;0;0).
Restriction: junior standing. The tools and techniques applicable for cost analysis and control including standard costs, variance analysis, cost volume relationships, cost estimation, and utilization of accounting data for control of operations.

IE 339. Work Measurement and Standards. 3 credits, 4 contact hours (2;2;0).
Prerequisites: IE 203, IE 224. Emphasizes the measurement and evaluation of existing work methods and how improvement can be achieved. Topics include visual and micro-motion study techniques, motion economy, time study, and work sampling. The development and use of standard data and computerized techniques. Also, hands-on experience through a series of laboratory experiments.

IE 355. Human Factors. 3 credits, 3 contact hours (3;0;0).
Restriction: junior standing. Human-machine systems analysis including study of workplace layout, measurement of employee efficiency and productivity, criteria for tool and fixture design or selection, industrial fatigue, environmental influences on performance including the effects of illumination, noise, vibration, thermal, and other atmospheric factors. Basic ideas of industrial hygiene; the impact of OSHA; and special techniques for experimenting with human subjects, via demonstrations and supervised experiments.

IE 411. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: IE 310. Restriction: approval of co-op faculty advisor and permission of the Office of Cooperative Education and Internships. Full-time work experience of approximately one semester's duration. Provides major-related work experience as a co-op/intern. Mandatory participation in seminars and completion of requirements that include a report and an oral presentation to IE faculty. Note: Normal grading applies to this COOP Experience.

IE 436. Cost Analysis and Engineering Economics. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing. Not open to industrial engineering majors. Focuses on the economic factors of concern to manufacturing engineers. Major topics include justification of proposed capital expenditures, equipment retirement and replacement decisions, cost determination, profitability studies, and manufacturing budget construction and utilization for cost control.

IE 439. Deterministic Models in Operations Research. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MATH 112. The deterministic techniques of operations research. Topics include the applications of linear, nonlinear, integer, and dynamic programming methods and network flows analysis to solve industrial and systems engineering problems.

IE 440. Stochastic Models in Operations Research. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IE 331 and MATH 112. Probabilistic techniques of operations research. Topics include the applications of Markov chains, queueing and inventory control models to analyze and evaluate systems performance.

IE 441. Information and Knowledge Engineering. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing. Introduction to recent advances in the application of computers in industrial engineering and database structures, both sequential and random. Description of methods for organizing data, database modeling, information storage and retrieval. Also, applications of expert systems concepts and techniques.

IE 443. Senior Project I. 2 credits, 4 contact hours (1;3;0).
Restriction: senior standing. The first part of a capstone design experience that integrates the knowledge gained from various program courses and uses it in executing an industry-provided project. Students working in teams initiate the design or redesign process of a real-world system taking into consideration multiple realistic constraints and appropriate engineering standards. During this phase, contacts with the sponsor are established, data are collected, and the design approach is selected.

IE 444. Senior Project II. 2 credits, 4 contact hours (1;3;0).
Prerequisite: IE 443. The final part of the capstone design experience. Students complete the data analysis, finalize the design, explain the incorporation of constraints and standards, and may help the industrial sponsor with the implementation process. A substantial report of all activities is required and a presentation is made to a diverse audience that includes the project managers from industry.

IE 445. Idustrial Simulation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 101, IE 331 or equivalent. Introduction to the application of simulation modeling for the analysis of complex industrial and manufacturing service systems. Examples are chosen from real-life situations such as warehousing, material handling, robotics, transportation, and hospital emergency rooms. Verification/validation as well as statistical analysis of both input/output data are introduced.

IE 447. Legal Aspects of Engineering. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing. Familiarization with the U.S. system of case law, statutes and regulations applicable to professional relationships involving the engineer. Includes contracts, property, product liability and other torts, governmental regulatory bodies such as OSHA, EPA, and NRC, professional liability, and role of codes and standards.

IE 449. Industrial Robotics. 3 credits, 4 contact hours (2;2;0).
Prerequisites: CS 101, PHYS 121, junior or senior standing. Robotics in manufacturing systems. The field of robotics is studied with emphasis given to the role of programmable robots in manufacturing. Hands-on experience with hardware and software necessary for various industrial robot systems through laboratory experience.

IE 450. Product Engineering Standards. 3 credits, 3 contact hours (3;0;0).
Restriction: senior standing. Developing and using standards in the design, manufacturing, and use of products. Topics include economics of parts standardization, drawing and assembly techniques, and use of national and international standards. Review of the role of standards-setting bodies and methods for the development of product testing standards used in industry and commerce.

IE 451. Industrial Measuring Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IE 331. Reviews contemporary measuring systems and provides a basic under-standing of the various methods, their accuracy, reliability, and relative costs to perform. Includes measuring methods needed for compliance evaluation in accordance with occupational and safety legislation, industrial processes, and product design.

IE 453. Computer Integrated Manufacturing. 3 credits, 4 contact hours (2;2;0).
Restriction: junior or senior standing. Examines the components of computer integrated manufacturing (CIM) including the design of information frameworks and network protocols required to orchestrate full manufacturing automation. Study of CAD, CAPP, robotics, NC, CNC, computer interfacing, and database systems in the context of a CIM environment. Exposure to state-of-the-art CIM software and hardware.

IE 455. Robotics and Programmable Logic Controllers. 3 credits, 4 contact hours (2;2;0).
Restriction: junior or senior standing. Introduction to the design and implementation of programmable logic controllers for use in industry in the areas of automotive assembly, pharmaceutical manufacturers, the chemical industry, and others. Includes ladder logic, input/output ports, continuous process control, timing and counting functions, chaining sequences, and digital gate logic.

IE 456. Introduction to Industrial Hygiene. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IE 355. Analysis of the effects of various environmental stressors on people at work, including their interference with performance and the development of acute and chronic health problems. Study of how numerous airborne contaminants, noise, thermal extremes, ionizing and nonionizing radiation, etc., affect workers alone and in combination. Topics include measurement and evaluation techniques, TLVs, control methodologies, legal requirements for employers.

IE 459. Supply Chain and Production Planning. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IE 331 or MATH 333. A study of the components and functioning of integrated production, planning, and control systems. Forecasting, aggregate planning, scheduling, and recent models of production and inventory control for optimizing continuous and intermittent manufacturing operations. MRP basics. Introduction to using a computer to apply scheduling models.

IE 460. Measuring Techiniques and Quality Control. 3 credits, 3 contact hours (3;0;0).
Prerequisite: understanding of basic probability. Not open to industrial engineering majors; intended for other engineers, inspection supervisors, and management. Various types of control charts and acceptance sampling systems and procedures. These techniques are used widely in industry to improve product quality and reduce costs.

IE 461. Product Quality Assurance. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IE 331. Methods used to achieve higher product quality, to prevent defects, to locate chronic sources of trouble, to measure process capability, and to use inspection data to regulate manufacturing processes are emphasized. Preparation of statistical control charts and selection of suitable sampling plans.

IE 463. Invention and Entrepreneurship. 3 credits, 3 contact hours (3;0;0).
Restriction: Junior or Senior standing or permission of instructor. This course will teach students the process of developing new products. It takes students from the art of creativity through product design and concludes with the formulation of a business plan for marking and production. If the new product satisfies the requirements of novelty, usefulness and nonobviousness, a patent application may be filed.

IE 466. Material Handling and Facilities Layout. 3 credits, 3 contact hours (3;0;0).
Prerequisite: IE 439. Analysis of organized human activities typified by industrial and office operations. Recent methods are applied to optimize location and layout of facilities. Introduction to modern material handling systems, expert systems in plant layout, logistics of motion of people and materials, flow analysis, plant layout, and material handling techniques.

IE 469. Reliability in Engineering Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisites: IE 331 or equivalent, senior standing. Emphasizes the determination of systems reliability from a knowledge of characteristics and reliability of individual system components. Topics include reliability concepts, failure rates, systems analysis, optimization, maintenance, etc. Covers techniques for the formulation and evaluation of reliability models.

IE 472. Product Liability Engineering. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing. The techniques available to the engineer to minimize the hazards of design and manufacturing that result in product liability cases. The effect of legal precedents on design, manufacturing, advertising, marketing, and using a product within developing technical disciplines such as: reliability prediction and analysis methods, assuring the quality of manufactured products, loss control systems, safety engineering precepts, human factors principles and design review. Review of government regulations for safety and protection.

IE 473. Safety Engineering. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing. The principles and practices of safety engineering in product and facilities design. Safe practices and hazard control, safety standards and codes, inspection procedures, the role of insurance, governmental regulations, and safety statistics. Participation in current safety engineering research studies. The Occupational Safety and Health Act and related legislation.

IE 480. Special Studies in Industrial Engineering for Non-Majors. 3 credits, 3 contact hours (3;0;0).
Restriction: permission of the IE faculty advisor. Not open to industrial engineering majors. Individual investigations under faculty guidance through consultation, readings, and visits with recognized authorities and institutions, dealing with specialized industrial engineering problems. Explore in depth an area of interest and give a report in a seminar setting, and submit a written project report.

IE 481. Investigations in Industrial Engineering I. 3 credits, 3 contact hours (0;0;3).
Restriction: junior or senior standing, per-mission of the IE faculty advisor. Individual investigation under faculty guidance through consultation, readings, and visits with recognized authorities and institutions, dealing with specialized industrial engineering design problems. Explore in depth an area of interest and give a report in a seminar setting, and submit a written project report.

IE 482. Investigations in Industrial Engineering II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: IE 481, permission of the IE faculty advisor. Further individual investigations, a continuation of IE 481.

IE 492. Engineering Management. 3 credits, 3 contact hours (3;0;0).
Restriction: junior or senior standing. An introduction for engineering majors to the fundamentals of engineering economics and the management process for engineering and development. Major topics include capital investment justification methods, project organization, scheduling and control techniques, legal, quality, and staffing issues.

ME 215. Engineering Materials and Processes. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CHEM 126 or CHEM 122. Students also must register for the lab component. Combined lecture and laboratory relating to the study of engineering materials. Processes of formation from liquid and particle state, plastic forming, molding deformation, and metal removal. Effects of heat treatment on material properties. Laboratory exercises involve basic machine tools and computer-controlled equipment.

ME 231. Kinematics of Machinery. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 213 and a C or better in MECH 234. Restriction: This course is restricted to students majoring in ME. Design, selection, and evaluation of mechanisms for various applications. Topics include displacement, velocity, and acceleration analysis of planar linkages, synthesis of function generators and motion generators, design of cams, gear-tooth geometry and analysis of gear trains.

ME 304. Fluid Mechanics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MECH 236, ME 311. Introduction to the basic principles of conservation of mass, momentum, and energy as they apply to engineering systems which utilize fluids. Some of the topics are dimensional analysis, theoretical and empirical analysis of one-dimensional compressible and incompressible flow, empirical analysis of external and internal flows, and elementary boundary layer theory.

ME 305. Introduction to System Dynamics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222, MECH 236, ME 231. Principles of dynamic system modeling and response with emphasis on mechanical, electrical, and fluid systems. Application of computer simulation techniques.

ME 310. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Completion of freshman year, approval of department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated by the co-op office and approved by the department. Mandatory participation in seminars and completion of a report.

ME 311. Thermodynamics I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211, PHYS 111. Thermodynamic fundamentals. Topics are the first and second laws of thermodynamics, physical properties of pure substances, entropy, ideal and real gases, and gaseous mixtures.

ME 312. Thermodynamics II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ME 311. A continuation of ME 311 including studies of irreversibility and combustion. Thermodynamic principles are applied to the analysis of power generation, refrigeration, and air-conditioning systems. Introduction to solar energy thermal processes, nuclear power plants, and direct energy conversion.

ME 315. Stress Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222, MECH 237, ME 215. Problems related to mechanical design. Topics include two-dimensional elasticity, transformation of stress and strain, plane stress problems, axisymmetric members, buckling criteria, and failure theories.

ME 316. Machine Design. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ME 231, ME 315. Aspects of the design process and design of machine elements. Mini-projects are used to introduce engineering design procedures.

ME 339. Fundamentals of Mechanical Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MECH 234. For industrial engineering majors. Topics include kinematics of mechanisms, machine components, and a brief intro-duction to mechanical vibrations. Students gain the ability to deal with design problems from the viewpoint of a non-specialist.

ME 343. Mechanical Laboratory I. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECE 405, MATH 279 or MATH 333 and MECH 236. Laboratory and lecture in instrumentation and measurement for mechanical engineering students. Applications for the sensing of such variables as pressure, temperature, mass flow, and displacement. Particular attention to the applicability and sensitivity of instruments.

ME 403. Mechanical Systems Design I. 3 credits, 3 contact hours (2;1;0).
Prerequisites: ME 304, ME 305, ME 312, ME 316. Lectures and projects covering problem solving methodology in the design, analysis, and synthesis of mechanical and thermal systems. The student's academic background combines with engineering principles and topics to serve as a foundation for broad engineering projects. Emphasis on creative thinking and the engineering design process in projects involving the optimal conversion of resources.

ME 405. Mechanical Laboratory II. 2 credits, 3 contact hours (1;2;0).
Prerequisites: ME 343, ME 312. Laboratory emphasizing the use of fundamental principles and instrumentation systems for the analysis and evaluation of mechanical components within a system.

ME 406. Mechanical Laboratory III. 2 credits, 3 contact hours (1;2;0).
Prerequisites: ME 405, ME 407. Laboratory covering the testing and evaluation of complete mechanical systems.

ME 407. Heat Transfer. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 222, ME 304, ME 311. A study of the three fundamental modes of heat transfer: conduction, convection, and radiation. A physical interpretation of the many quantities and processes in heat transfer using numerical methods. Theory is applied to the analysis and design of heat exchangers and other applications. Where appropriate, computer simulation is used.

ME 408. Mechanical Systems Design II. 2 credits, 3 contact hours (1;2;0).
Prerequisites: ME 403, ME 407. A continuation of ME 403 from a more integrated viewpoint, with lectures on special topics. Concepts in optimization and computer simulation are considered in the design and synthesis of mechanical engineering systems. The projects are more comprehensive, emphasizing creative design that incorporates appropriate engineering standards and multiple constraints.

ME 410. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ME 310, approval of the department, and permission of the Office of Cooperative Education and Internships. Full-time work experience of approximately one semester's duration. Provides major related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and project. Note: Normal grading applies to this COOP Experience.

ME 425. Finite Element Method in Mechanical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 101, MATH 222, and MECH 237. Introduction to central ideas underlying the finite element method in mechanical engineering and its computer implementation. Fundamental concepts such as interpolation functions for one- and two-dimensional elements, bar element method, Galerkin's method, discretization of a model, methods of assembling global matrices, and the final solution techniques for obtaining nodal values. Specific applications to mechanical engineering problems in trusses, beams, torsion, heat transfer, fluid flow, plane stress, and plane strain.

ME 430. Introduction to Computer-Aided Design. 3 credits, 4 contact hours (2;2;0).
Prerequisites: CS 101, FED 101 and Math 222. Introduction to basic concepts of computer-aided design as applied to mechanical engineering design problems. Topics include numerical techniques, computer graphics, geometric modeling, design optimization, and databases for design. The laboratory uses current CAD software packages for mechanical design. Projects involve applications of the basic principles using student's own as well as available software.

ME 431. Introduction to Robotics and Automation. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 101, MECH 236. Introduction to mechanics and control of robotic manipulators. Topics include spatial transformations, kinematics, dynamics, trajectory generation, actuators and control, and relations to product design and flexible automation.

ME 432. Principles of Air Conditioning and Refrigeration. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ME 304, ME 312; Corequisite: ME 407. A course in the fundamentals of air conditioning and refrigeration. Topics covered are psychometrics, cooling and heat load calculations, air distribution systems, duct design, vapor compression and absorption systems, and the principles of cooling towers.

ME 433. Vibration Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MECH 236, MATH 222. An introduction to the fundamental theory of mechanical vibrations. Undamped and damped systems with single and multiple degrees of freedom, transient vibration, vibrations of continuous media, and analog and numerical methods.

ME 435. Thermodynamics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 211, PHYS 111. Intended for non-mechanical engineering students of all disciplines. Topics include the basic laws of thermodynamics, properties of fluids and solids, analysis of open and closed systems, gas and vapor power cycles, refrigeration and air conditioning, and an introduction to heat transfer. Cannot be taken for credit by mechanical engineering students.

ME 437. Structural Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ME 315. Fundamentals of structural analysis. Consideration of stresses and deflections of beams as well as the design of beams, columns, trusses, and structural connections of steel, reinforced concrete, and timber structures.

ME 438. Introduction to Physical Metallurgy. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126 or CHEM 122, and ME 215 or MTEN 205. Introduction to metallic microstructures, solid solutions and the mechanical properties of metals and alloys. Physical understanding of diffusion processes is emphasized in covering the relationship between the nature of metals and different heat treating processes.

ME 439. Principles of Tribiology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126, MECH 237. An introduction to the principles of wear resistance of machine parts and tribology. Physical understanding of different mechanisms of wear and friction and methods of increasing durability.

ME 441. Computer Simulation and Analysis in Mechanical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ME 430. This course covers various topics in Computer-Aided Design (CAD) and Computer-Aided Engineering (CAE). The course provides an in-depth understanding and skill of constructing 2-D drawings using well-known commercial CAD package, and integrating 3-D solid modeling techniques into simulation, and analysis animation of new designs using commercial CAD/CAE software. The students will have hands-on experience to analyze Structure, Heat Transfer, and Computational Fluid Dynamics problems by using several different software packages. The course also focuses on CAD Product Data Exchange using both Direct Database conversion and International Standards based conversion methods between major CAD/CAE systems. Typical industrial applications will be illustrated.

ME 451. Introduction to Aerodynamics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ME 304, ME 311. Introduction to the basic principles and properties of fluid flow around immersed bodies. Topics include the kinematics and dynamics of fluid fields, the thin airfoil, finite wing theory, and one-dimensional compressible flow.

ME 452. Dynamics of Space Flight. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MECH 236, MATH 222. An introduction to the mechanics of space flight. After a brief introduction to the physics of the solar system, the dynamics of space flight are developed from the Newtonian viewpoint. Covers the performance and propulsion methods of rocketry.

ME 455. Automatic Controls. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ME 305. Introduction to the principles of automatic controls. Emphasis on systems, considering their mechanical, hydraulic, pneumatic, thermal, and displacement -aspects. First and second order linear systems. Introduction to system analysis techniques such as Nyquist and Bode diagrams and applications in system design.

ME 470. Engineering Properties of Plastics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ME 215, MECH 237. A study of the physical properties of the various commerical thermosetting and thermoplastic resins. An introduction to linear viscoelastic theory and its relationship to measurable mechanical properties of plastics. Also, engineering properties such as flammability, chemical resistance, and electrical properties.

ME 471. Introduction to Polymer Processing Techniques. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ME 304, ME 407. A study of the various plastics processing techniques, including extrusion, injection molding, blow molding, compression molding, thermoforming, rotational molding, casting, etc. The relationship between product design and choice of process will be presented.

ME 490. Mechanical Engineering Project A. 3 credits, 3 contact hours (0;0;3).
Prerequisite: departmental approval required. One or more individually selected projects. Projects usually require library research, design, cost analysis, planning of testing. Also involves an engineering report and a technical presentation.

ME 491. Mechanical Engineering Project B. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ME 490 and departmental approval required. One or more selected projects. Projects usually require library research, design, cost analysis, planning of testing. Also involves an engineering report and a technical presentation.

ME 495. Selected Topics in Mechanical Engineering. 3 credits, 3 contact hours (3;0;0).
This course explores a special topic in mechanical engineering.

B.S. in Industrial Engineering

(120 credits minimum)

First Year		
1st Semester		**Credits**
CS 115	Introduction to Computer Science in C++	3
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
ECON 201	Economics	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**14**
Second Year		
1st Semester		
IE 203	Applications of Computer Graphics in Industrial Engineering	2
MECH 320	Statics and Strength of Materials	3
CHEM 121	Fundamentals of Chemical Principles I	3
MATH 222	Differential Equations	4
Select one of the following:		3
HUM 211	The Pre-Modern World	

HUM 212	The Modern World	
HIST 213	The Twentieth-Century World	
	Term Credits	**15**
2nd Semester		
IE 224	Production Process Design	3
MECH 236	Dynamics	2
MATH 211	Calculus III A *	3
CHEM 122	Fundamentals of Chemical Principles II **	3
IE 331	Applied Statistical Methods	3
COM 312	Oral Presentations	3
	Term Credits	**17**
Third Year		
1st Semester		
IE 355	Human Factors	3
IE 335	Engineering Cost Analysis and Control	3
IE 439	Deterministic Models in Operations Research	3
ME 339	Fundamentals of Mechanical Design	3
ECE 405	Electrical Engineering Principles	3
	Term Credits	**15**
2nd Semester		
IE 334	Engineering Economy and Capital Investment	3
IE 339	Work Measurement and Standards	3
IE 440	Stochastic Models in Operations Research	3
IE 445	Idustrial Simulation	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
IE Technical Elective 1		3
IE 443	Senior Project I	2
IE 461	Product Quality Assurance	3
IE 441	Information and Knowledge Engineering	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
2nd Semester		
IE 444	Senior Project II	2
IE 459	Supply Chain and Production Planning	3
IE 466	Material Handling and Facilities Layout	3
IE Technical Elective 2		3
IE Technical Elective 3		3
	Term Credits	**14**
	Total Credits	**120**

Industrial Engineering Technical Elective-

Students in industrial engineering select 9 credits of technical electives. With the undergraduate advisor's approval, upper level technical courses from other departments may be used as technical electives. Graduate courses having an IE, EM or MNE prefix and courses taken for the BS/MS program are also acceptable, provided that the requirements for taking such courses are met. Select three courses from the following list:

Code	Title	Credits
IE 447	Legal Aspects of Engineering	3
IE 449	Industrial Robotics	3
IE 453	Computer Integrated Manufacturing	3
IE 455	Robotics and Programmable Logic Controllers	3

IE 463	Invention and Entrepreneurship	3
IE 469	Reliability in Engineering Systems	3
IE 473	Safety Engineering	3

Co-op

Two co-op courses taken in sequence replace a technical elective. In industrial engineering, In Industrial Engineering, IE 310 Co-op Work Experience I is taken without credit, and IE 411 Co-op Work Experience II is taken for degree credit, with IE 310 Co-op Work Experience I as a prerequisite.

* Students can take MATH 213 (http://catalog.njit.edu/search/?P=MATH%20213) (Calculus III B) instead of MATH 211 (http://catalog.njit.edu/search/?P=MATH%20211).

** Students can take BIOL 200 (Concepts in Biology) instead of CHEM 122 (https://catalog.njit.edu/search/?P=CHEM%20122).

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses"

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Mechanical Engineering

(120 credit minimum)

First Year		
1st Semester		**Credits**
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FED 101	Fundamentals of Engineering Design	2
CS 101	Computer Programming and Problem Solving	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
	Term Credits	**14**
Second Year		
1st Semester		
History and Humanities GER 200 level (p. 106)		3
MATH 213	Calculus III B	4
ME 215	Engineering Materials and Processes	3
MECH 234	Engineering Mechanics	2
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**16**
2nd Semester		
MATH 222	Differential Equations	4
ME 231	Kinematics of Machinery	3
MECH 236	Dynamics	2
MECH 237	Strength Of Materials	3

PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
	Term Credits	**15**
Third Year		
1st Semester		
ECE 405	Electrical Engineering Principles	3
MATH 279	Statistics and Probability for Engineers	2
ME 305	Introduction to System Dynamics	3
ME 311	Thermodynamics I	3
ME 315	Stress Analysis	3
	Term Credits	**14**
2nd Semester		
ME 304	Fluid Mechanics	3
ME 312	Thermodynamics II	3
ME 316	Machine Design	3
ME 343	Mechanical Laboratory I	3
ME 430	Introduction to Computer-Aided Design	3
	Term Credits	**15**
Fourth Year		
1st Semester		
History and Humanities GER 300+ level (p. 108)		3
ME 403	Mechanical Systems Design I	3
ME 405	Mechanical Laboratory II	2
ME 407	Heat Transfer	3
ME/TE	ME or Technical Elective I	3
	Term Credits	**14**
2nd Semester		
ME 406	Mechanical Laboratory III	2
ME 408	Mechanical Systems Design II	2
ME/TE	ME or Technical Elective II	3
ME/TE	ME or Technical Elective III	3
Select one of the following		3
MGMT 390	Principles of Business	
IE 492	Engineering Management	
Econ [a]		
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**16**
	Total Credits	**120**

5-year B.S. in Mechanical Engineering with Co-op Option A

(145 credit minimum)

First Year		
1st Semester		**Credits**
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FED 101	Fundamentals of Engineering Design	2
CS 101	Computer Programming and Problem Solving	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**

2nd Semester		
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
	Term Credits	**14**
Second Year		
1st Semester		
History and Humanities GER 200 level (p. 106)		3
MATH 213	Calculus III B	4
MECH 234	Engineering Mechanics	2
ME 215	Engineering Materials and Processes	3
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**16**
2nd Semester		
ENGR 210	Career Planning Seminar for En	1
MATH 222	Differential Equations	4
ME 231	Kinematics of Machinery	3
MECH 236	Dynamics	2
MECH 237	Strength Of Materials	3
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
	Term Credits	**16**
Summer		
CO-OP I, Co-op Work Experience I		
	Term Credits	**0**
Third Year		
1st Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
2nd Semester		
ECE 405	Electrical Engineering Principles	3
MATH 279	Statistics and Probability for Engineers	2
ME 305	Introduction to System Dynamics	3
ME 311	Thermodynamics I	3
ME 315	Stress Analysis	3
	Term Credits	**14**
Summer		
CO-OP II, Co-op Work Experience II		
	Term Credits	**0**
Fourth Year		
1st Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
2nd Semester		
ME 304	Fluid Mechanics	3
ME 312	Thermodynamics II	3
ME 316	Machine Design	3
ME 343	Mechanical Laboratory I	3

ME 430	Introduction to Computer-Aided Design	3
	Term Credits	**15**
Fifth Year		
1st Semester		
History and Humanities GER 300+ level (p. 108)		3
ME 403	Mechanical Systems Design I	3
ME 405	Mechanical Laboratory II	2
ME 407	Heat Transfer	3
ME/TE	ME or Technical Elective I	3
	Term Credits	**14**
2nd Semester		
ME 406	Mechanical Laboratory III	2
ME 408	Mechanical Systems Design II	2
ME/TE	ME or Technical Elective II	3
ME/TE	ME or Technical Elective III	3
Select one of the following		3
MGMT 390	Principles of Business	
IE 492	Engineering Management	
Econ [a]		
Humanities and Social Science Senior Seminar GER		3
	Term Credits	**16**
	Total Credits	**145**

5-year B.S. in Mechanical Engineering with Co-op Option B

(145 credit minimum)

First Year		
1st Semester		**Credits**
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I or General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FED 101	Fundamentals of Engineering Design	2
CS 101	Computer Programming and Problem Solving	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II or General Chemistry II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
	Term Credits	**14**
Second Year		
1st Semester		
History and Humanities GER 200 level (p. 106)		3
MATH 213	Calculus III B	4
MECH 234	Engineering Mechanics	2
ME 215	Engineering Materials and Processes	3
PHYS 121	Physics II	3

PHYS 121A	Physics II Lab	1
	Term Credits	**16**
2nd Semester		
ENGR 210	Career Planning Seminar for En	1
MATH 222	Differential Equations	4
ME 231	Kinematics of Machinery	3
MECH 236	Dynamics	2
MECH 237	Strength Of Materials	3
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
	Term Credits	**16**
Third Year		
1st Semester		
ECE 405	Electrical Engineering Principles	3
MATH 279	Statistics and Probability for Engineers	2
ME 305	Introduction to System Dynamics	3
ME 311	Thermodynamics I	3
ME 315	Stress Analysis	3
	Term Credits	**14**
2nd Semester		
ENGR 310	Co-op Work Experience I	12
	Term Credits	**12**
Summer		
CO-OP I, Co-op Work Experience I		
	Term Credits	**0**
Fourth Year		
1st Semester		
ME 304	Fluid Mechanics	3
ME 312	Thermodynamics II	3
ME 316	Machine Design	3
ME 343	Mechanical Laboratory I	3
ME 430	Introduction to Computer-Aided Design	3
	Term Credits	**15**
2nd Semester		
ENGR 410	Co-op Work Experience II	12
	Term Credits	**12**
Summer		
CO-OP II, Co-op Work Experience II		
	Term Credits	**0**
Fifth Year		
1st Semester		
History and Humanities GER 300+ level (p. 108)		3
ME 403	Mechanical Systems Design I	3
ME 405	Mechanical Laboratory II	2
ME 407	Heat Transfer	3
ME/TE	ME or Technical Elective I	3
	Term Credits	**14**
2nd Semester		
ME 406	Mechanical Laboratory III	2
ME 408	Mechanical Systems Design II	2
ME/TE	ME or Technical Elective II	3
ME/TE	ME or Technical Elective III	3
Humanities and Social Science Senior Seminar GER (p. 112)		3

Select one of the following		3
MGMT 390	Principles of Business	
IE 492	Engineering Management	
Econ [a]		
	Term Credits	**16**
	Total Credits	**145**

ME/Technical Electives-Students must select 4 course from the list below. In special cases, other ME/Technical Electives may be taken with departmental approval. BS/MS student may substitute ME 600-700 level courses with approval of the Mechanical Engineering Department.

Code	Title	Credits
CHEM 243	Organic Chemistry I [1]	
CHEM 244	Organic Chemistry II [1]	
CHEM 473	Biochemistry [1]	
ENTR 210	Introduction to Entrepreneurship	
ENTR 320	Financing New Venture	
ENTR 440	Lean Startup Accelerator [2]	
FIN 315	Fundamentals of Corporate Finance [2]	
IE 331	Applied Statistical Methods [3]	
IE 335	Engineering Cost Analysis and Control	
IE 447	Legal Aspects of Engineering	
IE 449	Industrial Robotics	
IE 453	Computer Integrated Manufacturing	
IE 455	Robotics and Programmable Logic Controllers	
IE 473	Safety Engineering	
MATH 331	Introduction to Partial Differential Equations	
MATH 333	Probability and Statistics [3, 4]	
MATH 335	Vector Analysis	
MATH 336	Applied Abstract Algebra	
MATH 337	Linear Algebra	
MATH 340	Applied Numerical Methods [5]	
MATH 371	Physiology And Medicine [5]	
MATH 372	Population Biology [5]	
ME 410	Co-op Work Experience II [6]	
MIS 363	Project Management for Managers [3]	
MRKT 330	Principles of Marketing [3]	
OM 375	Business Operations Management and Analytics [3]	
R120 101	General Biology [1]	
R120 102	General Biology II [1]	
ME 425	Finite Element Method in Mechanical Engineering	
ME 431	Introduction to Robotics and Automation	
ME 432	Principles of Air Conditioning and Refrigeration	
ME 433	Vibration Analysis	
ME 437	Structural Analysis	
ME 438	Introduction to Physical Metallurgy	
ME 439	Principles of Tribiology	
ME 441	Computer Simulation and Analysis in Mechanical Engineering	
ME 451	Introduction to Aerodynamics	
ME 452	Dynamics of Space Flight	
ME 455	Automatic Controls	
ME 470	Engineering Properties of Plastics	
ME 471	Introduction to Polymer Processing Techniques	

ME 490	Mechanical Engineering Project A [7]
ME 491	Mechanical Engineering Project B [7]

[1] Only for those students who are Pre-Med.
[2] Students cannot receive credit for both IE 331 and Math 333. Only one can be taken for degree credit.
[3] Only for those students who have declared a minor in Business.
[4] When Math 333 is used instead of Math 279, it cannot also be used as a ME/Technical Elective.
[5] Only for those students who have declared a minor in Math.
[6] Students must take ME 310 AND Me 410 to receive 3 credits for ME 410 toward the degree requirements as a ME/Technical Elective.
[7] Me 490/491 require departmental approval if used as ME/Technical electives.

Refer to the **General Education Requirement**s section of this catalog for further information on electives.

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Industrial Engineering Minor

Code	Title	Credits
IE 339	Work Measurement and Standards	3
IE 355	Human Factors	3
IE 439	Deterministic Models in Operations Research	3
IE 461	Product Quality Assurance	3
IE 466	Material Handling and Facilities Layout	3
Total Credits		**15**

Materials Engineering Minor

Minor in Materials Engineering (Student must select 5 courses for a total of 15 credits).

Code	Title	Credits
ME 215	Engineering Materials and Processes [1]	3
ME 438	Introduction to Physical Metallurgy	3
ME 470	Engineering Properties of Plastics	3
ME 490	Mechanical Engineering Project A	3
MTEN 201	Introductory Principles of Materials Engineering	3
MTSE 301	Principles of Material Science and Engineering	3
EVSC 325	Energy and Environment	3
BME 304	Material Fundamentals of Biomedical Engineering	3
BME 420	Advanced Biomaterials Science	3
BME 422	Biomaterials Characterization	3
BME 491	Research and Independent Study I	3
CE 360	Sustainable Civil Engr Mat	3
CE 490	Civil Engineering Projects	3
CHE 375	Structure, Properties and Processing of Materials	3
CHE 415	Introduction to 3D Printing	3
CHE 444	Introduction to Polymer Engineering	3
CHE 491	Research and Independent Study I	3
ENGR 301	Engineering Applications of Data Science	3

[1] Except for students majoring in ME.

General Engineering

The complexity of modern engineering, physical and life sciences problems often requires a team effort that can involve professionals from several other disciplines. For students interested in interdisciplinary problem solving, the engineering science programs offer challenging educational opportunities. Students must consult with the program advisor before undertaking a course of study in any engineering science option.

B.S. in General Engineering

(120 credit minimum)

A minimum of 120 credits is required for the B.S. in Engineering Science. Of those 120 credits, at least 30 credits are in an option.

Options consist of advanced undergraduate courses that show a progression in depth of knowledge in a given area of study, culminating with a senior project or undergraduate thesis. Option courses may be from different departments, but they must comprise a coherent program of study. Specific courses required by the engineering science curriculum may be counted among the 30 credits if appropriate. An option need not be one in which NJIT offers a B.S. degree. The specific course of study for any particular option will be developed with the approval of the program director.

Courses in biological sciences are available at the adjacent Newark Campus of Rutgers University. Students who demonstrate exceptional ability may choose from offerings at the graduate level at NJIT, Rutgers-Newark, or RBHS.

General Engineering B.S. (p. 609)

Engineering Science Courses

ESC 310. Work Experience I. 3 credits, 3 contact hours (0;0;3).

B.S. General Engineering

Undergraduate Program in General Engineering (GEN)

The Bachelors of Science General Engineering program at the Newark College of Engineering (NCE) is a broad-based and interdisciplinary program in engineering. It is designed for students who desire a rigorous, broad-based course of study in preparation for a professional career. The program provides students with the opportunity to study the traditional foundational engineering concepts in mathematics, science, application, and design. Additionally, built into the program are engineering electives where students can be exposed to courses in civil, mechanical, industrial, biomedical, chemical, computer, and electrical engineering in order to obtain a well-rounded knowledge base.

Students must work closely with the academic adviser to develop a meaningful plan of study to meet their interests and the program graduation requirements.

Program Objectives:

Students in the General Engineering program will learn about the various engineering paths and diverse career fields that they lead to. Through developing a student’s foundational STEM education and broad-based exposure to the traditional engineering fields, students will be prepared to either declare one of the majors offered by NCE or work closely with the academic advisor to plan a general curriculum.

We expect students and graduates of the General Engineering B.S. program to exhibit the following:

- **Professionalism** – students work on developing professional skills to help them be successful in the workplace including but, not limited to: communication, time management, leadership, collaboration, and networking.
- **Academic Excellence** – students work on enhancing their academic skills in order to be an asset in the various career fields of science, technology, engineering, and mathematics.
- **Commitment to Growth & Development** – students engage with the community to better understand themselves and others in order to problem solve and improve the lives of those around them.

B.S. in General Engineering

(120 credit minimum)

A minimum of 120 credits is required for the B.S. in General Engineering. Of those 120 credits, at least 58 credits are general engineering electives (18 credits in 200-level courses, 18 credits in 300-level courses, 15 credits in 400-level courses, 4 credits in laboratory courses). Students must work closely with the academic adviser to select the general engineering electives to meet their interests and the program graduation requirements.

First Year		
1st Semester		**Credits**
CHEM 121 or CHEM 125	Fundamentals of Chemical Principles I [1] or General Chemistry I	3
CHEM 125A	General Chemistry Lab I	1
FED 101	Fundamentals of Engineering Design [1]	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
FYS SEM	First-Year Student Seminar	0
	Term Credits	**17**
2nd Semester		
CHEM 122 or CHEM 126	Fundamentals of Chemical Principles II [2] or General Chemistry II	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
	Term Credits	**14**
Second Year		
1st Semester		
Select one of the following:		3
CS 101	Computer Programming and Problem Solving [3]	
CS 106	Roadmap to Computing for Engineers	
CS 115	Introduction to Computer Science in C++	
Select one of the following:		3
MATH 211	Calculus III A [4]	
MATH 213	Calculus III B	
Social Science GER (p. 114)		3
History and Humanities GER 200 level (p. 106)		3
GEN 301	Applications of Microcontrollers and IoT devices	3
	Term Credits	**15**
2nd Semester		
MATH 222	Differential Equations	4
MATH 333	Probability and Statistics	3
General Engineering Elective (200 level)		3
General Engineering Elective (200 level) [5]		3
General Engineering Elective (200 level) [5]		3
	Term Credits	**16**
Third Year		
1st Semester		
History and Humanities GER 300+ level (p. 108)		3
General Engineering Elective (200 level)		3
General Engineering Elective (200 level)		3
General Engineering Elective (200 level)		3
General Engineering Elective (300 level)		3
General Engineering Lab Elective		1
	Term Credits	**16**
2nd Semester		
History and Humanities GER 300+ level (p. 108)		3
ENGR 210	Career Planning Seminar for En [6]	1

General Engineering Elective (300 level)		3
General Engineering Elective (300 level)		3
General Engineering Elective (300 level)		3
General Engineering Lab Elective		1
	Term Credits	**14**
Fourth Year		
1st Semester		
Humanities and Social Science Senior Seminar GER (p. 112)		3
General Engineering Elective (300 level)		3
General Engineering Elective (300 level)		3
General Engineering Elective (400 level)		3
General Engineering Elective (400 level)		3
General Engineering Lab Elective		1
	Term Credits	**16**
2nd Semester		
GEN 491	Research Independent Study I	3
General Engineering Elective (400 level)		3
General Engineering Elective (400 level)		3
General Engineering Elective (400 level)		3
	Term Credits	**12**
	Total Credits	**120**

1 Students interested in Biomedical, Chemical, Computer, Electrical Engineering should take CHEM 125
2 Students interested in Biomedical, Chemical Engineering should take CHEM 126
3 Students interested in Computer, Electrical Engineering should take CS 115
4 Students interested in Computer, Electrical Engineering should take MATH 213
5 Two of the 200 level General Engineering Elective must have a lab component associated with the course
6 ENGR 210 is required only for students who take Math 211.

200 level General Engineering elective - At least 4 from Engineering

300 level General Engineering elective - At least 4 from Engineering

400 level General Engineering elective - At least 3 from Engineering

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SAET - Elec. & Mech. Division (SEMD)

On November 9, 2018, NJIT launched its newest school, the School of Applied Engineering and Technology (SAET), within the university’s Newark College of Engineering (NCE). SAET encompasses NCE’s engineering technology programs in two divisions (Electrical and Mechanical Engineering Technology Division and the Built Environment Division); the baccalaureate degree General Engineering program; and a division focused on Engineering Education practice and research. SAET serves about 1,000 NJIT students. The SAET offers Bachelor of Science in Engineering Technology (BSET) degrees in nine different options, as well as, Bachelor of Science (BS) degrees in Concrete Industry Management (CIM), and General Engineering.

The Electrical and Mechanical Engineering Technology Division (SEMD) consists of the Electrical and Computer Engineering Technology (ECET), Mechanical Engineering Technology (MET), Manufacturing Engineering Technology (MNET), Computer Technology (CPT), and Medical Informatics (MIT) programs.

The options in Electrical and Computer Engineering Technology, and Mechanical Engineering Technology accredited by the Engineering Technology Accreditation Commission (ETAC of ABET) http://abet.org (http://abet.org/)

Many students choose to complete their freshman and sophomore years at a community college or a technical institute, and obtain an associate's degree in applied science from these institutions. It is strongly recommended that students talk to an academic advisor at NJIT while they are still pursuing their associate's degree. The academic advisor will explain the transfer process in detail as well as suggest elective courses that may be beneficial. Contact an advisor by calling the School of Applied Engineering and Technology at (973) 596-3228, or by email at EngineeringTechnology@njit.edu.

After being admitted to NJIT, students must meet with an academic advisor to discuss the curriculum and any special interests the student might have. Students who lack necessary courses will be assigned bridge courses to make up the required prerequisites. Generally, courses taken at the freshman and sophomore level at the community colleges cannot substitute for junior or senior NJIT engineering technology courses. Engineering technology is that part of the technological field which requires the application of scientific and engineering knowledge and methods, combined with technical skills, for the implementation and extension of existing technologies. Engineering technology education focuses on preparing engineering technologists for positions that involve product development and improvement, system development, management, manufacturing and engineering operational functions. Graduates also enter the technical sales and customer services field, or continue in graduate work in engineering or management. Placement of graduates has been excellent.

NJIT Faculty

B

Barnes, William, Associate Professor

Brateris, Daniel J., University Lecturer

E

English, Robert, Professor Emeritus

J

Juliano, Thomas, Associate Professor

K

Khader, Michael, Associate Professor

L

Lieber, Samuel C., University Lecturer

M

Mahgoub, Mohamed A., Assistant Professor

Miima, John B., Assistant Professor

P

Potts, Laramie, Associate Professor

R

Rabie, Mohammad A., University Lecturer

Rahman, Sahidur, University Lecturer

Rockland, Ronald H., Professor

S

Sengupta, Arijit, Associate Professor

W

Washington, David W, Associate Professor

Wiggins, John, Senior University Lecturer

Programs

- Engineering Technology, Computer Technology (CMPT) - B.S. (p. 620)
- Engineering Technology, Electrical and Computer Engineering Technology (ECET) - B.S. (p. 623)
- Engineering Technology, Manufacturing Engineering Techology (MNET) - B.S. (p. 626)

CPT 310. Computer Design Fundamentals for Computer Technology. 3 credits, 4 contact hours (2;2;0).
Restriction: enrolled in the computer technology option. Boolean algebra, gates, combinational and sequential logic. Memory, microprocessor, and I/O control IC's. Sequential bus architecture.

CPT 315. Computer Architecture for Computer Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CPT 310. Computer design fundamentals for computer technology, Von Neumann computer architecture: processor, memory and I/O. Processor organization: registers, ALU, and control. Memory organization and memory bus, I/O organization: I/O bus, memory mapped I/O. Number representations and ALU designs. Fundamentals of assembly language, lab exercises in assembly language are used throughout to illustrate concepts.

CPT 325. Medical Informatics Technology. 3 credits, 3 contact hours (3;0;0).
Restriction: Junior standing. Medical Informatics (MI) professionals use information technology to benefit the health and human services industry. One of the main challenges is to develop an integrated medical record/information system that links doctors, pharmacists, medical imaging facilities and hospitals. In addition, MI professionals will also develop skills to design and develop suport technology for seniors to maintain independent life styles. This includes remote monitoring systems linked to medical professionals, software for support services, and home automation technology.

CPT 330. Software Web Applications for Engineering Technology I. 3 credits, 4 contact hours (2;2;0).
Common software applications using software objects. The use of software objects in the management of programming projects. Projects illustrate concepts.

CPT 335. Networks Applications for Computer Technology I. 3 credits, 4 contact hours (2;2;0).
Prerequisites: C++, Visual Basic, UNIX utilities. Covers common gateway interface (CGI), servers, network protocols, network administration, server and network per-formance.

CPT 341. Visual Basic.NET for Engineering Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisite: Previous programming experience. Creation of windows with text, controls, menus and graphics, events detection, files and objects management, object oriented techniques.

CPT 373. Web App Development for Mobile. 3 credits, 4 contact hours (2;2;0).
Prerequisites: A basic programming course, in addition is recommended an introductory web programming course. Mobile platforms are becoming ubiquitous and software development for these devices is becoming an essential skill for technical professionals. This software/App development course integrates software and web skills with cross platform open source tools that allow developers to write apps for multiple platforms. Course topics will include PhoneGap and open course development software, App layout, CSS (styling) and navigation (transition animations), JavaScript and native functions, geolocation listeners and Asynchronous JavaScript and XML (AJAX) skills. A class project will incorporate skills introduced in this course. Medical informatics majors will design and build an Electronic Medical records Apps. Other projects will be tailored to the interest of other majors.

CPT 395. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Restriction: Approval of the department and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

CPT 401. Senior Project. 2 credits, 2 contact hours (2;0;0).
Prerequisite: MIS 345. Restriction: senior standing in computer technology. Project management and development, scheduling, proposal writing, documentation of software projects, technical presentations. The successful completion of the project consists of research on a recent computer software and/or hardware product, and the application of the findings to the development of a project, which must include a software component. The senior project may be replaced by a cooperative education experience course, subject to advisor's approval.

CPT 425. Medical Informatics Technology II. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CPT 325. Restriction: Senior standing. Advanced topics, builds on the core competencies introduced in Medical Informatics I. This course focuses on: Management of Information in Healthcare Organizations/Cost Benefit Analysis, Health and Financing, Consumer Health and Telehealth and Wireless Patient-Monitoring Systems. Cutting edge technologies that will impact on future healthcare delivery.

CPT 430. Software Web Applications for Engineering Technology II. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CPT 330. Common applications using software objects. The use of software objects in the management of programming projects. Projects are used to illustrate concepts.

CPT 435. Networks Applications for Computer Technology II. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CPT 335. Network security. Database implementations. Scaling.

CPT 440. Visual Basic Applications for Engineering Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CPT 340. PC-based control techniques, embedded systems. Database control. Real-time control. Network data acquisition. Man-machine interface and ergonomics considerations.

CPT 450. Computer Graphics for Computer Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisites: Calculus II, knowledge of the programming language used in the course, check with the instructor. Drawing shapes, curves and text. Colors and areas, point of light, shading. Masking, 2-D drawings and transformations, 3-D drawings and transformations. Animation. Introduction of a popular graphics package. Lab exercises are used throughout to illustrate concepts.

CPT 491. Special Projects in Computer Technology. 1 credit, 1 contact hour (1;0;0).
Restriction: Senior standing in computer technology. The student works on selected projects guided by the department staff.

CPT 492. Special Projects in Computer Technology. 2 credits, 2 contact hours (2;0;0).
See CPT 491.

CPT 493. Special Projects in Computer Technology. 3 credits, 3 contact hours (3;0;0).
See CPT 492.

ECET 201. Circuits I. 3 credits, 4 contact hours (2;2;0).
This first course in Electrical Circuits introduces the student to both DC and AC Circuit Theory. It includes Ohm's and Kirchoff's Laws for analysis of series and parallel circuits. Series-parallel, ladder and bridge networks are analyzed. Resonance and frequency response are included along with an introduction to AC circuits. Circuit simulations and laboratory experiments are designed to support the theory and obtain measurement skills.

ECET 202. Circuits II. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 201 or ECE 231 and MATH 138 or MATH 111. This second course in Electrical Circuits expands on Circuit Theory introduced in ECET 201. It includes Ohm's and Kirchhoff's Laws for analysis of series and parallel AC circuits. Series-parallel, ladder and bridge networks are analyzed using AC signals. Resonance and frequency response are included. The basic theory and operation of diodes and transistors, including dc biasing are studied. Circuit simulation and laboratory experiments are designed to support the theory and obtain measurement skills.

ECET 205. Fundamentals of Analog Electronics. 3 credits, 4 contact hours (2;2;0).
Prerequisite: ECET 202 or ECE 232 This course introduces students to the active components used in electronics circuits. It covers the physics, the characteristics, and some applications of semiconductor diodes and transistors. The applications will include amplifiers, rectifiers, op amps, oscillators, and timers. Circuit simulation and laboratory experiments are designed to support the theory and provide measurement skills.

ECET 210. Intro. to Microprocessors and Computer Architecture. 3 credits, 4 contact hours (2;2;0).
Prerequisite: None This is an introductory course in computer architecture and microprocessor applications for students who already have basic knowledge of digital circuit principles. Computer hardware architecture is analyzed, and assembly-language programs are written and run. Computer architecture concepts are applied through the use of assembly software programs for a popular microprocessor family. Theoretical ideas are reinforced by building and testing realistic experimental systems in the laboratory.

ECET 211. Computer Architecture. 2 credits, 4 contact hours (3;1;0).
Prerequisites: (CS 100 or CS 106 or CS 113 or CS 114 or CS 115 or CS 116) and ECET 215. This course covers the fundamentals of computer architecture and organization including processor organization, registers, ALU, memory, and IO. The architecture and design of each element is studied and reinforced during lab. Lab projects may include the design a simple RISC microcomputer using HDL or the use of RISC microcontroller systems to perform basic IO and control functions. HDL and assembly languages are studied.

ECET 214. Introduction to Communications. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 202 or ECE 232. Corequisite: ECET 205 A study of amplitude modulation, frequency modulation, and pulse modulation systems of transmission and reception, including applications of these systems in radio, television and telemetry. Introduces the latest digital communications theory and applications. Computer simulation and laboratory experiments are designed to support the theory and obtain measurement skills.

ECET 215. Introduction to Digital Electronics. 3 credits, 4 contact hours (2;2;0).
The first course in digital electronics develops the fundamentals of the binary system, circuit implementation from Boolean functions and map minimization. Course includes study of combinational logic, sequential logic circuits, flip-flops, counters, and shift register. Computer simulation and laboratory experiments are designed to support the theory and obtain measurement skills.

ECET 300. Circuit Analysis: Transform Methods. 3 credits, 3 contact hours (3;0;0).
Prerequisites: (ECET 303 or ECE 232) and (MATH 238 or MATH 112) and (ECET 205 or ECE 271). Corequisites: MATH 322 or MATH 222. The principles, theorems and techniques of circuit analysis are reviewed. The technique of waveform and circuit transforms is introduced. Laplace transforms are studied and applied in the solution of circuit problems with a variety of input functions. Fourier analysis also is introduced. Extensive use of computer simulation software.

ECET 303. Circuit Measurements. 2 credits, 4 contact hours (1;3;0).
Prerequisites: (ECET 205 or ECE 271) and (MATH 138 or MATH 111). Lecture and laboratory sessions are designed to develop techniques for the measurement of various circuit parameters as well as the theoretical prediction of these parameters. Extensive use of computer simulation software.

ECET 305. Integrated Circuit Applications. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 303 and MATH 238 or MATH 112. Corequisite: ECET 300. Provides a working knowledge of the characteristics and applications of integrated circuits. Topics include how linear ICs work, the most common circuit configurations in which ICs are used, and how to design the most commonly needed circuits with ICs, using manufacturers specification sheets.

ECET 310. Microprocessors I. 3 credits, 4 contact hours (2;2;0).
Prerequisites: Courses in digital logic and introduction to microprocessors (AAS level). Develops a working knowledge of the characteristics and applications of microprocessors. Emphasis is put on the architecture and instruction set of an advanced microprocessor. Representative data handling problems are studied and tested in the laboratory.

ECET 311. Embedded Systems I. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (CS 100 or CS 106 or CS 113 or CS 114 or CS 115 or CS 116) and (ECET 211 or CPT 315 or ECE 252) and (ECET 215 or ECE 251) and (ECET 205 or ECE 271). Develops a working knowledge of the characteristics and applications of devices used in embedded systems such as microcontrollers. Emphasis is put on the architecture, instruction sets, and assemblers. Representative data handling problems and interfacing are studied and tested in the laboratory using state-of-the art hardware.

ECET 314. Communication Systems. 3 credits, 4 contact hours (2;2;0).
Corequisite: ECET 300. A study of amplitude modulation, frequency modulation, and pulse modulation systems of transmission and recep-tion, including applications of these systems in radio, television, and telemetry. Introduces the latest digital communications theory and applications. Perform appropriate laboratory exercises and projects.

ECET 319. Electrical Systems and Power. 3 credits, 4 contact hours (2;2;0).
Prerequisites: Physics I and Calculus (AAS level). Restriction: For non-ECET majors only. The fundamentals of ac and dc circuit theory are studied. Transistor and diode theory and their applications in amplifiers and filters are investigated. Electrical machines are also included in this course. Computer simulation as well as appropriate laboratories are required.

ECET 329. Analog and Digital Electronics. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 201 or ECE 231. Building on ECET 201, a study of more advanced topics in electronics including AC circuit analysis, op-amps, transistors, digital logic, and microcontrollers. Computer simulation as well as laboratories are required.

ECET 344. Numerical Computing for Engineering Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (CS 100 or CS 106 or CS 113 or CS 114 or CS 115 or CS 116) and (MATH 238 or MATH 112). An introduction to the use of a computer to analyze and solve problems common in engineering. Using computers and the application language students will confront a variety of tasks that will promote an object oriented programming structure. The goal of this course is to understand and program routines commonly used in the design of computer algorithms for computer-based problems. Practical applications as well as mathematical programming are stressed.

ECET 350. Computerized Industrial Controls. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (ECET 211 or CPT 315) and ECET 311. This course introduces students to the theory and application of computerized control systems and technologies used in industry today. The course focuses on the hands-on development and integration of programmable logic controllers (PLCs), motor controllers (drives), and supervisory software.

ECET 365. Digital Logic and Circuit Design. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ECET 215 or ECE 251 Develops the mathematics and minimization techniques together with the circuit implementation for the design of combinational and sequential digital solid-state logic circuits. Studies decoders, mulitplexers, counters, registers, and PLDs. Computer and communications circuits are used as examples. Projects employ computer simulation of digital circuits.

ECET 395. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Restriction: Completion of Freshman year and Approval of the department and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

ECET 400. Senior Project. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 305 and ECET 344 and ECET 411 and COM 313. Capstone project course for the ECET program. Students work as a group to design and develop a product. Students must study project management, concurrent engineering, proposal development, research, societal impact, market research, prototyping and testing. Students develop a formal project proposal, Gantt chart and design specifications for their project. Students apply technical knowledge to build and test their project. Documentation and demonstration of formal testing procedures, computer analysis, simulation, time and cost estimates and compliance with specifications is required. Students present a functioning prototype of the project to a design review board and other students enrolled in the course.

ECET 401. ECET Senior Project I. 2 credits, 2 contact hours (2;0;0).
Prerequisites: ECET 344, ECET 305, ECET 411 and COM 313. The first course in a two-course sequence comprised of Senior Project 1 (ECET 401) and Senior Project 2 (ECET 402). Project management, concurrent engineering, proposal development, library research, and computer usage are stressed. Students develop a formal proposal, technical specifications, Gantt chart, and design specifications for the senior project to be implemented in ECET 402.

ECET 402. ECET Senior Project II. 1 credit, 2 contact hours (0;2;0).
Prerequisite: ECET 401 (The previous semester) Apply technical knowledge to implement, build, and test the project approved in ECET 401.Complete library research, design specifications, computer analysis, simulation, and time and cost estimates. Purchase and build a working prototype of the design. Complete formal testing procedures to verify that the prototype meets design specifications. Submit formal written documentation and present the project during an oral presentation to a design review board and other students in the class.

ECET 406. Control Systems and Transducers. 4 credits, 6 contact hours (3;3;0).
Prerequisite: ECET 305. Class and laboratory study of analog and digital automatic control. Using Laplace transforms, principles of analysis and design of control systems are introduced. Transducer characteristics and their application in instrumentation and control are investigated. Several experiments are implemented using Programmable Logic Controllers (PLCs).

ECET 410. Microprocessors II. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 310 and ECET 365. Covers the operations, bread boarding, and interfacing of devices peripheral to microcom-puters. Emphasizes embedded applications of microprocessers to systems requiring both hardware and software development. Advanced topics include programmable peripheral I/O controllers, interrupts and local ISA, PCI and USB buses.

ECET 411. Embedded Systems II. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 311. This course is the second of two embedded systems courses. The primary objective is to prepare students in the ECET curriculum to design embedded systems as part of senior project and also in industry. The design of embedded systems is investigated at the hardware and software level with an emphasis on processor and system architecture. The C language is used for programming.

ECET 412. Power Generation and Distribution. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 205 or ECE 271. Restrictions: Junior or Senior Standing. Electrical generation, transmission, and distribution systems with an emphasis on 3 phase analysis, design, short circuit currents due to symmetrical faults, and reliability considerations of the electric power system. The laboratory portion includes hands on activities and experiments that align electric power theory with application. Design considerations for inside / outside plant, worker safety, system interconnection and protection, while focusing on reliability and cost considerations are covered.

ECET 414. Solar Photovoltaic Site Planning and System Installation. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 205 or ECET 329. Restrictions: Junior or Senior Standing. This course covers the following topics on solar photovoltaic (PV) systems: introduction to renewable energy and PV systems, solar thermal systems, solar radiation, sun path characteristics, panel installation, and troubleshooting. Moreover, the identification and analysis of a PV array site as well as the development of a site layout are discussed with emphasis on the implementation of the associated electrical codes and safety rules. This course will prepare the students for the North American Board of Certified Energy Practitioners (NABCEP) test for certified solar PV system installer.

ECET 415. Fundamentals of Telecommunications. 3 credits, 4 contact hours (2;2;0).
Prerequisites: CS 100 or CS 106 or CS 113 or CS 114 or CS 115 or CS 116. Restrictions: Junior or Senior Standing. The focus of this course is on network data communication systems and related protocols. Main topics include transmission media including coax, twisted pair, fiber optics, wired, and wireless media. The Transmission Control Protocol/Internet Protocol (TCP/IP) model, as well as the Open System Interface (OSI) model, are discussed with emphasis on the details of the TCP/IP model. Additional topics such as wired and wireless LAN, backbone networks, wide area networks, The Internet, networking security, and networking design are covered.

ECET 416. Networking Applications. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (CS 100 or CS 106 or CS 113 or CS 114 or CS 115 or CS 116) and ECET 415. Introduces students to the technology of networking with a particular focus on local area networks and the protocols associated with network communication. Comprised of two components: concept/theory and hands-on/applications in the laboratory. Topics include: an overview of network communication systems, networking concepts, network protocols, network standards, wide area networks, local area networks, enterprise networks, network topology, media access control, transport control protocol, internet protocol, and routing. Students learn to analyze traffic flow on network links and how to write network based software applications.

ECET 418. Transmission Systems. 3 credits, 4 contact hours (2;2;0).
Prerequisite: ECET 214. Restrictions: Junior or Senior Standing. A study of wireless and terrestrial transmission systems with an emphasis on fiber optics and the latest wireless techniques. The lectures examine the technologies as well as the advantages and disadvantages of the various transmission techniques. The laboratories are a mixture of fiber optic, microwave, and wireless experiments providing hands-on experience in these important areas.

ECET 419. Design of Internet Based Embedded Systems. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 411. Restrictions: Junior or Senior Standing. This course explores the fundamental technologies required to build modern embedded systems that are utilized and controlled over the internet. Students learn the basics of foundational internet technologies and data structures such as IoT basics, HTTP requests and response methods, REST web service structures, client/server model topologies, JSON data representation, apache web server, HTTP / IP routing basics, PHP, MySQL, and linux basics. The course explores combinations of these technologies to form complete client/server communication systems that are specifically design for control and utilization of embedded systems using web based communication. The course concludes with a final project where students design an internet based embedded system that can be controlled, monitored, and utilized over the internet.

ECET 430. Electronics Design for Manufacturing and Production. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ECET 205 or ECET 329. Restrictions: Junior or Senior Standing. This course teaches the fundamental skills required to design and manufacture electrical systems on printed circuit boards. The fundamental skills of electronics CAD are taught along with industry standards for schematic designations, engineering change orders, component packaging, simulation, and verification. Students are taught basic and advanced topics in PCB construction, analysis, and layout including auto-routing with a focus on through hole and surface mount technology, impedance control, heat dissipation, interconnects, panelization techniques, and production specific features and designations. Manufacturing files and outputs are studied emphasizing the necessary considerations for mass production, testing, component selection, stencil designs, solder composition, and reliability concerns.

ECET 435. Digital Signals: Processing, Presentation, and Management. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (CS 100 or CS 106 or CS 113 or CS 114 or CS 115 or CS 116) and (MATH 138 or MATH 111). Restrictions: Junior Standing or Department Approval. This course covers the fundamentals of digital signal processing including signal acquisition, manipulation, and presentation. MATLAB, Python, and Excel are used as methods of computer programming, automation, and signal processing. Students learn the fundamentals of signal sampling, processing, reconstruction, digital signal types, quantization, encoding, FIR and IIR and filters, and various methods for the design of digital signal filters based on use cases and specifications. Emphasis is placed on effective data presentation techniques. The course concludes with a final project which can be implemented in hardware or software.

ECET 440. Clinical Internship. 3 credits, 3 contact hours (3;0;0).
By Advisement". Consists of 200 hours of experience in the clinical engineering department of a hospital. The student is under the supervision, and is evaluated by, the director of clinical engineering at the hospital. A final report is submitted to and graded by the NJIT faculty advisor.

ECET 444. Technology Applications of Object-Oriented Programming. 3 credits, 4 contact hours (2;2;0).
Prerequisite: ECET 344. Restrictions: Junior or Senior Standing. Brings together prior software knowledge and applies it to develop modern software applications. Comprised of theory and hands-on applications in the lab. Concepts in modular/structured design and object-oriented design will be combined to develop modern internet and database connected applications. Examine several case studies during the last few weeks. Design, construct and test a practical software project.

ECET 491. Special Projects in ECET. 1 credit, 3 contact hours (3;0;0).
By Advisement". Special projects course for ECET students with subject matter to be arranged by instructor and approved by program coordinator.

ECET 492. Special Projects in ECET. 2 credits, 3 contact hours (3;0;0).
By Advisement". See ECET 491.

ECET 493. Special Projects in ECET. 3 credits, 3 contact hours (0;0;3).
By Advisement". See ECET 491.

ECET 495. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: ECET 395. Provides major-related work experience as a co-op/intern. Mandatory participation in seminars and completion of requirements that include a report and/or project.

MET 103. Engineering Graphics and Intro. to CAD. 2 credits, 3 contact hours (1;2;0).
A first course in Computer Aided Design (CAD), includes lab work using AutoCAD software. Topics include fundamentals of engineering graphics, AutoCAD command structure, setting units and limits, drafting primitives, layering, use of editing tools; grid, snap, and axis commands. Upon successful completion of this course, students should be able to effectively produce two-dimensional drawings using the AutoCAD software program.

MET 105. Applied Computer Aided Design. 2 credits, 3 contact hours (1;2;0).
Prerequisite: MET 103. A second course in Computer Aided Design (CAD), additional AutoCAD topics include blocks, move and copy, array, mirror, text, text styles, 3D and isometric modes. Upon successful completion of this course, students should be able to use advanced AutoCAD commands to quickly and efficiently produce 2D and 3D drawings, and also be able to modify the AutoCAD environment (e.g., menues, macros, etc.) to boost productivity.

MET 205. Advanced Computer Aided Design. 3 credits, 4 contact hours (2;2;0).
Prerequisite: MET 105. This course introduces advanced CAD applications, including attribute and attribute extraction, external reference files, solid modeling, surface rendering and animation. Upon successful completion of this course, students should be able to use a CAD software package to develop animations consisting of 3D models with rendered surfaces.

MET 235. Statics for Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 102 or PHYS 111 and MATH 238 or MATH 112. Provides an understanding of equilibrium of particles and rigid bodies subject to concentrated and distributed forces. Upon successful completion of this course, the students should be able to analyze problems involving the equilibrium of particles and rigid bodies, including simple machines, trusses, and frictional forces.

MET 236. Dynamics for Technology. 2 credits, 2 contact hours (2;0;0).
Prerequisites: MET 235 or MECH 234 or MECH 235. Provides an understanding of the mathematics of the motion of particles and rigid bodies, and of the relation of forces and motion of particles. Upon successful completion of this course, the students should be able to describe the motion of particles and rigid bodies as functions of time and position, develop their equations of motions due to applied forces, and determine post impact behavior.

MET 237. Strength of Materials for Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisite: MET 235 or MECH 234 or MECH 235. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structured problems, and an understanding of the mechanical behavior of materials under various load conditions. The laboratory experience is integrated within the course. Upon successful completion of this course, the students should be able to determine stresses and deformations for a variety of simple structural problems.

MET 301. Analysis and Design of Machine Elements I. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MATH 238 or MATH 112, and MET 237 or MECH 237. The principles of strength of materials are applied to mechanical design. Topics include theory of failure, stress concentration factors and fatigue, the design and analysis of shafts subjected to static and dynamic loadings, and critical speed of a rotating shaft.

MET 302. Analysis and Design of Machine Elements II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MET 301. A continuation of MET 301, including analysis and design of power screws, brakes, clutches, belts, chain drives, gears, gear trains, bearings, and other machine elements.

MET 303. Applied Thermodynamics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 138 or MATH 111 and PHYS 103 or PHYS 121. Basic principles of thermodynamics and their applications to internal combustion engines, turbines, compressors, power generating and refrigeration systems.

MET 304. Applied Fluid Mechanics. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MATH 238 or MATH 112, PHYS 103 or PHYS 121. An introduction to fluid statics and the basic laws of fluid flow; conservation of mass, momentum and energy. Applications of the basic laws to internal and external incompressible flow, including specific topics in pipe flow systems, centrifugal pumps and fans, streamlining, and fluid flow meters.

MET 307. Plastics Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (CHEM 301 or CHEM 126 or CHEM 122), and (MET 105 or FED 101), and (MET 237 or MECH 237). An introduction to the basic concepts of plastics conversion, resin classification, processing techniques and significant engineering properties.

MET 308. Plastics Processing Techniques. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MET junior standing, MET 307. A study of the various processing techniques for both thermoset and thermoplastic materials. Topics include extrusion, injection molding, blow molding, compression moldings, and casting processes.

MET 314. Dynamics of Machinery. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MET 236 or MECH 236, and MATH 238 or MATH 112, and MET 105 or FED 101. Acquaints students with motion and forces in machines. Topics include velocity and accelerations in linkages, gears, cam and gear trains, static and dynamic forces, and torques in linkages.

MET 395. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisite: MET JUNIOR STANDING. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

MET 401. Mechanical Design Project I. 2 credits, 2 contact hours (2;0;0).
Prerequisites: MET 302, MET 303, MET 304, MET 314, ECET 329, COM 313. Project and lecture applies the principles learned in all technical courses to more advanced design situations. Proposal of a typical mechanical engineering system is presented by an individual or by small groups. The proposal must meet the approval of course instructor. A formal proposal is required.

MET 403. Applied Thermodynamics II. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (MATH 309 or MATH 211 or MATH 213), and MET 303, and MET 304. Builds on a first course on thermodynamics and covers thermodynamic properties of steam, first and second law of thermodynamics. Topics include power and refrigeration cycles, psychrometric chart and combustion.

MET 404. Applied Heat Transfer. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (MATH 309 or MATH 211 or MATH 213), and MET 303, and MET 304. An introduction to the fundamental theories and applications of heat transfer. Emphasizes understanding and practical problem solving in covering the three fundamental modes of heat transfer: conduction, convection, and radiation.

MET 407. Structural Design. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MATH 238 or MATH 112, and MET 237 or MECH 237, and MET 105 or FED 101. Acquaints students with the fundamentals of structural design. Topics include analysis and design of structural members due to various loadings (tension, compression, bending, torsion, and shear), deflections of structural members, truss analysis, stress analysis of weldment.

MET 409. AirConditioning and Refrigeration. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MET 303, MET 304. Calculation of building cooling and heating loads, psychrometric charts, air distribution and duct design. Topics also include compression and absorption refrigeration cycles, automatic control of refrigeration systems, and building energy management.

MET 415. Automatic Control Systems. 3 credits, 4 contact hours (2;2;0).
Prerequisites: (ECET 201 or ECE 405), and MET 314, and (CS 106 or CS 100 or CS 101 or CS 113), and (MET 105 or FED 101). Introduction to programmable logic controllers (PLC) as a tool for industrial controls of machines and process. Includes selections of hardware and software, ladder logic programming, wiring methods, maintenance and troubleshooting.

MET 448. Mechanical Design Project II. 1 credit, 2 contact hours (2;0;0).
Prerequisite: MET 401. Continuation of project MET 401. Oral presentation and formal written report are required.

MET 450. Mech Design Capstone Project. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MET 303, MET 304, MET 314, ECET 329, (COM 312 or COM 313). Corequisite: MET 302. Project and lecture applies the principles learned in all technical courses to more advanced design situations. Proposal of a typical mechanical engineering system is presented by an individual or by small groups. The proposal must meet the approval of course instructor. A formal proposal is required.

MET 491. Special Projects in MET. 1 credit, 3 contact hours (3;0;0).
One-credit special project course for MET students. Must have an instructor agreeing to sponsor the project. Approval by program coordinator is required.

MET 492. Special Projects in MET. 2 credits, 3 contact hours (3;0;0).
Two-credit special project course for MET students. Must have an instructor agreeing to sponsor the project. Approval by program coordinator is required.

MET 493. Special Projects in MET. 3 credits, 3 contact hours (3;0;0).
Three-credit special project course for MET students. Must have an instructor agreeing to sponsor the project. Approval by program coordinator is required.

MET 495. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisite: MET 395. Approval of the department, and permission of the Office of Cooperative Education and Internships. Full-time work experience for approximately one semester. Provides major-related work experience. Mandatory participation in seminars and completion of requirements that include a report and/or project.

MIT 231. Intro to Comp Security:Med Dev. 3 credits, 4 contact hours (2;2;0).
Prerequisites: An introductory Computer Programming Course: CS 100 or CS 106 and IT 120. Medical devices and systems are uniquely vulnerable to hacking and intrusion due to the nature of architecture: i.e. usually a dedicated device designed to solve a limited medical application such as an infusion pump that delivers medications in measured dosages. These systems rarely have more than a minimal computer footprint with limited or no operating system, i.e. a dedicated controller, and are usually updated periodically wirelessly. Our increased reliance on life sustaining technology required that computer professionals and engineers are educated on the evolving issues and solutions to these potentially life threatening dangers.

MIT 326. Electronic Medical Record Design. 3 credits, 4 contact hours (2;2;0).
This course will prepare students to manage medical records and related information in different medical settings like individual/group medical practices, health care organizations, long-term care settings, insurance companies, health-care software consulting companies, and/or government agencies. This course will also enable Medical Informatics student interns to become well versed in technology used during their internships. This course has two main objectives; first planning for Electronic Medical Record (EMR) adoption and implementation, and second, practical techniques of implementing and customizing Electronic Medical Records.

MIT 360. Introduction to Gerontology. 3 credits, 4 contact hours (2;2;0).
Prerequisites: Junior level standing, R920 201 or R830 101. Introduction to Gerontology is an introduction to the field of human aging. The course of study will include a multidisciplinary examination of the way in which human aging is viewed and how we perceive the process of growing older and how society responds to the issues of aging. The class will look at aging from multiple perspectives that include the social, political and biological sciences, arts and humanities, care giving and social services. This proposed course will provide students with an understanding of the unique challenges individuals experience as they age. Second it provides some basic hands/labs covering assistive technologies and personal and mobile sensors.

MIT 362. Geriatric Engineering I. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MIT 360 and (CS 106 or CS 113 or CS 115 or CPT 341) and (MATH 305 or MNET 315.) This course will first provide students with an understanding of the unique challenges individuals experience as they age. It introduces system design techniques to facilitate assistive technologies that foster independent living. The course provides a labs for the emerging field of designing assistive technologies and personal and mobile sensors. Labs will incorporate A hands low-power small footprint computing devices for sensor monitoring. Students will explore the feasibility of using, for example Raspberry Pi, and Arduino platforms, to monitor vital signs and export data to Electronic Health Record (EHR) platforms. Big Data challenges will be explored in preparation for meaningful use applications required by all EHR systems.

MIT 440. Clinical Internship. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Junior Level Standing, CPT 325 and permission MIT program coordinator. During the course of a semester the student gains 100 hours of experience in the IT or Network and Security department of a hospital. The student is under the supervision, and is evaluated by, the director of the corresponding program at the hospital. A final report is submitted to and graded by the BS, MIT Program Advisor at NJIT.

MIT 460. Economics of Aging: Microeconomics(individual) and Macroeconomic(global) Challenges. 3 credits, 5 contact hours (2;2;1).
Corequisites: MIT 360. Restrictions: Senior Standing. Microeconomics is the science of how people make decisions at the small scale. Macroeconomics looks at how the economy works as a whole ("on aggregate") This course will investigate the challenges an aging individual face dealing with fixed incomes in an environment of exploding health and housing costs and the larger effects on population aging on the global economy. Economic and political stresses on governments necessitated by demographics where fewer workers are paying for a growing older population. The impacts of technology and longer life spans will necessitate professionals to create new and innovative solutions. Included are computer simulations focused on modelling these economic forces.

MNET 215. Materials and Processes for Technology. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MET 103, PHYS 103, PHYS 103A, CHEM 301 or CHEM 126 or CHEM 122. The course introduces students to applications of materials, manufacturing processes, and metrology. Topics include engineering materials, heat treatment process, fabrication processes, finishing processes, and inspection processes.

MNET 300. Concepts In Machining. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ME 215 and MET 105. Applications in the machining of various materials. Topics include speeds and feeds calculations, tooling concepts, gaging techniques and prototype construction.

MNET 303. Advanced Techniques in CAD/CAM. 3 credits, 4 contact hours (2;2;0).
Prerequisite: MET 105. Applications including hands-on experience with CAD/CAM systems. Emphasis is on understanding how displayed objects are represented and manipulated on the computer. Laboratory experiences contribute to an understanding of the advantages and limitations of CAD/CAM systems.

MNET 315. Industrial Statistics. 3 credits, 4 contact hours (2;2;0).
Introduction to statistics covering data collection, analysis and presentation. Specialized topics include probability, control charts, correlation, regression, hypothesis testing, and -experimentation.

MNET 318. Mnfg Process Design. 3 credits, 4 contact hours (2;2;0).
Prerequisite: MNET 303. A development of the principles of production, methodology and economics in view of production requirements with respect to materials, tolerances and finish. Production processes are matched to the product requirements. Laboratory work supports the lecture. Computer problem solving is incorporated in the course.

MNET 395. Coop Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments are facilitated by the co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

MNET 405. Numc Control Machn Tools. 3 credits, 4 contact hours (2;2;0).
Prerequisites: ME 215 and MNET 303. Fundamental concepts of numerical control systems. Assignments include mill and lathe programming techniques, sheet metal processing, and CNC economics.

MNET 414. Industrial Cost Analysis. 3 credits, 3 contact hours (3;0;0).
An introduction to general costing techniques. Time value of money concepts are introduced to decision-making matters such as equipment justification, design selection and fabrication costs.

MNET 416. Production Scheduling. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MNET 315. A study of manual and computerized methods for setting schedules. Gantt charts, CPM, PERT, PERT/COST, and Line of Balance are some of the topics treated. Problems of line balancing and machine loading are discussed.

MNET 420. Quality Systems. 3 credits, 4 contact hours (2;2;0).
Prerequisite: MNET 315. Introduction in quality control that emphasizes design quality, total quality management and statistical process control. Additional topics include quality economics, ISO, reliability, service quality, measurement and acceptance sampling.

MNET 421. Contracts & Specs. 3 credits, 3 contact hours (3;0;0).

MNET 422. Tool Design. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MET 237, MNET 300 and MNET 303. Introduction to the design of cutting tools with emphasis on speeds, feeds, and power requirements. Covers design of jigs, fixtures, punch and dies, gaging and inspection tooling with emphasis on current industrial practices.

MNET 423. Motion & Time Study Tech. 3 credits, 4 contact hours (2;2;0).
A study of the basic principles of motion study concerning workplace design and related techniques involving process analyses, man-machine charts and micromotion study. Covers stopwatch time study techniques as well as predetermined time standards, work sampling and wage incentive system.

MNET 425. Advanced Manufacturing Rotation. 2 credits, 4 contact hours (3;1;0).
Prerequisites: MET 237, MNET 300, MNET 315, MNET 318. The course applies the principles learned in all technical courses to an Advanced Manufacturing environment. The student will rotate under the various manufacturing/metrology areas within an Advanced Manufacturing facility. Progress reports, oral presentation and a formal written report are required.

MNET 426. Manufacturing Project. 2 credits, 4 contact hours (1;3;0).
Prerequisite: Senior standing. A capstone project requiring a formal written report and oral presentation.

MNET 495. Cooperative Experien II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: MNET 395 or its equivalent, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as a co-op/intern. Mandatory participation in seminars and completion of requirements that include a report and/or project.

TMT 301. Digital Electronics for Telecommunications. 3 credits, 4 contact hours (2;2;0).
Studies the fundamentals of digital electronics including combinational and sequential logic. Emphasizes those signals and configurations commonly employed in telecommunication systems. Theory is reinforced in hardware and simulation laboratory exercises.

B.S. in Engineering Technology, Computer Technology

Computer Technology (CMPT) is an interdisciplinary program which combines courses mainly in Engineering Technology, Computer Science and Management. The program also provides a background in mathematics and science which is sufficient to allow students to go on to graduate school. It is designed as a continuation of an associate's degree program in computer science, computer programming, computer networking, or computer software. This program prepares the student for careers as a computer application programmer, database administrator, computer system manager, computer network manager, software specialist, Management Information Systems (MIS) manager, customer support engineer, computer sales representative or educator and trainer in the field of computer applications.

Students who wish to enter the program as a transfer student are typically students with an associate’s degree in a program of computer studies, such as computer science, computer technology, computer software or computer networking.

A maximum of 60 credit hours may be transferred into this program, and students need most of the following courses: Calculus I, Science such as biology, botany, chemistry, geology or physics, Communications, Economics / Accounting , Physical Education , Introduction to Programming, Data Structures / Advanced High Level Language Programming, Operating Systems (DOS, Windows, Unix) and Database Concepts with SQL (Access, dBase, Visual Basic). Students are expected to have some knowledge of C++ or another object oriented language. Students with less than 64 credits or with deficiencies in the above subject areas are considered on a case by case basis.

(120 credits minimum)

First Year		
1st Semester		**Credits**
ENGL 101	English Composition: Introduction to Academic Writing	3
Science Literacy with Lab GER		4
MATH 138 or MATH 135	General Calculus I or Calculus for Business	3
FYS SEM	First-Year Student Seminar	0
CS 106	Roadmap to Computing for Engineers	3
	Term Credits	**13**
2nd Semester		
ENGL 102	English Composition: Introduction to Writing for Research	3
Science Literacy with Lab GER		4
CS 113 or CS 115	Introduction to Computer Science or Introduction to Computer Science in C++	3
IT 201	Information Design Techniques	3
Specialization/Technical Elective 1		3
ET 101	Introduction to Engineering Technology	0
	Term Credits	**16**
Second Year		
1st Semester		
EPS 202	Society, Technology, and the Environment (or Rutgers Equivalent Elective)	3
Free Elective		3
History and Humanities GER 200 level (p. 106)		3
IT 202	Internet Applications	3
IT 120	Introduction to Network Technology	3
Specialization/Technical Elective 2		3
	Term Credits	**18**
2nd Semester		
Free Elective		3
IS 331	Database Design Management and Applications	3
Specialization/Technical Elective 3		3
Specialization/Technical Elective 4		3
Specialization/Technical Elective 5		3
	Term Credits	**15**
Third Year		
1st Semester		
CPT 310	Computer Design Fundamentals for Computer Technology	3
CPT 330	Software Web Applications for Engineering Technology I	3
CPT 341	Visual Basic.NET for Engineering Technology	3
COM 313	Technical Writing	3
Select one of the following:		2
CPT 492	Special Projects in Computer Technology	
MET 103	Engineering Graphics and Intro. to CAD	
Technical Elective		
MIS 245	Introduction to Management Information Systems	3
	Term Credits	**17**

2nd Semester		
CPT 315	Computer Architecture for Computer Technology	3
CPT 335	Networks Applications for Computer Technology I	3
MATH 305	Statistics for Technology	3
MRKT 330	Principles of Marketing	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
CPT 430	Software Web Applications for Engineering Technology II	3
CPT 440	Visual Basic Applications for Engineering Technology	3
OM 375	Business Operations Management and Analytics	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**12**
2nd Semester		
CPT 401	Senior Project	2
CPT 435	Networks Applications for Computer Technology II	3
Science Elective Course in Physics or Chemistry		3
Free Elective		3
Technical Elective-Course in IT or CS		3
	Term Credits	**14**
	Total Credits	**120**

GER Electives

Refer to the **General Education Requirement** section of this catalog for further information on GER electives.

CMPT Specializations - Select one specialization from the list below. Students must complete a combination of 6 courses in specialization and technical electives.

IT Security Specialization:

Code	Title	Credits
Complete the following 2 courses:		
CPT 335	Networks Applications for Computer Technology I	
CPT 435	Networks Applications for Computer Technology II	
Technical Electives		
Select four of the following:		
IT 220	Wireless Networks	
IT 330	Computer Forensic	
IT 331	Privacy and Information Technology	
IT 332	Digital Crime	
IT 430	Ethical Hacking for System Administrators	
CS 434	Advanced Database Systems	
CS 608	Cryptography and Security	
CS 639	Elec. Medical Records: Med Terminologies and Comp. Imp.	
R120 102	General Biology II	
R120 142	Anatomy & Physiology	

Medical Informatics Specialization:

Code	Title	Credits
Complete the following 4 courses:		
CPT 325	Medical Informatics Technology	
CPT 425	Medical Informatics Technology II	
MIT 326	Electronic Medical Record Design	

R120 141	Anatomy & Physiology
Techincal Electives:	
Select two of the following:	
IT 220	Wireless Networks
IT 330	Computer Forensic
IT 331	Privacy and Information Technology
IT 332	Digital Crime
IT 430	Ethical Hacking for System Administrators
CS 434	Advanced Database Systems
CS 608	Cryptography and Security
CS 639	Elec. Medical Records: Med Terminologies and Comp. Imp.
R120 102	General Biology II
R120 142	Anatomy & Physiology

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Engineering Technology, Electrical and Computer Engineering Technology

The Electrical and Computer Engineering Technology (ECET) program emphasizes the application of electrical/electronics principles and devices and computer hardware and software. Graduates of the ECET program are involved in product development and improvement, system development, management, manufacturing and engineering operational functions, in a wide variety of companies in the computer, telecommunications, medical electronics and other technical fields. Graduates also have positions in technical sales and customer service, and a significant percentage continue their studies and earn graduate degrees in engineering or management.

The placement of graduating students has been excellent. ***This program is accredited by The Engineering Technology Accreditation Commission (ETAC of ABET), http://www.abet.org***

Graduates of this program are eligible to sit for the Professional Engineer's examination in New Jersey with the appropriate experience, as determined by the New Jersey Board of Professional Engineers and Land Surveyors (http://www.njconsumeraffairs.gov/pels/). Graduates of the program are also eligible to pursue graduate degrees in biomedical engineering, electrical and computer engineering, engineering management, management or related areas and students may participate in the BS/MS Program (http://www.njit.edu/graduatestudies/program-options/bs-ms/index.php (http://www.njit.edu/graduatestudies/program-options/bs-ms/)). The full four-year curriculum for the program is shown below. Students who wish to enter the program as a transfer student are typically students with an A.A.S. degree in Electrical Engineering Technology and should have completed most or all of the courses, or their equivalents, in the first two years of the program as shown below. In the case of all students, both four-year and transfer, a minimum of 120 credits is required for graduation.

Program Educational Objectives

- Our graduates will establish productive careers in technology-based organizations in such diverse positions as design, manufacturing, teaching, management, system engineering and sales.
- Our graduates will participate in lifelong learning activities including graduate school and other professional education.

Student Outcomes

- an ability to select and apply the knowledge, techniques, skills, and modern tools of their disciplines to broadly-defined engineering technology activities
- an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies
- an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes
- an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives
- an ability to function effectively as a member or leader on a technical team
- an ability to identify, analyze, and solve broadly-defined engineering technology problems
- an ability to apply written, oral and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;

- an understanding of the need for and an ability to engage in self-directed continuing professional development
- an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity
- a knowledge of the impact of engineering technology solutions in a societal and global context
- a commitment to quality, timeliness, and continuous improvement
- the application of digital and analog circuit design, computer software, and embedded systems to the development of electrical and computer systems;
- the ability to analyze and develop communications, control, computer, or power systems
- the ability to apply project management techniques to computer and electrical systems.
- the ability to utilize statistics/probability, transform methods and differential equations in support of electrical and computer systems
-

(120 credits minimum)

First Year		
1st Semester		**Credits**
MATH 138	General Calculus I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
CS 106	Roadmap to Computing for Engineers	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MET 103	Engineering Graphics and Intro. to CAD	2
ET 101	Introduction to Engineering Technology	0
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
MATH 238	General Calculus II	3
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
ECET 201	Circuits I	3
ECET 215	Introduction to Digital Electronics	3
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**16**
Second Year		
1st Semester		
ECET 202	Circuits II	3
Technical Elective (200 level or higher) [1]		3
ECON 201	Economics	3
ECET 211	Computer Architecture	2
Select one of the following:		3
HUM 211	The Pre-Modern World	
HUM 212	The Modern World	
HIST 213	The Twentieth-Century World	
	Term Credits	**14**
2nd Semester		
ECET 205	Fundamentals of Analog Electronics	3
ECET 214	Introduction to Communications	3
Technical Elective (200 level or higher) [1]		3
Free Elective (200 level or higher) [2]		3
	Term Credits	**12**
Third Year		
1st Semester		
MATH 309	Mathematical Analysis for Technology	4
ECET 303	Circuit Measurements	2

ECET 311	Embedded Systems I	3
ECET 365	Digital Logic and Circuit Design	3
COM 313	Technical Writing	3
	Term Credits	**15**
2nd Semester		
MATH 322	Differential Equations for Applications	3
ECET 411	Embedded Systems II	3
ECET 300	Circuit Analysis: Transform Methods	3
ECET 305	Integrated Circuit Applications	3
ECET 344	Numerical Computing for Engineering Technology	3
Free Elective (300 level or higher) [2]		3
	Term Credits	**18**
Fourth Year		
1st Semester		
MNET 414	Industrial Cost Analysis	3
MATH 305 or MNET 315	Statistics for Technology or Industrial Statistics	3
PHIL 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering	3
ECET Technical Elective [3]		3
ECET Technical Elective [3]		3
	Term Credits	**15**
2nd Semester		
ECET 400	Senior Project	3
CHEM 301	Chemical Technology	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
ECET Technical Elective [3]		3
Technical Elective (300 level or higher) [1]		3
	Term Credits	**15**
	Total Credits	**120**

1. Tech Electives: Any course with a technical subject matter. Lower division must be 200 level or higher, upper division must be 300 level or higher. Excludes CPT 310.
2. Free Electives: Any course offered by the university, may be technical or non-technical. Lower division must be 200 level or higher, upper division must be 300 level or higher
3. ECET Electives: ECET 350,412,414,415,416,418,419,430,440, and 444. ECE Bridge Courses may also be used to fill these ECET Elective courses.
4. Alternates for Eng 352: ENG 340

ECET Technical Electives

ECET Technical electives are 300 and 400 level courses offered by the ECET program that are not previously required courses within the program. All ECET students are required to take at least two of these courses for their degree. ECET elective courses taken in addition to the two required can fill any of the elective requirements. Note: ECET 329 is not considered an ECET Technical Elective course as it is only for non-ECET majors and cannot be used towards the ECET degree.

Code	Title	Credits
ECET 350	Computerized Industrial Controls	3
ECET 412	Power Generation and Distribution	3
ECET 415	Fundamentals of Telecommunications	3
ECET 416	Networking Applications	3
ECET 418	Transmission Systems	3
ECET 440	Clinical Internship	3
ECET 444	Technology Applications of Object-Oriented Programming	3

Technical Electives

Technical electives can be satisfied only by courses with a technical subject matter; this excludes Humanities, History, Economics, Social Sciences, Literature, and any other non-technical subject. In general, the following subjects qualify as Technical Electives: ARCH, BIO, BIOL, BME, CE, CET, CHEM, CPT, CS, ECE, EM, ENGR, IE, IS, IT, MATH, ME, MECH, MET, MIS, MNET, OPSE, PHYS, and SET. Except CPT 310 Computer Design Fundamentals for Computer Technology or MATH 305 Statistics for Technology or MATH 309 Mathematical Analysis for Technology or MATH 322 Differential Equations for Applications or CHEM 301 Chemical Technology or MNET 315 Industrial Statistics or MNET 414 Industrial Cost Analysis. Additionally, any course required for the ECET degree cannot be used as a technical elective, in the case where a class has been substituted in place of a required course, the originally required course cannot be used as an elective.

Free Electives

Free electives may be satisfied by any course offered at the university. The ECET program contains two free electives, one 3 credit course, 200 or higher level and one 3 credit course, 300 or higher level.

Co-op Work Experience (Internship)

Co-op Work Experience is not required as part of the ECET program, although it is highly recommended. Students can participate in a sixteen-week paid internship at a variety of local companies. Students who pass Co-op can use the credit to fulfill any of the six non-ECET required electives.

To apply for Co-op students must first visit the Career Development Services office at NJIT and fill out a Co-op application. The application will be sent to your academic advisor for approval and you will be notified of the decision.

Co-op Classes

The ECET Co-op classes are ECET 395 Co-op Work Experience I and ECET 495 Co-op Work Experience II.

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Engineering Technology, Manufacturing Engineering Technology

Manufacturing Engineering Technology students focus on courses which develop their background in fabrication, metrology, quality control, industrial statistics/six sigma, manufacturing management, plastics processing, and packaging. The subjects covered in the core curriculum include established and modern manufacturing processes, metrology, material science, applied manufacturing/engineering software, computer-aided design (CAD), computer-aided manufacturing (CAM), automated controls (Programmable Logic Controls (PLCs), microprocessors, robotics, electrical circuits and electronics principles, quality control, engineering economics, and production and operations management.

The Manufacturing Engineering Technology (MNET) program is a full four-year curriculum, which also provides an opportunity for transfer students with A.A.S. degrees in Mechanical Engineering Technology to complete their baccalaureate degree. In the case of all students, both four-year and transfer, a minimum of 120 credits is required for graduation. (see Curriculum)

Transfer From AAS program

NJIT has articulation agreements with a number of AAS programs in the state. A list of agreements can be found at http://www.njit.edu/admissions/transfer-students (http://www.njit.edu/admissions/transfer-students/). Students who expect to transfer to the junior year of the Bachelor of Science in Engineering Technology (B.S.E.T.) program would have their courses correlated to the existing MNET program curriculum: Manufacturing Engineering Technology (MNET) Program (http://catalog.njit.edu/undergraduate/newark-college-engineering/technology/manufacturing-engineering-technology/).

(120 credit minimum)

First Year		
1st Semester		**Credits**
MATH 138	General Calculus I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
MET 103	Engineering Graphics and Intro. to CAD	2
ENGL 101	English Composition: Introduction to Academic Writing	3
CS 106	Roadmap to Computing for Engineers	3
ET 101	Introduction to Engineering Technology	0

FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
MATH 238	General Calculus II	3
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
MET 105	Applied Computer Aided Design	2
ENGL 102	English Composition: Introduction to Writing for Research	3
ECON 201 or EPS 202	Economics or Society, Technology, and the Environment	3
	Term Credits	**15**
Second Year		
1st Semester		
MET 235	Statics for Technology	3
ECET 201	Circuits I	3
Select one of the following: *		3
CHEM 301	Chemical Technology	
Technical Elective		
History and Humanities GER 200 level (p. 106)		3
Technical Elective		3
	Term Credits	**15**
2nd Semester		
MET 205	Advanced Computer Aided Design	3
MET 237	Strength of Materials for Technology	3
ME 215	Engineering Materials and Processes	3
Free Elective		3
MET 236	Dynamics for Technology	2
	Term Credits	**14**
Third Year		
1st Semester		
COM 313	Technical Writing	3
MNET 303	Advanced Techniques in CAD/CAM	3
MNET 300	Concepts In Machining	3
MNET 315	Industrial Statistics	3
MET 303	Applied Thermodynamics	3
	Term Credits	**15**
2nd Semester		
Select one of the following: *		3
CHEM 301	Chemical Technology	
Technical Elective		
ECET 329	Analog and Digital Electronics	3
MET 304	Applied Fluid Mechanics	3
MNET 318	Mnfg Process Design	3
Free Elective		3
	Term Credits	**15**
Fourth Year		
1st Semester		
MNET 405	Numc Control Machn Tools	3
MNET 414	Industrial Cost Analysis	3
MNET 416	Production Scheduling	3
MNET 420	Quality Systems	3
MNET 425	Advanced Manufacturing Rotation	2

History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**17**
2nd Semester		
MET 415	Automatic Control Systems	3
MNET 422	Tool Design	3
Technical Elective		3
MNET 426	Manufacturing Project	2
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
	Total Credits	**120**

* Chem 301 Chemical Technology is a required course to be taken either first semester sophomore year for NJIT sophomores, or second semester junior year for Upper Division Transfer Students.

Approved Technical Electives

Code	Title	Credits
IE 449	Industrial Robotics	3
IE 473	Safety Engineering	3
ECET 319	Electrical Systems and Power	3
MNET 421	Contracts & Specs	3
MNET 423	Motion & Time Study Tech	3
MNET 395	Coop Experience I	3
MNET 495	Cooperative Experien II	3
MET 205	Advanced Computer Aided Design	3
MET 307	Plastics Technology	3
ECET 210	Intro. to Microprocessors and Computer Architecture	3
MET 308	Plastics Processing Techniques	3
CPT 330	Software Web Applications for Engineering Technology I	3
CPT 341	Visual Basic.NET for Engineering Technology	3
MATH 322	Differential Equations for Applications	3

Additional courses from other departments may be substituted as Technical Electives after obtaining prior approval from the MNET Program Coordinator.

Approved Electives

Code	Title	Credits
MGMT 390	Principles of Business	3

Co-op

Co-op courses must be approved by the MNET Program Coordinator and Career Development Services. MNET 395 is taken as an elective for degree credit. Students taking a Full-Time Co-op may only register for a maximum of 9 credits including Co-op, but are fulltime.

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

B.S. in Engineering Technology, Mechanical Engineering Technology

The Mechanical Engineering Technology (MET) program prepares graduates with knowledge, problem solving ability, and hands-on skills to enter careers in the design, installation, manufacturing, testing, evaluation, technical sales, or maintenance of mechanical systems. Our graduates typically have strengths in the analysis, applied design, development, implementation, or oversight of advanced mechanical systems and processes.

The MET program emphasizes hands-on experience and the use of state-of-the-art computer software in the fields of mechanical design, automatic controls, power generation, CAD/CAM, HVAC, and engineering sales. The program also provides a background in mathematics and science, which is sufficient to allow students to go on to graduate school, and also obtain a professional engineering license. ***This program is accredited by The Engineering Technology Accreditation Commission (ETAC of ABET),*** ***http://www.abet.org***

Graduates of this program are eligible to sit for the Professional Engineer's examination in New Jersey with the appropriate experience, as determined by the New Jersey Board of Professional Engineers and Land Surveyors. (http://www.njconsumeraffairs.gov/pels/). Graduates of the program are also eligible to pursue graduate degrees in mechanical engineering, management or related areas and students may participate in the BS/MS Program (http://www.njit.edu/graduatestudies/program-options/bs-ms/index.php (http://www.njit.edu/graduatestudies/program-options/bs-ms/)). The full four-year curriculum for the program is shown below. Students who wish to enter the program as a transfer student are typically students with an A.A.S. degree in Mechanical Engineering Technology and should have completed most or all of the courses, or their equivalents, in the first two years of the program as shown below. In the case of all students, both four-year and transfer, a minimum of 128 credits is required for graduation.

Program Educational Objectives

- Our graduates will possess the strengths to obtain and advance in positions that require analysis, applied design, development, implementation, or oversight of mechanical systems and processes.
- Our graduates will have the knowledge, problem solving ability, and hands-on skills to be successful in careers in the design, installation, manufacturing, testing, evaluation, technical sales, or maintenance of mechanical systems.
- Our graduates will have the foundation to take advantage of opportunities for life-long learning and professional development.

Student Outcomes

- an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;
- an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;
- an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;
- an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;
- an ability to function effectively as a member or leader of a technical team;
- an ability to identify, analyze, and solve broadly-defined engineering technology problems;
- an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;
- an understanding of the need for and an ability to engage in self-directed continuing professional development;
- an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;
- a knowledge of the impact of engineering technology solutions in a societal and global context;
- a commitment to quality, timeliness, and continuous improvement;

(120 credit minimum)

First Year		
1st Semester		**Credits**
MATH 138	General Calculus I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
MET 103	Engineering Graphics and Intro. to CAD	2
ENGL 101	English Composition: Introduction to Academic Writing	3
CS 106	Roadmap to Computing for Engineers	3
ET 101	Introduction to Engineering Technology	0
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
MATH 238	General Calculus II	3
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
MET 105	Applied Computer Aided Design	2
ENGL 102	English Composition: Introduction to Writing for Research	3
ECON 201 or EPS 202	Economics or Society, Technology, and the Environment	3
	Term Credits	**15**

Second Year		
1st Semester		
MET 235	Statics for Technology	3
Technical Elective		3
ECET 201	Circuits I	3
History and Humanities GER 200 level (p. 106)		3
Select one of the following:		3
Technical Elective		
CHEM 301	Chemical Technology	
	Term Credits	**15**
2nd Semester		
MET 236	Dynamics for Technology	2
MET 237	Strength of Materials for Technology	3
ME 215	Engineering Materials and Processes	3
Free Elective (2xx or 3xx)		3
Technical Elective		3
	Term Credits	**14**
Third Year		
1st Semester		
MATH 309	Mathematical Analysis for Technology	4
MET 301	Analysis and Design of Machine Elements I	3
MET 303	Applied Thermodynamics	3
MET 314	Dynamics of Machinery	3
COM 313	Technical Writing	3
	Term Credits	**16**
2nd Semester		
MET 302	Analysis and Design of Machine Elements II	3
MET 304	Applied Fluid Mechanics	3
ECET 329	Analog and Digital Electronics	3
Select one of the following: *		3
Technical Elective		
CHEM 301	Chemical Technology	
Free Elective (3xx)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
MNET 315	Industrial Statistics	3
MET 415	Automatic Control Systems	3
History and Humanities GER 300+ level (p. 108)		3
Select one of the following:		3
CPT 310	Computer Design Fundamentals for Computer Technology	
CPT 341	Visual Basic.NET for Engineering Technology	
Technical Elective		3
	Term Credits	**15**
2nd Semester		
MNET 414	Industrial Cost Analysis	3
MET 450	Mech Design Capstone Project	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
Technical Elective		3

Technical Elective		3
	Term Credits	**15**
	Total Credits	**120**

* Chem 301 Chemical Technology is a required course to be taken either first semester sophomore year for NJIT sophomores, or second semester junior year for Upper Division Transfer Students.

Free Electives

Consult the program coordinator. Students entering with fewer than 9 credits in humanities/social science must take an appropriate humanities/social science course to fulfill the NJIT GER.

Suggested Technical Electives

Code	Title	Credits
MET 205	Advanced Computer Aided Design	3
IE 224	Production Process Design	3
MET 307	Plastics Technology	3
MET 308	Plastics Processing Techniques	3
MET 395	Co-op Work Experience I	3
MET 403	Applied Thermodynamics II	3
MET 404	Applied Heat Transfer	3
MET 407	Structural Design	3
MET 409	AirConditioning and Refrigeration	3
MET 495	Co-op Work Experience II	3
MNET 300	Concepts In Machining	3
MNET 318	Mnfg Process Design	3
MNET 405	Numc Control Machn Tools	3
MNET 416	Production Scheduling	3
MNET 422	Tool Design	3
MNET 303	Advanced Techniques in CAD/CAM	3
MNET 420	Quality Systems	3
CPT 330	Software Web Applications for Engineering Technology I	3
CPT 341	Visual Basic.NET for Engineering Technology	3

Additional courses from other departments may be substituted as Technical Electives after obtaining prior approval from the MET Program Coordinator.

Co-op

Co-op courses must be approved by the MET Program Coordinator and Career Development Services. MET 395 Co-op Work Experience I is taken as an elective for degree credit. Students taking full time Co-op may only register for a maximum of 9 credits including Co-op. Students taking part time Co-op may only register for a maximum of 15 credits.

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses"

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Engineering Technology, Medical Informatics Technology

Medical Informatics is an interdisciplinary program which combines courses from Information Systems, Biology and Management. The program also provides a background in mathematics and science which is sufficient to allow students to go onto graduate school. It is the study of how health data is collected, stored and communicated, how data is used for administration and clinical decision making and how computers and telecommunications can be applied to support those processes.

The areas of study in Medical Informatics are; Medical Records, Tele-monitoring, Expert Systems, Security, CT-MRI & PET scan data analysis and storage and Medical Sensors. The full four-year curriculum for the program is shown below. Students who wish to enter the program as a transfer student are typically students with an A.S. degree Computer Science or Medical Informatics, and should have completed most or all of the courses, or their equivalents, in the first two years of the program as shown below. In the case of all students, both four-year and transfer, a minimum of 120 credits is required for graduation.

(120 credits minimum)

First Year		
1st Semester		**Credits**
R120 101	General Biology	4
MATH 138 or MATH 135	General Calculus I or Calculus for Business	3
CS 106 or CS 100	Roadmap to Computing for Engineers or Roadmap to Computing	3
IT 120	Introduction to Network Technology	3
ENGL 101	English Composition: Introduction to Academic Writing	3
ET 101	Introduction to Engineering Technology	0
FYS SEM	First-Year Student Seminar	0
	Term Credits	**16**
2nd Semester		
BME 111	Introduction to Physiology	3
CS 113 or CS 115	Introduction to Computer Science or Introduction to Computer Science in C++	3
ENGL 102	English Composition: Introduction to Writing for Research	3
EPS 202	Society, Technology, and the Environment	3
Technical Elective 1		3
	Term Credits	**15**
Second Year		
1st Semester		
CS 114 or CS 116	Introduction to Computer Science II or Introduction to Computer Science II in C++.	3
IT 201	Information Design Techniques	3
IT 220	Wireless Networks	3
COM 200	Communicating in Organizations	3
	Term Credits	**12**
2nd Semester		
IT 202	Internet Applications	3
Technical Elective 2		3
MATH 305 or MNET 315	Statistics for Technology or Industrial Statistics	3
R920 201 or R830 101	Intro Sociology I or Principles Of Psychology I	3
Select one of the following:		3
HUM 211	The Pre-Modern World	
HUM 212	The Modern World	
HIST 213	The Twentieth-Century World	
	Term Credits	**15**
Third Year		
1st Semester		
CPT 325	Medical Informatics Technology	3
CPT 310	Computer Design Fundamentals for Computer Technology	3
CPT 330	Software Web Applications for Engineering Technology I	3
COM 313	Technical Writing	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**

2nd Semester		
CPT 425	Medical Informatics Technology II	3
CPT 341	Visual Basic.NET for Engineering Technology	3
CPT 335	Networks Applications for Computer Technology I	3
MIT 326	Electronic Medical Record Design	3
IT 230	Computer and Network Security	3
	Term Credits	**15**
Fourth Year		
1st Semester		
CPT 401	Senior Project	2
CS 331	Database System Design & Mgmt	3
MIT 360	Introduction to Gerontology	3
IT 330 or IT 430	Computer Forensic or Ethical Hacking for System Administrators	3
Technical Elective 3		3
	Term Credits	**14**
2nd Semester		
MIT 362	Geriatric Engineering I	3
Technical Elective 4		6
CPT 373	Web App Development for Mobile	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
Technical Elective 5		3
	Term Credits	**18**
	Total Credits	**120**

GER Electives

Refer to the **General Education Requirement** section of this catalog for further information on GER electives.

Technical Electives

Code	Title	Credits
IT 220	Wireless Networks	3
IT 330	Computer Forensic	3
IT 331	Privacy and Information Technology	3
IT 332	Digital Crime	3
IT 430	Ethical Hacking for System Administrators	3
CS 434	Advanced Database Systems	3
CS 608	Cryptography and Security	3
CS 639	Elec. Medical Records: Med Terminologies and Comp. Imp.	3
MIT 440	Clinical Internship	3
R120 102	General Biology II	4
R120 142	Anatomy & Physiology	4

Geriatric Engineering Technology Minor

Code	Title	Credits
The following fours courses are required:		
ECET 201	Circuits I	3
MIT 231	Intro to Comp Security:Med Dev	3
MIT 360	Introduction to Gerontology	3
MIT 362	Geriatric Engineering I	3
The remaining 1 course from the following:		

MIT 326	Electronic Medical Record Design	3
CPT 325	Medical Informatics Technology	3

Note: Students majoring in Medical Informatics Technology are not eligible for the Geriatric Engineering Technology Minor

Grand Challenges of Engineering Minor

(16 credits)

Requires approval by Grand Challenge Scholar Program coordinator.

Code	Title	Credits
ENGR 290	Pers of the Grand Challenges	1
ENGR 423	Drone Science Fundamentals	3
or CHE 415	Introduction to 3D Printing	
or ENGR 301	Engineering Applications of Data Science	
or MTSE 318	Engineering Materials	
or OPSE 301	Introduction to Optical Science and Engineering	
or OPSE 310	Virtual Instrumentation	
or OPSE 410	Biophotonics	
ENGR 491	Research and Independent Study I	3
ENGR 492	Research and Independent Study II	3
IE 463	Invention and Entrepreneurship	3
or IE 492	Engineering Management	
or ENTR 210	Introduction to Entrepreneurship	
or ENTR 320	Financing New Venture	
or ENTR 330	Entrepreneurial Strategy	
or ENTR 440	Lean Startup Accelerator	
or ENTR 485	ST in Entrepreneurship	
ENGR 493	Service Learning Experience for Engineers	3
Total Credits		**16**

Manufacturing Engineering Technology Minor

Code	Title	Credits
The following 3 courses are required:		
ME 215	Engineering Materials and Processes	3
or MNET 215	Materials and Processes for Technology	
MNET 303	Advanced Techniques in CAD/CAM	3
MNET 315	Industrial Statistics	3
Remaining 2 courses from the following:		6
MNET 300	Concepts In Machining	
MNET 318	Mnfg Process Design	
MNET 405	Numc Control Machn Tools	
MNET 414	Industrial Cost Analysis	
MNET 416	Production Scheduling	
MNET 420	Quality Systems	
MNET 421	Contracts & Specs	
MNET 422	Tool Design	
MNET 423	Motion & Time Study Tech	
Total Credits		**15**

SAET - Built Env. Division (SBED)

On November 9, 2018, NJIT launched its newest school, the School of Applied Engineering and Technology (SAET), within the university's Newark College of Engineering (NCE). SAET encompasses NCE's engineering technology programs in two divisions (Electrical and Mechanical Engineering Technology Division and the Built Environment Division); the baccalaureate degree General Engineering program; and a division focused on Engineering Education practice and research. SAET serves about 1,000 NJIT students. The SAET offers Bachelor of Science in Engineering Technology (BSET) degrees in nine different options, as well as, Bachelor of Science (BS) degrees in Concrete Industry Management (CIM), and General Engineering.

The Built Environment Division (SBED) consists of the Construction Engineering Technology (CET), Construction Management Technology (CMT), Concrete Industry Management (CIM), and Surveying Engineering Technology (SET) programs.

The options in Construction Engineering Technology and Surveying Engineering Technology are accredited by the Engineering Technology Accreditation Commission (ETAC of ABET) http://abet.org (http://abet.org/)

Many students choose to complete their freshman and sophomore years at a community college or a technical institute, and obtain an associate's degree in applied science from these institutions. It is strongly recommended that students talk to an academic advisor at NJIT while they are still pursuing their associate's degree. The academic advisor will explain the transfer process in detail as well as suggest elective courses that may be beneficial. Contact an advisor by calling the School of Applied Engineering and Technology at (973) 596-3228, or by email at EngineeringTechnology@njit.edu.

After being admitted to NJIT, students must meet with an academic advisor to discuss the curriculum and any special interests the student might have. Students who lack necessary courses will be assigned bridge courses to make up the required prerequisites. Generally, courses taken at the freshman and sophomore level at the community colleges cannot substitute for junior or senior NJIT engineering technology courses. Engineering technology is that part of the technological field which requires the application of scientific and engineering knowledge and methods, combined with technical skills, for the implementation and extension of existing technologies. Engineering technology education focuses on preparing engineering technologists for positions that involve product development and improvement, system development, management, manufacturing and engineering operational functions. Graduates also enter the technical sales and customer services field, or continue in graduate work in engineering or management. Placement of graduates has been excellent.

NJIT Faculty

B

Barnes, William, Associate Professor

Brateris, Daniel J., University Lecturer

E

English, Robert, Professor Emeritus

J

Juliano, Thomas, Associate Professor

K

Khader, Michael, Associate Professor

L

Lieber, Samuel C., University Lecturer

M

Mahgoub, Mohamed A., Assistant Professor

Miima, John B., Assistant Professor

P

Potts, Laramie, Associate Professor

R

Rabie, Mohammad A., University Lecturer

Rahman, Sahidur, University Lecturer

Rockland, Ronald H., Professor

S

Sengupta, Arijit, Associate Professor

W

Washington, David W, Associate Professor

Wiggins, John, Senior University Lecturer

Programs

- Engineering Technology, Construction Engineering Technology (CET) - B.S. (p. 640)
- Engineering Technology, Construction Management Technology (CMT) - B.S. (p. 643)
- Engineering Technology, Surveying Engineering Technology (SET) - B.S. (p. 645)
- Concrete Industry Management (CIM) - B.S. (p. 647)
- Remote Sensing Minor (p. 649)

CET 233. Structural Analysis in Construction. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MET 237. This course will cover the aspects of the design and construction of structural steel and reinforced concrete for construction engineering technology students. This will include the design of beams, slabs and columns as well review of the connection of these structural members as encountered in practice.

CET 313. Construction Procedures I. 3 credits, 3 contact hours (3;0;0).
Corequisite: CET 317. An introduction to heavy construction practices. Emphasis is on construction equipment, site preparation, earthmoving, compaction, dewatering, piles, drilling and blasting, and tunnelling. Case studies in heavy construction are used.

CET 314. Construction Procedures II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CET 313, CET 317. An introduction to building construction practices and building materials. Emphasis is on structural systems, construction materials and detailed finishing operations required to make a serviceable structure. Case studies in building construction are used.

CET 317. Construction Computing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 106 Application of available software to construction-related computing problems, including: strength of materials, structural analysis, fluids/ hydraulics, surveying, scheduling, cost estimating, and computerized drafting (CAD).

CET 322. Construction Codes and Regulations. 3 credits, 3 contact hours (3;0;0).
An introduction to the New Jersey Uniform Construction Code, the BOCA National Building Code, NJ DOT Standard Specifications and the CSI specification format. A code analysis of a typical construction project is undertaken.

CET 323. Construction Safety. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CET 313 and CET 314 This course will address the safety issues encountered in construction as mandated by the Occupational Safety and Health Act (OSHA)and other similar regulations.

CET 331. Structural Systems. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CET 233. Study of types and behavior of modern structures using both analytical and intuitive techniques. Examples include beam and column, one- and two-way slab systems, wood and masonry systems, and wind and seismic analysis.

CET 341. Soils and Earthwork. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MET 237 A study of the significant soil types and tests. Problems are investigated relating to soil mechanics, soil supported foundations for engineering structures. Appropriate field trips are made.

CET 411. Cost Estimating. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CET 313, CET 314, CET 317. Take off of quantities of materials from typical building and highway projects. Pricing for labor, materials, and equipment. Crew sizes, productivity and manpower leveling. Computerized cost estimating and take off methods. Prepare a complete bid estimate for a construction project.

CET 413. Environmental Science. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CET 313, CET 314, CET 431. An introduction to construction-related environmental science topics, including basic environmental chemistry, geology, ground water hydrology, basic air quality, surface water run-off, erosion and sedimentation control, indoor air quality, and vibration analysis. Case studies cover various construction activities with respect to their effect on the environment and the manner in which they can be controlled.

CET 415. Construction Project Management. 3 credits, 3 contact hours (3;0;0).
Restriction: Senior standing in construction enginerring technology or contruction management technology. An introduction to construction management and administration methods and procedures including the design and construction process, project organizational structure, construction planning, contract administration, records and reports, financial management, risk analysis, manual and computerized GANTT and CPM scheduling, change orders and extra work, claims and disputes, cost accounting and document tracking.

CET 416. Senior Construction Project. 2 credits, 3 contact hours (1;2;0).
Prerequisites: CET 415; second semester senior standing in construction engineering technology or construction management technology. Simulates the methods and procedures used to successfully manage a construction project. Provides familiarization with constructability analysis, value engineering, productivity improvement, quality control, advanced field and office administration techniques, problem solving, and construction automation. Extensive use of construction-related computer software. Written submittals and oral presentations required.

CET 421. Construction Contracts. 3 credits, 3 contact hours (3;0;0).
Legal aspects of the various types of construction contracts and specifications. Scope, format, and use of various types of contracts such as owner-contractor and contractor-sub-contractor.

CET 431. Construction Testing. 3 credits, 4 contact hours (2;2;0).
Prerequisite: MET 237. Exposure to a variety of construction-related field tests and field testing equipment. Includes concrete mix design, concrete testing, soil density and compaction, asphalt tests, load testing of wood, mortar analysis and testing, brick and CMU testing, and quality control methods and procedures for finishes.

CET 435. Design of Temporary Structures. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CET 331. Analysis of loadings on, and design of, temporary structures required in construction. Formwork, shoring and scaffolding systems, temporary bridges, trenching, and temporary retaining walls are among the subjects covered. Construction safety associated with temporary structures is stressed.

CET 460. Forensics in Construction. 3 credits, 3 contact hours (3;0;0).
Restriction: Senior standing in construction engineering technology. Construction failure, in its many forms, are both interesting and instructive and in the context of this course students will study construction failures in their many forms.

CET 490. Special Project. 3 credits, 3 contact hours (0;0;3).
Prerequisite: Senior standing in construction engineering technology. The student works on one or more individually selected projects guided by the department staff. The project must be construction related and may include planning, research (library or lab), engineering report, and statistical, analytical, or field investigation. Any of these may follow class-inspired direction, or the students may branch out on their own. The project(s) of each student must be completed and professionally presented by assigned due date for appropriate review and recording of accomplishments.

CET 491. Special Projects. 1 credit, 1 contact hour (1;0;0).
Restriction: Senior standing in construction engineering technology. The student works on an individually selected project guided by the department staff. The project may be design- or construction-related and may include research, engineering design, technical report, or field investigation. Requirements will include a written submittal.

CET 492. Special Projects. 2 credits, 2 contact hours (0;0;2).
Restriction: Senior standing in construction engineering technology. The student works on a selected project guided by the department staff. The project may be design or construction related and may include research, engineering design, technical report or field investigation. Requirements will include a written submittal.

CET 493. Special Projects. 3 credits, 3 contact hours (3;0;0).

CET 497. Co-op Work Experience. 3 credits, 3 contact hours (0;0;3).
Restriction: Approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as co-op/intern. Mandatory participation in seminars and completion of requirements that include a report and/or project.Note: Normal grading applies to this COOP Experience.

CIMT 101. Introduction to the Concrete Industry. 3 credits, 3 contact hours (3;0;0).
This course is an overview of the concrete industry including historical aspects, the chemistry, properties and uses of concrete, production and delivery, and management of production facilities. Students will also be introduced to concrete construction and contracting, environmental concerns, professionalism, and career opportunities in the concrete industry.

CIMT 205. Concrete Properties and Testing. 3 credits, 4 contact hours (2;2;0).
The effects of concrete-making materials (aggregates, cements, admixtures, etc.) on the properties of fresh and hardened concrete will be studied and analyzed from an applications point of view. Concrete mixture proportioning calculations, statistical analysis of strength tests, and the economics of various concrete mixes will also be discussed.

CIMT 210. Concrete Applications I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CIMT 101 and CIMT 205. This course is the first of two courses designed to provide a detailed study of the many applications of concrete in the construction of buildings, pavements, and other facilities as they relate directly to the concrete industry. Emphasis will be placed on the advantages, disadvantages and unique problems facing the concrete industry and suppliers of materials used in the manufacture of concrete products.

CIMT 305. Concrete Applications II. 3 credits, 3 contact hours (3;0;0).
This course is a continuation of CIMT 210 and focuses on codes, specifications and industry standards as well as the production and delivery issues related to traditional and unique concrete applications.

CIMT 310. Concrete Products and Delivery. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CIMT 210 Concrete Applications I. This course will provide the student with a basic understanding of managing the order and delivery process common to all concrete products. An emphasis will be given to planning, organizing and controlling at both the management level as well as the supervisory level.

CIMT 315. Concrete Construction Methods. 3 credits, 3 contact hours (3;0;0).

CIMT 405. Advanced Concrete Testing and Quality Assurance. 3 credits, 4 contact hours (2;2;0).
Prerequisite: CIMT 205. This course will focus on advanced concrete testing techniques and quality assurance procedures currently used in the industry for traditional and specialty applications.

CIMT 410. Senior Project in CIM. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Senior standing in Concrete Industry Management. The student works on one or more individually selected projects guided by the department staff. The project must be concrete industry related and may include planning, research (library or lab), engineering report and statistical, analytical, or field investigation. Any of these may follow class-inspired direction, or the students may branch out on their own. The project(s) of each student must be completed and professionally presented by assigned due date for appropriate review and recording of accomplishments.

CIMT 491. Special Project in CIM. 1 credit, 1 contact hour (1;0;0).

CIMT 492. Special Project in CIM. 2 credits, 2 contact hours (2;0;0).

CIMT 493. Independent Study. 3 credits, 3 contact hours (0;0;3).

CIMT 497. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as co-op/intern. Mandatory participation in seminars and completion of requirements that include a report and/or project.Note: Normal grading applies to this COOP Experience.

CIMT 498. Coop Work Experience II. 3 credits, 3 contact hours (0;0;3).

CMT 332. Structural Systems for Construction Management. 3 credits, 3 contact hours (3;0;0).
Study of the types and behavior of building structural systems using qualitative analysis techniques. Systems to be covered will include those involving structural steel, reinforced concrete, wood and timber, and plain and reinforced masonry. The effect of wind and seismic events on these systems is reviewed.

CMT 414. Environmental Science for Construction Management. 3 credits, 3 contact hours (3;0;0).
An introduction to construction-related environmental topics, including environmental chemistry, geology, ground water hydrology, outdoor air quality, surface water run-off, erosion and sedimentation control, indoor air quality, asbestos abatement, radon remediation, and noise and vibration.

CMT 436. Temporary Structures for Construction Management. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CMT 332. Study of the types of the various temporary systems and structures used in field construction activities, including concrete forming and falsework, sheeting and shoring for excavations, scaffolding, barricades, ladders, and temporary bridges and ramps. Construction safety with respect to the systems is covered.

CMT 452. Mechanical and Electrical Systems for Construction. 3 credits, 3 contact hours (3;0;0).
Study of the different types of water supply, plumbing, fire protection, heating, ventilation, air conditioning and electrical systems commonly employed in residential and commercial buildings. Case studies include an overview of the design of these systems and their installation in the field.

SET 200. Introduction To Geomatics. 3 credits, 3 contact hours (3;0;0).
Plane surveying with angle and distance measurements; leveling; topographic mapping; traverse and area computations; horizontal and vertical curves; cross sections; triangulation; state plane coordinates; 3-D surveying using Global Positioning System (GPS), Geographic Information Systems (GIS) and remote sensing technology for surveying and mapping applications. Emphasis is on the use of the computers for solving typical field and office problems.

SET 200A. Introduction to Geomatics Lab. 1 credit, 3 contact hours (0;3;0).
Co-requisite: SET 200 or department permission. Field exercises in conjunction with the classroom exercises utilizing classical and electronic surveying instruments and COGO/CAD software.

SET 203. Introduction to Remote Sensing Science & Technology. 3 credits, 3 contact hours (3;0;0).
Prerequisites or Corequisites: Computing Literacy GER. This course provides an introduction to remote sensing (RS), emphasizing the techniques that are used to monitor the Earth’s surface. It will introduce the fundamentals of electromagnetic radiation (EMR), principles and concepts of RS, and EMR measurement by air-and space-borne optical, thermal, radar and LiDAR instruments, as well as Unmanned Aerial Vehicles (UAVs). The main theme will be how qualitative and quantitative information from RS data are acquired, processed, analyzed and utilized.

SET 207. Evidence and Procedures for Property Surveys. 3 credits, 3 contact hours (3;0;0).
Co-rerequisites: CE 200, SET 200 or permission of instructor. Introduction to surveying law and to the concept of evidence related to boundary locations as discoverable on the ground and through deeds or other written records. Understanding of the principles of property law, titles, land ownership, transfer of land ownership, deed descriptions, evidence recovery and conflict resolutions.

SET 220. Raster-based Geographic Information System. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Courses include CS 100 or CS 106 or CS 101 or CS 115. Pre or Corequisites: Satisfied by computer literacy GER. The course will focus on the fundamentals of the raster data model for geospatial analysis, visualization, and report generation. Course topics include Geographic Information System (GIS) operations as buffer, overlay, classification techniques, sampling theory, map algebra, and cartographic principles for data visualization and interpretation. Students are required to have basic computer skills.

SET 280. Marine Surveying. 4 credits, 6 contact hours (3;3;0).
Prerequisite: CE 200 or SET 200. Marine Surveying builds on the core competencies introduced in "Introduction to Geomatics":. This course focuses on computer generated solutions for nautical charts and water boundary delineations using imaging, optical, LiDAR, and acoustic observations via marine, airborne, and space-based platforms; to understand marine surveying technology for solutions on environmental problems; develop skills and techniques to enhance, interpret, and analyze acoustic measurements using computer-based methods.

SET 301. Route Surveying. 4 credits, 6 contact hours (3;3;0).
Co-requisites: CE 200, SET 200 or equivalent, or permission of instructor. Horizontal and vertical curves computation and layout with regard to highway design. Special emphasis on complex curves. Topics include control, positioning, error analysis, highway design problems, and layout. Concepts of right-of-way surveys. Also included is an introduction on the concepts of machine control.

SET 302. Geodetic Control Surveying. 4 credits, 6 contact hours (3;3;0).
Co-requisites: CE 200, SET 200 or equivalent, or permission of instructor. A study of the higher order methods and techniques of surveying such as Global Positioning System (GPS) with observations of Real-Time networks, 1st, 2nd and 3rd Orders of Accuracy along with the requisite computations to reduce these observations to measurements and the applications of these measurements to the State Plane Coordinate systems and the geoid.

SET 303. Photogrammetry and Aerial Photo Interpretation. 4 credits, 6 contact hours (3;3;0).
Prerequisites: CE 200 or SET 200 or equivalent. A review of the principles of photography, including the physical science of optics as related to the use of aerial photos, to engineering and land surveying projects. Includes the necessary mathematics of photogrammetry and the process of designing and establishing the required data for proper acquisition of photogrammetric information.

SET 304. Adjustment Computations I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 111 or equivalent. A course designed to give the student the necessary knowledge to reduce survey observations to measurements; to analyze the data to determine the relationship of adjusted measurements to the observations; to verify that the mathematical constraints have been met; and to introduce approximate and least squares adjustments of surveying observations.

SET 307. Boundaries and Adjacent Properties. 3 credits, 3 contact hours (3;0;0).
Prerequisites: SET 207 or equivalent, or permission of instructor. A course on legal principles regarding boundaries and the constructive solutions of the problems of boundary surveying by a consideration of deed descriptions and examples of their application to surveying.

SET 320. Vector-based Geographic Information System. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 100 or CS 101 or CS 106 or CS 115. Pre or Corequisites: Satisfied by computer literacy GER. This course, the second in the Geographic Information Systems (GIS) Specialization, will go in-depth on how to analyze vector spatial data and to use cartography techniques to communicate results. Topics include geometric and attribute descriptives of vector data models, vector topology, Entity Relational Diagrams, spatial queries using Structured Query Language (SQL) syntax, descriptive statistics, spatial analysis and visualization.

SET 360. Digital Surveying Methods. 3 credits, 4 contact hours (2;2;0).
Prerequisites: SET 200 and SET 200A or instructor permission. The goal of this course is that students will be taught skills in using robotic and digital geospatial data collection technologies for mapping using Computer Aided Drafting (CAD) methods. The course has three parts. Part 1 deals with data collection, where both analogue and digital data collectors of field observations are covered. Methods focus on approaches that minimized the contribution for operator and instrument errors on the observations. In part 2, emphasis is on data preparation, reductions, and processing for coordinate computations. Part 3 focuses on CAD methods for preparing as-built site plans, plat or survey diagram, survey work plan, CAD modeling capabilities to construct a Digital Elevation Model (DEM) or a Digital Surface Model (DSM), topographic mapping outputs, and construct GIS layers from survey data. The emphasis of this course is on hands-on exercises in the practice of geospatial data collection, handling instrumentation, data processing and data representation.

SET 401. Fundamentals Of Geodesy. 3 credits, 3 contact hours (3;0;0).
Prerequisite: SET 302. Geodesy and its relation to surveying and other disciplines. Topics include geometric, physical and satellite geodesy. Also includes the concept of map projection.

SET 403. Remote Sensing Principles for Geomatics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 200 or SET 200. Principles of remote sensing for Geomatics application build on the core competencies introduced in Introduction to Surveying. This course focuses on computer generated solutions from technologies used for the acquisition and production of geospatial data via terrestrial, airborne, and space-based platforms; to understand remote sensing technology for solutions on scientific environmental problems; develop skills and techniques to enhance, interpret, and analyze digital imagery using computer-based methods.

SET 404. Adjustment Computations II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: SET 304. Concepts of survey observations for adjustment and estimation models. A continuation of the theory of least squares and the mathematical weighting of observations. Also includes the statistical evaluation of least squares results with hands-on training using state-of-the-art industry standard software.

SET 407. Boundary Line Analysis. 4 credits, 6 contact hours (3;3;0).
Prerequisite: SET 307. Develops the analytical synthesis of real property law, land surveying procedures, and scenario development compatible with current case law decisions for the development of most probable scenarios of boundary location for the court's consideration.

SET 420. Geographic/Land Information Systems. 4 credits, 6 contact hours (3;3;0).
Prerequisites: SET 207 or permission of instructor. Geographic/Land Information System builds on the core competencies that were introduced in the course "Introduction to Surveying". This course focuses on understanding the fundamentals of Geographic/Land Information Systems (GIS/LIS) and Multi-Purpose Cadastres. Topics on LIS emphasize issues relating to the design, implementation, and maintenance of land records. Topics on GIS emphasize GIS data models (vector versus raster) and database development for applications in diverse fields like criminal justice, economics, and infrastructure. Students will learn practical skills on web-based mapping and GIS.

SET 423. Remote Sensing of the Environment. 3 credits, 3 contact hours (3;0;0).
Prerequisite: SET 303. This course focuses on various aspects of remote sensing applications in the domain of natural resources. Students will have the opportunity to obtain hands-on experience through real-world applications of remote sensing technologies in the biosphere, the hydrosphere, the pedosphere, the atmosphere, and the built environment. Students will come out of this course with a mastery of a wide range of interpretation, measurement, environmental monitoring and mapping skills using remotely sensed data.

SET 433. Remote Sensing Digital Image Processing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: SET 303. This course introduces conceptual and practical aspects of digital image analysis from airborne and spaceborne earth-observing instruments, and provides up-to-date information on analytical methods used to analyze digital remote sensing data. The project-based course will emphasize the advanced techniques for remote sensing data processing and analysis. In-class exercises will give students hands-on experience in the fundamentals of digital image processing and information extraction techniques.

SET 440. Land Development. 3 credits, 4 contact hours (2;2;0).
Prerequisites: SET 207 and CE 321 or instructor permission. Understanding the process of development of land through the study of land use law, federal, state and municipal land use regulations, federal and state regulations regarding environmental issues and the administrative and statutory laws governing the preparation of land surveys; impart the ability to prepare a land survey from initial contact and the proposal phase to preliminary and final plan approval through a class project designed to cover all of these phases.

SET 460. GIS Data Integration and Decision Support. 3 credits, 3 contact hours (3;0;0).
Prerequisites: SET 200 or Department permission. This is the 3rd course of a 3-part sequence of a basic training program for a GIS analyst. GIS for decision support involves processes of analyzing and identifying patterns in geographic data and describing relationships between spatial features. This course introduces a number of techniques on analysis of spatial data and data integration through a combination of lectures and hands-on experiential learning. Students will work on a term project by applying GIS tools and geospatial analytical techniques to build a decision support system for a solution to a problem in their career field.

SET 490. Senior Project in Surveying. 2 credits, 2 contact hours (2;0;0).
Prerequisite: Senior standing. The student works on an individual surveying project guided by the department staff. The project should concentrate on a specific aspect of surveying, not necessarily on field measurements. Project includes library research, written report and oral presentation of findings.

SET 491. Special Projects in Surveying. 1 credit, 1 contact hour (0;0;1).
This course provides students with research experience in Geomatics/Surveying at the undergraduate level. Course content and scope of study will be approved by the coordinator of the SET program. Topics can include GPS data processing, marine surveying for bathymetric modeling and generalization, and geophysical surveying using gravity and topography data. Course outcomes include knowledge of advanced data processing, data analysis, and interpretation at the undergraduate level.

SET 492. Special Projects in Surveying. 2 credits, 2 contact hours (0;0;2).
This course provides students with research experience in Geomatics/Surveying at the undergraduate level. Course content and scope of study will be approved by the coordinator of the SET program. Topics can include GPS data processing, marine surveying for bathymetric modeling and generalization, and geophysical surveying using gravity and topography data. Course outcomes include knowledge of advanced data processing, data analysis, and interpretation at the undergraduate level.

SET 493. Special Projects in Surveying. 3 credits, 3 contact hours (0;0;3).
This course provides students with research experience in Geomatics/Surveying at the undergraduate level. Course content and scope of study will be approved by the coordinator of the SET program. Topics can include GPS data processing, marine surveying for bathymetric modeling and generalization, and geophysical surveying using gravity and topography data. Course outcomes include knowledge of advanced data processing, data analysis, and interpretation at the undergraduate level.

B.S. in Engineering Technology, Construction Engineering Technology

The construction industry is an interesting and dynamic career that combines the elements of technical knowledge, management skills and creativity to breathe life into a set of plans, turning them into a real structure. The Construction Manager needs the technical ability to successfully interface with design professionals such as architects and engineers as well as the management skills to work with the talented trades persons that perform the actual work of construction. These skills are acquired in the classroom as well as through internships and co-op education programs and in all phases of the construction industry such as building construction as well as heavy/highway and utility construction. These internship and co-op opportunities are supported by our industry partners.

The students in NJIT's Construction Engineering Technology (CET) program acquire a broad set of technical skills as well as business, communication and management knowledge in order to successfully enter the construction management field. Graduates of our program are successful contractors, construction managers, project executives, project managers and construction inspectors.

This program is accredited by the Engineering Technology Accreditation Commission (ETAC of ABET), http://abet.org (http://abet.org/). Graduates of this program are eligible to sit for the Professional Engineer's examination in New Jersey with the appropriate experience, as determined by the New Jersey Board of Professional Engineers and Land Surveyors. http://www.njconsumeraffairs.gov/pels/). Graduates of the program are also eligible to pursue graduate degrees in civil engineering, management or related areas and students may participate in the BS/MS Program (http://www.njit.edu/graduatestudies/program-options/bs-ms/index.php).

The full four-year curriculum for the program is shown below. Students who wish to enter the program as a transfer student are typically students with an A.A.S. degree in Civil or Construction Engineering Technology and should have completed most or all of the courses, or their equivalents, in the first two years of the program as shown below. In the case of all students, both four-year and transfer, a minimum of 120 credits is required for graduation.

Program Educational Objectives

• Graduates of our program will attain positions of responsibility within the various aspects of the construction industry.

• Graduates of our program will have the necessary skills to avail themselves of the opportunities for lifelong learning and professional development.

Student Outcomes

• An ability to select and apply the knowledge, techniques, skills, and modern tools of their disciplines to broadly-defined engineering technology activities; and,

• An ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies; and,

• An ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes; and,

• An ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives; and,

• An ability to function effectively as a member or leader on a technical team; and,

• An ability to identify, analyze, and solve broadly-defined engineering technology problems; and,

• An ability to apply written, oral, and graphical communication in both technical and nontechnical environments; and an ability to identify and use appropriate technical literature; and,

• An understanding of the need for and an ability to engage in self-directed continuing professional development; and,

• An understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity; and,

• A knowledge of the impact of engineering technology solutions in a societal and global context; and,

• A commitment to quality, timeliness, and continuous improvement; and,

• Producing and utilizing design, construction and operations documents; and,

• Performing economic analyses and cost estimates related to design, construction and maintenance of systems in the construction technical specialties; and,

• An ability to select appropriate construction materials and practices; and,

• An ability to apply principles of construction law and ethics; and,

• An ability to apply basic technical concepts to the solution of construction problems involving hydraulics and hydrology, geotechnics, structures, construction scheduling and management and construction safety, and

• An ability to perform standard analysis and design in at least one recognized technical specialty within construction engineering technology that is appropriate to the goals of the program.

(120 credits minimum)

First Year		
1st Semester		**Credits**
CS 106	Roadmap to Computing for Engineers	3
MATH 138	General Calculus I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
ENGL 101	English Composition: Introduction to Academic Writing	3
MET 103	Engineering Graphics and Intro. to CAD	2
ET 101	Introduction to Engineering Technology	0
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
MATH 238	General Calculus II	3
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3
MET 105	Applied Computer Aided Design	2
ACCT 117	Principles Of Fin Accountng	3
	Term Credits	**15**
Second Year		
1st Semester		
MET 235	Statics for Technology	3
ECET 201	Circuits I	3
MET 304	Applied Fluid Mechanics	3
SET 200	Introduction To Geomatics	3
SET 200A	Introduction to Geomatics Lab	1
History and Humanities GER 200 level (p. 106)		3
	Term Credits	**16**
2nd Semester		
MET 237	Strength of Materials for Technology	3
CET 233	Structural Analysis in Construction	3
ECON 201	Economics	3
History and Humanities GER 300+ level (p. 108)		3
Technical or Management Elective		3
	Term Credits	**15**
Third Year		
1st Semester		
CET 313	Construction Procedures I	3
CET 317	Construction Computing	3
CET 322	Construction Codes and Regulations	3
MET 303	Applied Thermodynamics	3
MATH 305	Statistics for Technology	3
	Term Credits	**15**
2nd Semester		
CET 314	Construction Procedures II	3
CET 323	Construction Safety	3
CET 331	Structural Systems	3
CET 341	Soils and Earthwork	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**

Fourth Year		
1st Semester		
CET 411	Cost Estimating	3
CET 415	Construction Project Management	3
CET 421	Construction Contracts	3
MNET 414	Industrial Cost Analysis	3
CET 431	Construction Testing	3
	Term Credits	**15**
2nd Semester		
CET 413	Environmental Science	3
CET 416	Senior Construction Project	2
CET 435	Design of Temporary Structures	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
MGMT 390	Principles of Business	3
	Term Credits	**14**
	Total Credits	**120**

See the **General Education Requirements** "Refer to the General Education Requirements for specific information for GER courses"

B.S. in Engineering Technology, Construction Management Technology

The construction industry is an interesting and dynamic career that combines the elements of technical knowledge, management skills and creativity to breathe life into a set of plans, turning them into a real structure. The Construction Manager needs the technical ability to successfully interface with design professionals such as architects and engineers as well as the management skills to work with the talented trades persons that perform the actual work of construction. These skills are acquired in the classroom as well as through internships and co-op education programs and in all phases of the construction industry such as building construction as well as heavy/highway and utility construction. These internship and co-op opportunities are supported by our industry partners.

The students in NJIT's Construction Management Technology (CMT) program acquire a broad set of management skills as well as business, management, communication, and technical knowledge in order to successfully enter the construction management field. Graduates of our program are successful contractors, construction managers, project executives, project managers and construction inspectors. Graduates of the program are eligible to pursue graduate degrees in civil engineering, management or related areas and students may participate in the BS/MS Program (http://www.njit.edu/graduatestudies/program-options/bs-ms/index.php). The full four-year curriculum for the program is shown below. Students who wish to enter the program as a transfer student are typically students with an A.A.S. degree in Civil or Construction Engineering Technology and should have completed most or all of the courses, or their equivalents, in the first two years of the program as shown below. In the case of all students, both four-year and transfer, a minimum of 120 credits is required for graduation.

(120 credits minimum)

First Year		
1st Semester		**Credits**
CS 106	Roadmap to Computing for Engineers	3
MATH 138	General Calculus I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
ENGL 101	English Composition: Introduction to Academic Writing	3
MET 103	Engineering Graphics and Intro. to CAD	2
ET 101	Introduction to Engineering Technology	0
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
MATH 238	General Calculus II	3
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
ENGL 102	English Composition: Introduction to Writing for Research	3

MET 105	Applied Computer Aided Design	2
ECON 201	Economics	3
	Term Credits	**15**
Second Year		
1st Semester		
ACCT 115	Fundamentals of Financial Accounting	3
MGMT 290	Business Law I	3
History and Humanities GER 200 level (p. 106)		3
SET 200	Introduction To Geomatics	3
SET 200A	Introduction to Geomatics Lab	1
	Term Credits	**13**
2nd Semester		
ACCT 215	Managerial Accounting I	3
MIS 245	Introduction to Management Information Systems	3
CIMT 205	Concrete Properties and Testing	3
History and Humanities GER 300+ level (p. 108)		3
Technical or Management Elective		3
	Term Credits	**15**
Third Year		
1st Semester		
MATH 305	Statistics for Technology	3
CET 313	Construction Procedures I	3
FIN 315	Fundamentals of Corporate Finance	3
CET 317	Construction Computing	3
CET 322	Construction Codes and Regulations	3
	Term Credits	**15**
2nd Semester		
CET 314	Construction Procedures II	3
CMT 332	Structural Systems for Construction Management	3
HRM 301	Organizational Behavior	3
CET 323	Construction Safety	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
CET 411	Cost Estimating	3
CET 415	Construction Project Management	3
MNET 414	Industrial Cost Analysis	3
CMT 452	Mechanical and Electrical Systems for Construction	3
CET 421	Construction Contracts	3
Technical or Management Elective		3
	Term Credits	**18**
2nd Semester		
CET 413	Environmental Science	3
CMT 436	Temporary Structures for Construction Management	3
CET 416	Senior Construction Project	2
MGMT 390	Principles of Business	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**14**
	Total Credits	**120**

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses"

B.S. in Engineering Technology, Surveying Engineering Technology

(120 credit minimum)

Surveying involves activities such as mapping the earth above and below sea level; determining the position of the boundaries of public or private land including national and international boundaries; providing geospatial information necessary for the construction of private and public works; designing, establishing and administering of land and geographic information systems (LIS/GIS) and the integration of the data within those systems; positioning and monitoring of physical features, structures and engineering works; planning, development and re-development of property whether urban or rural; determining facts about the size, shape and gravity field of the earth; conducting hydrographic surveys for marine and coastal infrastructure development; and conducting high precision measurements for worldwide control networks and for industrial applications and scientific studies. The surveyor utilizes a wide variety of techniques and equipment on the job. Some of the equipment is terrestrial-based, other equipment is air- and space-borne.

The Surveying Engineering Technology (SET) curriculum stresses the technical, theoretical and legal aspects of surveying. Technical surveying courses include theory and application of Global Position Systems (GPS) and Geographic Information Systems (GIS). Law or Law-related courses are integrated into the program in order to impart to students the legal knowledge and legal responsibility of a land surveyor.

This program is accredited by The Engineering Technology Accreditation Commission (ETAC of ABET), http://www.abet.org. Graduates of this program are eligible to sit for the Professional Engineer's examination in New Jersey with the appropriate experience, as determined by the New Jersey Board of Professional Engineers and Land Surveyors. (http://www.njconsumeraffairs.gov/pels/). Graduates of the program are also eligible to pursue graduate degrees in Geodesy, Remote Sensing, and Mapping and students may participate in the BS/MS Program (http://www.njit.edu/graduatestudies/program-options/bs-ms/index.php (http://www.njit.edu/graduatestudies/program-options/bs-ms/)).

The full four-year curriculum for the program is shown below. Students who wish to enter the program as a transfer student are typically students with an AAS. degree in Civil or Construction Engineering Technology or Computer Science and should have completed most or all of the courses, or their equivalents, in the first two years of the program as shown below. In the case of all students, both four-year and transfer, a minimum of **120 credits is required for graduation**.

Program Educational Objectives

- Graduates will become licensed surveyors and/or GIS specialists.
- Graduates will be able to take on supervisory roles in their firms. Some graduates will start their own surveying practice.
- Graduates will be able to apply and expand upon their undergraduate-level surveying preparation. This will be accomplished through continuing education and becoming involved in regional and national professional societies such as NJSPLS and ACSM.

Student Outcomes

- an ability to select and apply the knowledge, techniques, skills, and modern tools of their disciplines to broadly-defined engineering technology activities
- an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies
- an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes
- an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives
- an ability to function effectively as a member or leader on a technical team
- an ability to identify, analyze, and solve broadly-defined engineering technology problems
- an ability to apply written, oral and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;
- an understanding of the need for and an ability to engage in self-directed continuing professional development
- an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity
- a knowledge of the impact of engineering technology solutions in a societal and global context
- a commitment to quality, timeliness, and continuous improvement
- an ability to utilize modern measurement technologies to acquire spatial data,
- an ability to utilize industry-standard software to solve technical problems,
- an ability to apply technical concepts to the design and implementation of measurement systems to meet project requirements,
- an ability to design and implement procedures, and analyze data for conformance with precision and accuracy requirements, and

- an ability to carry out or supervise surveying activities and processes such as measurements, positioning, mapping, boundary determination, and geographic/land information systems.

First Year		
1st Semester		**Credits**
CS 106	Roadmap to Computing for Engineers	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Lab	1
ET 101	Introduction to Engineering Technology	0
FYS SEM	First-Year Student Seminar	0
	Term Credits	**14**
2nd Semester		
Select one of the following:		3
EVSC 125	Fundamentals of Environmental Sciences	
CHEM 121	Fundamentals of Chemical Principles I	
BIOL 200	Concepts in Biology	
ENGL 102	English Composition: Introduction to Writing for Research	3
MATH 112	Calculus II	4
PHYS 121	Physics II	3
PHYS 121A	Physics II Lab	1
MET 103	Engineering Graphics and Intro. to CAD	2
	Term Credits	**16**
Second Year		
1st Semester		
MGMT 290	Business Law I	3
Math Elective [1]		3
Computer Science/Technology/Engineering Elective [2]		3
SET 200	Introduction To Geomatics	3
SET 200A	Introduction to Geomatics Lab	1
SET 207	Evidence and Procedures for Property Surveys	3
	Term Credits	**16**
2nd Semester		
MATH 305	Statistics for Technology	3
ECON 201 or EPS 202	Economics or Society, Technology, and the Environment	3
History and Humanities GER 200 level (p. 106)		3
SET 280	Marine Surveying	4
Computer Science/Technology/Engineering Elective [2]		3
	Term Credits	**16**
Third Year		
1st Semester		
SET 304	Adjustment Computations I	3
SET 307	Boundaries and Adjacent Properties	3
CE 321	Water Resources Engineering	3
COM 313	Technical Writing	3
SET 301	Route Surveying	4
	Term Credits	**16**
2nd Semester		
SET 302	Geodetic Control Surveying	4
SET 303	Photogrammetry and Aerial Photo Interpretation	4
SET 360	Digital Surveying Methods	3

History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**14**
Fourth Year		
1st Semester		
SET 404	Adjustment Computations II	3
SET 420	Geographic/Land Information Systems	4
Computer Science/Technology/Engineering Elective [2]		3
Free Elective		3
	Term Credits	**13**
2nd Semester		
SET 401	Fundamentals Of Geodesy	3
SET 407	Boundary Line Analysis	4
SET 490	Senior Project in Surveying	2
SET 440	Land Development	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**15**
	Total Credits	**120**

1. MATH 337 (http://catalog.njit.edu/search/?P=MATH%20337) Linear Algebra is recommended. Acceptable alternatives are MATH 211 Calculus III A, MATH 213 (http://catalog.njit.edu/search/?P=MATH%20213) Calculus III B, MATH 226 (http://catalog.njit.edu/search/?P=MATH%20226) Discrete Analysis, MATH 240 (http://catalog.njit.edu/search/?P=MATH%20240) Numerical Mathematics Laboratory.
2. List of Approved Computer Literacy and/or Technology Elective
   IS 265 - Introduction to Information Systems
   IS 465 - Advanced Information Systems
   CS 331 – Database Systems Design and Management
   CS 435 - Advanced Data Structures and Algorithm Design
   SET 403 - Remote Sensing Principles for Geomatics

Other Technical/Engineering Elective

Civil/Environmental/Engineering, Construction Engineering Technology, Computer courses

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

B.S. in Concrete Industry Management

The Concrete Industry Management (CIM) program is designed to train and educate the student in the field of concrete industry by exposing the student to a multidisciplinary program which draws on management and technology to produce a well-rounded graduate who is able to enter a career in the concrete industry. The four-year Bachelor of Science degree program focuses on science, technology, management and production as well as the mandatory university courses in English, history and the humanities. The concrete industry is a $931 billion dollar industry which is eager to employ graduates, who are educated and trained, to manage, develop and own concrete industry businesses.

The objective of this program is to produce graduates grounded in the basics of concrete's production techniques and its use in a multitude of construction applications. In addition, graduates acquire a minor in business administration.

The full four-year curriculum for the program is shown below. Students who wish to enter the program as a transfer student are typically students with an A.A.S. degree in Civil or Construction Engineering Technology and should have completed most or all of the courses, or their equivalents, in the first two years of the program as shown below. Students in other majors, such as Business, may have taken many of the required courses. In the case of all students, both four-year and transfer, a minimum of 120 credits is required for graduation.

(120 credits minimum)

First Year		
1st Semester		**Credits**
MATH 138	General Calculus I	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1

CS 106	Roadmap to Computing for Engineers	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MET 103	Engineering Graphics and Intro. to CAD	2
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
ACCT 117	Principles Of Fin Accountng	3
CHEM 301	Chemical Technology	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MGMT 290	Business Law I	3
CIMT 101	Introduction to the Concrete Industry	3
	Term Credits	**15**
Second Year		
1st Semester		
ACCT 215	Managerial Accounting I	3
CIMT 205	Concrete Properties and Testing	3
CIMT 210	Concrete Applications I	3
History and Humanities GER 200 level (p. 106)		3
Technical Elective		3
	Term Credits	**15**
2nd Semester		
MIS 245	Introduction to Management Information Systems	3
Technical Elective (100-200 level)		3
COM 313	Technical Writing	3
MATH 305	Statistics for Technology	3
CIMT 305	Concrete Applications II	3
	Term Credits	**15**
Third Year		
1st Semester		
CET 313	Construction Procedures I	3
MGMT 390	Principles of Business	3
CIMT 310	Concrete Products and Delivery	3
FIN 315	Fundamentals of Corporate Finance	3
CET 323	Construction Safety	3
	Term Credits	**15**
2nd Semester		
CET 314	Construction Procedures II	3
MRKT 330	Principles of Marketing	3
CIMT 315	Concrete Construction Methods	3
History and Humanities GER 300+ level (p. 108)		3
MNET 420	Quality Systems	3
	Term Credits	**15**
Fourth Year		
1st Semester		
CET 411	Cost Estimating	3
CET 415	Construction Project Management	3
CIMT 405	Advanced Concrete Testing and Quality Assurance	3
CIMT 497	Co-op Work Experience I	3
Technical Elective (300-400 level)		3
	Term Credits	**15**
2nd Semester		
Humanities and Social Science Senior Seminar GER (p. 112)		3

CET 413	Environmental Science	3
MNET 414	Industrial Cost Analysis	3
CIMT 410	Senior Project in CIM	3
Technical Elective(300-400 level)		3
	Term Credits	**15**
	Total Credits	**120**

Free Electives

Consult the program coordinator. Students transferring into this program with fewer than 9 credits in humanities/social science must take an appropriate humanities/social science course to fulfill the NJIT GER.

Co-op

Co-op is a required course in this program, and must be approved by the faculty advisor and Career Services.

This curriculum represents the maximum number of credits per semester for which a student is advised to register. A full-time credit load is 12 credits. First-year students are placed in a curriculum that positions them for success which may result in additional time needed to complete curriculum requirements. Continuing students should consult with their academic advisor to determine the appropriate credit load.

Remote Sensing Minor

Code	Title	Credits
The following 4 courses are required:		
SET 200	Introduction To Geomatics	3
SET 203	Introduction to Remote Sensing Science & Technology	3
SET 303	Photogrammetry and Aerial Photo Interpretation	4
SET 423	Remote Sensing of the Environment	3
Remaining 1 course from the following:		3
SET 433	Remote Sensing Digital Image Processing	
EVSC 484	Environmental Analysis	
CE 450	Urban Planning	
Total Credits		**16**

SAET - Eng. Edu. Division (SEED)

On November 9, 2018, NJIT launched its newest school, the School of Applied Engineering and Technology (SAET), within the university's Newark College of Engineering (NCE). SAET encompasses NCE's engineering technology programs in two divisions (Electrical and Mechanical Engineering Technology Division and the Built Environment Division); the baccalaureate degree General Engineering program; and a division focused on Engineering Education practice and research. SAET serves about 1,000 NJIT students. The SAET offers Bachelor of Science in Engineering Technology (BSET) degrees in nine different options, as well as, Bachelor of Science (BS) degrees in Concrete Industry Management (CIM), and General Engineering

The Engineering Education Division (SEED) consists of the Technology Education Program (TEED) and the General Engineering Program (GEN).

Many students choose to complete their freshman and sophomore years at a community college or a technical institute, and obtain an associate's degree in applied science from these institutions. It is strongly recommended that students talk to an academic advisor at NJIT while they are still pursuing their associate's degree. The academic advisor will explain the transfer process in detail as well as suggest elective courses that may be beneficial. Contact an advisor by calling the School of Applied Engineering and Technology at (973) 596-3228, or by email at EngineeringTechnology@njit.edu.

After being admitted to NJIT, students must meet with an academic advisor to discuss the curriculum and any special interests the student might have. Students who lack necessary courses will be assigned bridge courses to make up the required prerequisites. Generally, courses taken at the freshman and sophomore level at the community colleges cannot substitute for junior or senior NJIT engineering technology courses. Engineering technology is that part of the technological field which requires the application of scientific and engineering knowledge and methods, combined with technical skills, for the implementation and extension of existing technologies. Engineering technology education focuses on preparing engineering technologists for positions that involve product development and improvement, system development, management, manufacturing and engineering operational functions. Graduates also enter the technical sales and customer services field, or continue in graduate work in engineering or management. Placement of graduates has been excellent.

NJIT Faculty

B

Barnes, William, Associate Professor

Brateris, Daniel J., University Lecturer

E

English, Robert, Professor Emeritus

J

Juliano, Thomas, Associate Professor

K

Khader, Michael, Associate Professor

L

Lieber, Samuel C., University Lecturer

M

Mahgoub, Mohamed A., Assistant Professor

Miima, John B., Assistant Professor

P

Potts, Laramie, Associate Professor

R

Rabie, Mohammad A., University Lecturer

Rahman, Sahidur, University Lecturer

Rockland, Ronald H., Professor

S

Sengupta, Arijit, Associate Professor

W

Washington, David W, Associate Professor

Wiggins, John, Senior University Lecturer

Programs

- Engineering Technology, Technology Education (TEED) - B.S. (p. 652)

ENGR 101. Analytical Meth for Engr Appl. 4 credits, 6 contact hours (4.5;1.5;0).
Prerequisite:SAT Math score of 500 or above This course provides foundation in analytical methods that are used by engineers through an application-oriented, hands-on introduction to engineering analytical methods.

ENGR 210. Career Planning Seminar for En. 1 credit, 1.5 contact hour (1.5;0;0).
Prerequisite: Sophomore Standing. This course aims at providing engineering students with multidisciplinary and career planning skills in a seminar environment with emphasis on career planning, resume writing, and interview skills.

ENGR 290. Pers of the Grand Challenges. 1 credit, 1 contact hour (1;0;0).
Prerequisite: Approval of the Instructor and the Grand Challenges Program Director; sophomore or higher standing. The first step for aspiring students in becoming a grand challenges scholar. Seven engaging colloquia will be offered every fall semester. Faculty conducting research in a Grand Challenge Theme will present the colloquia with one faculty member presenting at each colloquium. At the conclusion of each faculty presentation, and in the weeks in-between the presentations, students will engage in an activity organized to focus on exploring a potential engineering solution, addressing societal impacts, and holding debates on differing perspectives.

ENGR 301. Engineering Applications of Data Science. 3 credits, 4 contact hours (2;2;0).
Prerequisites: CS 100 or CS 101 or CS 106 or CS 113 or CS 115 or BME 210. Pre or Corequisites: MATH 225 or MATH 244 or MATH 279 or MATH 305 or MATH 333 or ECE 321 or IE 331 or MNET 315. Restriction: This course is intended for engineering majors. This is a course for junior level undergraduates in any engineering discipline focusing on the use of data science techniques to solve problems in engineering. We will first discuss the Python programming language and how it can be used to access, manipulate, explore, and visualize scientific datasets. We will discuss statistics and probability as it applies to engineering problems such as safety factors and probability of part failure; this includes conditional probability, probability distributions, hypothesis testing, and Bayesian inference. We will then discuss more advanced statistical models ("machine learning"), including linear and logistic regression, decision trees, and clustering. Possible applications of these methods will be demonstrated in such disciplines and topics as (but not limited to): chemical, mechanical and electrical engineering (optimization and controls), materials engineering (structure and property databases), biomedical engineering (medical diagnosis and medical imaging) and electrical and computer engineering (signal processing, target tracking, robotic navigation). Students will gain hands-on experience in implementing and utilizing these various methods through computational laboratory assignments and reports and a semester-long engineering design project.

ENGR 310. Co-op Work Experience I. 12 credits, 12 contact hours (0;0;12).
Prerequisites: ENGR 210; Completion of 36 credits; Cumulative GPA 2.5; Approval of department; Approval of CDS. Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Mandatory participation in seminars and completion of a report.

ENGR 311. Co-op Work Experience - Summer. 1 credit, 1 contact hour (0;0;1).
Prerequisites: ENGR 210; Completion of 36 credits; Cumulative GPA 2.5; Approval of department; Approval of CDS. Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Mandatory participation in seminars and completion of a report.

ENGR 320. Prototyping Essentials. 3 credits, 4 contact hours (2;2;0).
Prerequisites: MATH 111 or MATH 113 or MATH 138 or (MATH 110 and ENGR 101) or (MATH 107 and ARCH 156). This course introduces students to the fundamental skills, equipment, safety procedures, and theory required to prototype and test basic mechanical and electrical systems as part of the engineering and product design process. Students learn basic prototyping skills starting with hand tools and moving to computer-controlled cutting, shaping, and measurement equipment such as 3D printers, water jets, lasers, CMM's, mills, and lathes. Students learn to use software to design components, develop and interpret prints, and program fabrication and inspection machinery. Entrepreneurial concepts, budget, and economic factors associated with prototyping are discussed and examined. Laboratory exercises require students to design, model, fabricate, and validate components and systems. The course concludes with a final project requiring students to design and produce a physical project in the NJIT Makerspace.

ENGR 400. Multidisciplinary Engineering Design Project. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Junior or Senior standing and approval of instructor and NCE Associate Dean for Academic Affairs. Students design, document, and build a project or portion of a larger system as part of a multidisciplinary project under the supervision of a faculty member. Deliverables include written engineering design requirements, standards and specifications, bill of materials, detailed drawings suitable for fabrication, and a demonstration of a fabricated, assembled, tested, and functional project. Additional requirements may be added by the instructor with approval of the NCE Associate Dean for Academic Affairs.

ENGR 410. Co-op Work Experience II. 12 credits, 12 contact hours (0;0;12).
Prerequisites: ENGR 310; Completed at least 9 credits after ENGR 310; Cumulative GPA 2.5; Approval of department; Approval of CDS. Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Mandatory participation in seminars and completion of a report.

ENGR 423. Drone Science Fundamentals. 3 credits, 4 contact hours (3;1;0).
Restrictions: NCE students with senior standing and with instructor permission. This course will cover the fundamentals of quadrotor drone kinematics and dynamics, quadrotor sensor data analysis, linear and non-linear flight control, and motion planning for a single quadrotor. Students will be guided through the process of building a quadrotor drone, setting up the required flight control parameters and associated Hardware-In-The-Loop simulators, and using Python/C programming for basic single quadrotor motion planning algorithms. Students will also be guided through the preparation for the Federal Aviation Authority (FAA) Part 107 Certified Drone Pilot knowledge test.

ENGR 424. Robotics Science Fundamentals. 3 credits, 4 contact hours (3;1;0).
Prerequisites: BME 210 or CS 101 or CS 106 or CS 113 or CS 115. This hands-on course will cover experiments that elucidate the fundamentals of ground robots and robotic manipulators, sensor data analysis, linear and non-linear motion control, and motion planning for a ground robots and robotic manipulators. Student will be guided through the process of building such robots, setting up the required motion control parameters and associated Hardware-In-The-Loop simulators, and programming of sensor-based single and multi-robot motion planning algorithms.

ENGR 491. Research and Independent Study I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: Approval of the Instructor (Faculty Mentor) and the Grand Challenges Program Director Junior or higher standing. Restrictions: Junior or higher standing. Provides the student with an opportunity to work on a research project under the individual guidance of a faculty mentor associated with the Grand Challenges Scholars Program. A written report, or a research paper, or a final presentation is required for course completion.

ENGR 492. Research and Independent Study II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGR 491. Restrictions: Junior or higher standing, and Approval of the Instructor (Faculty Mentor) and the Grand Challenges Program Director. Provides the student with an opportunity to continue to work on a research project under the individual guidance of a faculty mentor associated with the Grand Challenges Scholars Program. Students may continue the work they started in ENGR 491 or can work on a different grand challenge with the same or different faculty mentor. A written report, or a research paper or a final presentation is required for course completion.

ENGR 493. Service Learning Experience for Engineers. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENGR 290. Restrictions: Junior or higher standing, and Approval of the Grand Challenges Program Director. Through service experiential learning, students will engage in acquiring a multi-cultural competency. A host of opportunities are available for fulfilling this competency: an experience will require prior approval of the GCSP Faculty Advisor and the Program Director. Students will be required to develop a plan in carrying out the experience. Potential opportunities include but are not limited to 1. An Engineers without Borders project, 2. An EPICS project, 3. A global internship or cooperative education experience that is voluntary (unpaid), and 4. A study abroad experience.

ESC 310. Work Experience I. 3 credits, 3 contact hours (0;0;3).

ET 101. Introduction to Engineering Technology. 0 credits, 2 contact hours (2;0;0).
This course introduces the student to engineering technology. Also included is an introduction to the various engineering technology options: Construction, Electrical and Computer, and Mechanical Engineering Technologies as well as Concrete Industry Management.

GEN 301. Applications of Microcontrollers and IoT devices. 3 credits, 4 contact hours (2;2;0).
Prerequisites: FED 101, CS 101 or CS 106 or CS 115 or BME 210. Microcontrollers are an integral part of many modern technological devices. This course will familiarize students to microcontrollers and its exciting applications in the fields of Internet of Things (IoT) and Robotics using a project-based hands-on approach. The microcontroller will be used as a component part of a broader design activity to introduce students to coding, logic, and automation in the wider context of product design. Students will work on multiple mini-projects to integrate a programmable system into a prototype such as a heart monitor, step counter, electronic scoreboard or a food temperature probe. Overall, this course will provide a basic understanding of software design and coding, microcontroller interfacing with sensors, actuators, motors etc., and robotics. Students will also develop modeling and prototyping skills and will be inspired towards making and service-learning.

GEN 491. Research Independent Study I. 3 credits, 3 contact hours (3;0;0).
Restriction: senior standing in general engineering. Provides the student with an opportunity to work on a research project under the individual guidance of a program faculty member.

GEN 492. Research Independent Study II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: GEN 491. A continuation of GEN 491.

B.S. in Engineering Technology, Technology Education

There is a great need for highly qualified teachers of science and technology at the secondary school level. Nationwide, middle and high schools are facing a shortage of technology teachers. The Technology Education (TEED) program is a partnership between NJIT and Rutgers University, Newark, offering a degree in Engineering Technology and an instructional certification with the Teacher of Technology Education (1810) endorsement.

The technology education curriculum provides an in-depth knowledge of various engineering technology disciplines in addition to the required education courses. Students will take a core group of technical courses, and have an ability to concentrate in one or more of the Engineering Technology options. Students will also complete their degree with a 6 credit student teaching course.

The curriculum for the program is shown below. Students who wish to enter the program as a transfer student are typically students with an A.A.S. degree in an Engineering Technology program or an A.S. program in a technical discipline. These students should have completed most or all of the courses, or their equivalents, in the first two years of the program as shown below. In the case of all students, both four-year and transfer, a minimum of 123 credits is required for graduation[1].

(123 credits)

First Year		
1st Semester		**Credits**
CS 106	Roadmap to Computing for Engineers	3
ENGL 101	English Composition: Introduction to Academic Writing	3
PHYS 102	General Physics	3
PHYS 102A	General Physics Lab	1
MATH 138	General Calculus I	3
MET 103	Engineering Graphics and Intro. to CAD	2
ET 101	Introduction to Engineering Technology	0
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
MATH 238	General Calculus II	3
PHYS 103	General Physics	3
PHYS 103A	General Physics Lab	1
ECET 201	Circuits I	3
MET 105	Applied Computer Aided Design	2

ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**15**
Second Year		
1st Semester		
MET 235	Statics for Technology	3
CHEM 301	Chemical Technology	3
ECET 215	Introduction to Digital Electronics	3
R300 292	Social Foundation [1]	3
R300 295	Urban Adol Psych	3
	Term Credits	**15**
2nd Semester		
MET 237	Strength of Materials for Technology	3
History and Humanities GER 200 level (p. 106)		3
ME 215	Engineering Materials and Processes	3
R300 297 & R300 298 & R300 299	21st Century Urban Educator and 21st Century Urban Educator and 21st Century Urban Educator [2]	3
IE 224	Production Process Design	3
Technical Elective		3
	Term Credits	**18**
Third Year		
1st Semester		
STS 310	Technology and Human Values	3
R300 390	Understand Ed Eval	3
R300 410	Ict In Secondary Sch	3
CPT 325	Medical Informatics Technology	3
R300 388 & R300 369	Curriculum & Instruct Sem and Curriculum & Instruct: Tech Ed [2]	3
	Term Credits	**15**
2nd Semester		
History and Humanities GER 300+ level (p. 108)		3
MATH 305 or MNET 315	Statistics for Technology or Industrial Statistics	3
R300 386 & R300 380	Methods of Teaching Sec School and Methods of Teaching Secondary [2]	3
CET 313	Construction Procedures I	3
IE 355	Human Factors	3
	Term Credits	**15**
Fourth Year		
1st Semester		
Humanities and Social Science Senior Seminar GER (p. 112)		3
CET 317	Construction Computing	3
Technical ET Elective (3xx or 4xx)		3
Technical Elective		3
	Term Credits	**12**
2nd Semester		
CET 314	Construction Procedures II	3
Technical ET Elective (3xx or 4xx)		3
Technical Elective		3
R300 418	Secondary Practicum [3]	1
R300 419	Clinical Practice	2
	Term Credits	**12**

Fifth Year		
1st Semester		
R300 487	Student Teaching & Seminar	3
R300 488	Clinical II: St Teaching Exp	3
	Term Credits	**6**
	Total Credits	**123**

1 Apply Rutgers – Newark Urban Teacher Education Program
2 Courses must be taken concurrently.
3 Praxis must be taken prior to taking this class.

Martin Tuchman School of Management

The degree programs and research efforts at NJIT's Martin Tuchman School of Management (MTSM) are directed toward understanding the effects of technology and technological change on business. MTSM's goal is to prepare a new generation of technology-savvy business leaders who are ready for the challenges of the continuing technological revolution.

MTSM is committed to providing a solid foundation in business and management within a hands-on, experiential learning environment. Small class sizes and opportunities to co-op or intern with major corporations throughout the region and to work with startup companies in) VentureLink allow students to learn first-hand about entrepreneurship and product innovation. Currently, there are over 700 students enrolled in the school's undergraduate and graduate programs. In addition, almost 200 students majoring in engineering, computing, social science, and the applied and design sciences are pursuing a business minor. Joint B.S./M.S. or B.S./M.B.A. options allow students in several departments across the university to accelerate their studies and earn a master's degree in management or an M.B.A. in addition to their undergraduate degree.

MTSM offers an undergraduate program leading to the B.S. degree in Business with concentrations in accounting systems, finance, innovation and entrepreneurship, management information systems, and marketing and a B. S. degree in Financial Technology (FinTech). At the master's level, MTSM offers two programs leading to an M.S. degree in management (M.S.M.) with concentrations in Web Systems and Media, Global Project Management, Business Analytics and Financial Technology, and a Master of Business Administration (M.B.A.) with concentrations in MIS, finance, marketing, innovation and entrepreneurship, IT sales and analytics, or a custom concentration. The MBA program is available on-campus or online. MTSM also offers a PhD in Business Data Science.

- Business - B.S. (p. 671)
- Financial Technology - B.S. (p. 674)

- Business Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/management/management/business-minor/)
- Economics Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/management/management/economics-minor/)
- Innovation and Entrepreneurship Minor (http://catalog.njit.edu/archive/2022-2023/undergraduate/management/management/innovation-entrepreneurship-minor/)

Programs

- Management - M.S. (http://catalog.njit.edu/archive/2022-2023/graduate/management/management/ms/)
- Management of Technology - M.B.A. (http://catalog.njit.edu/archive/2022-2023/graduate/management/management/technology-mba/)

Martin Tuchman School of Management Courses

ACCT 115. Fundamentals of Financial Accounting. 3 credits, 3 contact hours (3;0;0).
This is an introductory-level financial accounting course designed to develop fundamentals of financial accounting. This course will help students develop skills in applying financial accounting principles to record basic economic transactions, summarize and present such transactions in financial statements as well as to analyze reported accounting information from a user's perspective to make informed financial decisions. Students will also learn to appreciate accounting as a dynamic, changing discipline rather than an inflexible set of rules.

ACCT 117. Principles Of Fin Accountng. 3 credits, 3 contact hours (3;0;0).
This is an introductory course designed to develop fundamentals of financial accounting-a process of identifying, recording, and communicating economic events of an organization. This course will provide students with an opportunity to develop skills in applying financial accounting principles to record basic economic transactions, summarize and present such transactions in financial statements as well as analyze reported accounting information by using ratios.

ACCT 215. Managerial Accounting I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ACCT 115 or ACCT 117. This course introduces fundamentals of cost and managerial accounting, including an introduction to job orders and process costing systems, cost allocation, cost behavior, managerial decision models, cost and budgetary planning and control, standard costing, analysis of variance, and responsibility accounting. The course is designed to develop the fundamentals of managerial accounting and provide students with a working knowledge of how accounting data are used by management in planning, decision-making and operational control.

ACCT 325. Intermediate Accounting I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ACCT 215. This course provides an in-depth study of generally accepted accounting principles in the classification, presentation and disclosure of assets required by external users of financial statements. Students will learn to complete accounting cycle activities; prepare and evaluate financial statements with data from an accounting information system; apply financial accounting functions and theory to recognize and measure different types of assets; calculate earnings per share; carry out income tax accounting; and understand the nature and effect of accounting errors.

ACCT 335. Managerial Accounting II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ACCT 215. A study of the concepts and techniques used by cost accountants to assist decision-makers within the organization. In-depth, real-world scenarios will be discussed including process accounting, job-order accounting, measuring quality costs, activity-based costing, and evaluating performance. Students will be introduced to methods currently being used by American businesses, including service firms, as well as manufacturers.

ACCT 340. Accounting Data Analytics and Visualization. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ACCT 115; ACCT 215; MGMT 216. Pre or Corequisites: MIS 385 . The combination of computerization and automation of many accounting tasks as well as the explosion of available data is changing the accounting profession. To address this, accountants are increasingly required to have an analytics mindset to perform their jobs. Building upon the fundamentals of accounting learned in prior courses, ACCT 340 Accounting Data Analytics and Visualization explores accounting concepts through the application of data analytics. This course intends to help students to develop the skills to ask the right questions, to learn how to use tools they may encounter in the workplace such as Excel and Tableau to examine and analyze data, and then to effectively interpret results to make business decisions. This analytics mindset is crucial early in the study of accounting to meet the demands of today’s accounting jobs.

ACCT 403. Financial Statement Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218; FIN 315. This course offers comprehensive coverage of analysis of financial statements so that students can: a)evaluate the financial position of a firm; b) assess the firm's inherent value and the value of its securities; c) assess the firm's obligations and its ability to meet them; and d) analyze sources and uses of cash.

ACCT 415. Auditing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ACCT 435. An examination of current auditing theory and procedures employed in carrying out the audit. The course will cover the life cycle of the audit from accepting an audit, gathering evidence to giving an opinion on a company's financial reports.

ACCT 425. Tax Accounting I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ACCT 215 or ACCT 116. This course is the first part of the two tax accounting courses, with a focus on federal individual income taxation. It is designed to give the students a comprehensive understanding of personal income tax laws and to able him to prepare personal income tax returns of considerable complexity. Topics covered in this course will include gross income, property transactions, capital gains/losses, itemized deductions employee expenses, depreciation, accounting methods and tax credits, among others.

ACCT 435. Intermediate Accounting II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ACCT 325. This is the second part of the two intermediate level financial accounting courses designed to review the basic financial required statements and provide accounting students with in-depth study of accounting principles advanced by responsible professional organizations. Topics covered include the classification, presentation and disclosure of assets, liabilities and stockholders' equity for external users of financial information.

ACCT 490. Independent Study in Acct. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ACCT 325 and approval of proposal by the SOM faculty member or lecturer who will supervise the study. Self-paced study on some aspect of managing organizations. Cannot substitute for any required course nor duplicate the coverage of any regularly offered course. Accepted proposals and project results are kept in a file available to all SOM faculty and instructional staff and to students contemplating starting an independent study project.

ECON 201. Economics. 3 credits, 3 contact hours (3;0;0).
The nature of a market economy. Microeconomics, demand theory, production possibilities, cost and price, equilibrium analysis, and applications to decision making in the firm. Macroeconomics, national income accounts, consumption, investment, government monetary and fiscal policy, and problems of employment and price levels. Economic analysis leading to an understanding of current developments in the United States economy and international trade and currency problems. Students who have received credit for ECON 265 or ECON 266 may not subsequently receive credit for ECON 201. Students majoring within Martin Tuchman School of Management are not allowed to register this course.

ECON 265. Microeconomics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 135 or MATH 138 or MATH 111. The theory of price determination and resource allocation under various market structures. The theory of demand, production, costs, factor and product pricing, income distribution, market failure, implications of government intervention in the market, and comparison of the free enterprise and alternative systems. Students who have received credit for SS 201 may not subsequently receive credit for ECON 265.

ECON 266. Macroeconomics. 3 credits, 3 contact hours (3;0;0).
The theory of national income determination. The determinants of aggregate production, employment and prices, as well as money and banking, business cycles and monetary and fiscal policy. Students who have received credit for ECON 201 may not subsequently receive credit for ECON 266.

ECON 485. Special Topics in Economics. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of business and their application not regularly covered in any other business course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course.

ENTR 210. Introduction to Entrepreneurship. 3 credits, 3 contact hours (3;0;0).
Provides an understanding of the processes with which to bring technological innovation to market through a new venture. Emphasis is on opportunity recognition, business model validation, and the strategic management of new ventures. Students will form virtual companies, learn the protocols of technological innovation concepts including securing funding and intellectual property protection, and engage the regional entrepreneurship ecosystem.

ENTR 320. Financing New Venture. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENTR 410 or ENTR 210. This course teaches students how to estimate the funding required to bring an innovation to market, how to secure such funding, and how to track the venture's progress through financial metrics. The course covers the entire life cycle of new ventures, from bootstrapping through growth to harvesting.

ENTR 330. Entrepreneurial Strategy. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENTR 410 or ENTR 210. Integrates knowledge of the different aspects of business learned in previous course work. In addition, provides an understanding of the decisions that guide the overall operations of a business organization and how the organization interacts with its markets, competitors, and suppliers. For the student who is considering starting or managing a small business. Combines classroom instruction in business strategy along with case analysis of small firms.

ENTR 440. Lean Startup Accelerator. 3 credits, 3 contact hours (3;0;0).
This is a hands-on workshop to help students get their new business idea launched. It utilizes the Lean Startup Methodology where students are expected to interview and acquire actual customers during the course.

ENTR 485. ST in Entrepreneurship. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of innovation and entrepreneurship and their application not regularly covered in any other business or entrepreneurship course. The precise topics to be covered, along with prerequisites, are announced in the semester prior ro the offering of the course.

ENTR 490. Independent Study in ENTR. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENTR 410 and approval of proposal by the SOM faculty member or lecturer who will supervise the study. Self-paced study on some aspect of managing organizations. Cannot substitute for any required course nor duplicate the coverage of any regularly offered course. Accepted proposals and project results are kept in a file available to all SOM faculty and instructional staff and to students contemplating starting an independent study project.

FIN 218. Financial Markets and Institutions. 3 credits, 3 contact hours (3;0;0).
This course provides an overview of the main features of financial markets and institutions in the United States, including interest rates and rates of return and how they are determined. It also covers securities traded on the U.S. financial markets including bonds, stocks, and derivatives and discusses how financial institutions, especially commercial banks work, along with the role of government in regulating financial markets and institutions.

FIN 306. Blockchain Technology for Business. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MGMT 216 and FIN 218. In this course, students will delve into the world of blockchain technology and the promise it holds for business. In particular, students will study how cryptocurrencies like Bitcoin make use of the blockchain to facilitate peer-to-peer digital transactions. With a solid understanding of the mechanics of the crypocurency blockchain protocol, students will discover the problems blockchain technologies aim to solve and determine how they can support the business goals. Student will do this by learning about smart contracts and the most important use cases. Students will analyze how smart contracts work, how they're used today, and how to reason about their capabilities, and what ongoing technical challenges they pose. In the course project, students will come up with their own application and outline the challenges that might exist in its adoption. For the practical skill of Blockchain leverage, the blockchain techniques and system development will be illustrated by IBM Skills Academy Platform through Blockchain Design and Lab sessions.

FIN 310. Data-Driven Financial Modeling. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MGMT 216, MGMT 316, and FIN 315 or FIN 218. This course equips students with new analytic and modeling tools to tackle rapidly changing and dynamic financial markets. In particular, this course delivers modelling frameworks such as regression analysis, forecasting, Monte-Carlo simulation, optimization, and binomial trees; and it illustrates how to apply these frameworks in financial contexts such as portfolio management, term-structure estimation, capital budgeting, risk measurement, risk analysis in discounted cash flow models, and pricing of European, American, exotic, and real options.

FIN 315. Fundamentals of Corporate Finance. 3 credits, 3 contact hours (3;0;0).
This course focuses on how companies invest in real assets and how they raise the money to pay for those investments. Topics covered include the firm and the financial manager, time value of money, bonds, stocks, and net present value. International finance, risk management, capital structure strategy and case studies of technology-based companies will be introduced.

FIN 320. Fin Data Analytics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 100 or CS 103, MATH 333 or MGMT 216, and FIN 218. This course covers data analytics for common finance applications using popular programming languages, such as Python or R. It consists of two stages: Stage 1 for introducing programming basics; Stage 2 for covering commonly used analytical skills for applications in finance. Two real-data applications will strengthen the students' hands-on experiences. The course provides students with essential analytics training as needed for financial applications.

FIN 401. Securities in Financial Markets. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218 and FIN 315. This course offers a quantitative approach to evaluating fixed income securities and to managing bond portfolios. Specific topics include: modern theory of bond pricing, pricing of high risk bonds, derivatives, and risk management.

FIN 402. Financial Risk Measurement and Management. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218 and FIN 315. This course offers an in-depth analysis of the measurement and management of risk in financial markets. Topics include: assessing overall market risk, credit risk, liquidity risk, settlement risk, volatility risk, measuring portfolio risk, and extreme value risk.

FIN 403. Financial Statement Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218 and FIN 315. This course offers comprehensive coverage of analysis of financial statements so that students can: a) evaluate the financial position of a firm; b) assess the firm's inherent value and the value of its securities; c) assess the firm's obligations and its ability to meet them; and d) analyze sources and uses of cash.

FIN 410. Data Mining & Machine Learning. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 111 or MATH 135, FIN 310 and FIN 320. FIN 410 provides an in-depth study of data mining and machine learning, with a focus on finance applications. This course is practice-oriented and develops the required skills to apply contemporary analysis tools of data mining & machine learning tools in financial data and facilitate decision making in stock market. Coverage includes data mining and machine learning concepts, processes, methods, and techniques; tools and metrics; and integration with Big Data.

FIN 416. Advanced Corporate Finance. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218 and FIN 315. Advanced corporate finance with an emphasis on the financial management of technology-based organizations. Case studies are used for comparative analysis. Emphasis is on organizational productivity and profitability.

FIN 417. Investments Management. 3 credits, 3 contact hours (3;0;0).
Pre or Corequisites: FIN 315. The course is intended to introduce students to key concepts, valuation methods and models and practical issues in investments from an investor's perspective. The course has two main components. First, the course will cover the theories of investments where the students will learn the main ideas proposed in academic literature to construct well-diversified portfolios. Second, the course will provide students the necessary tools to put the theoretical concepts covered in this course into practice.

FIN 422. International Finance. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218 and FIN 315. Introduction to the international financial management of the firm with an emphasis on technology-based organizations. Topics covered include hedging currency risk, capital budgeting internationally, raising funds internationally. Global competitiveness is addressed with comparative analysis of the financial management practices of American, European and Japanese firms.

FIN 423. Risk Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: FIN 315. The management of risk in the business enterprise. Topics include meas-urement of risk and hedging strategies, sources of liability, property and liability insurance, and insurance administration.

FIN 430. Options and Futures Markets. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218, FIN 315, MATH 135 (or MATH 138, MATH 111). This course covers options, forward contracts, futures contracts and swaps, and will give students a working knowledge of how these contracts work, how they are used, and how they are priced. Students will learn how corporations and portfolio managers can hedge different kinds of risks or alter the distribution of returns on their portfolios using various techniques.

FIN 485. Special Topics in Finance. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of business and their application not regularly covered in any other business course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course.

FIN 490. Independent Study in Finance. 3 credits, 3 contact hours (0;0;3).
Prerequisites: FIN 218, FIN 315 and approval of proposal by the SOM faculty member or lecturer who will supervise the study. Self-paced study on some aspect of managing organizations. Cannot substitute for any required course nor duplicate the coverage of any regularly offered course. Accepted proposals and project results are kept in a file available to all SOM faculty and instructional staff and to students contemplating starting an independent study project.

HRM 301. Organizational Behavior. 3 credits, 3 contact hours (3;0;0).
Restrictions: Junior or Senior standing. A foundation course in individual and group behavior in organizations. Processes such as perception, motivation and leadership are examined with a focus on issues central to technology-based organizations (innovation, creativity, managing technical professionals).

HRM 303. Human Resources Management. 3 credits, 3 contact hours (3;0;0).
Covers basic human resources concepts including recruitment, selection, EEO, training, labor relations, and human resources information systems. Human resources management practices in technology-based firms are studied in detail.

HRM 310. Managing Diversity and Inclusion in Organizations. 3 credits, 3 contact hours (3;0;0).
The course analyzes issues that arise in managing a diverse work force and including diverse people in senior positions throughout the organization. Through class discussions, readings, group projects, and talks from outside industry speakers you learn about interpersonal skills and strategies to recruit, train, motivate, promote, and include employees with diverse characteristics. You learn major organizations' best practices in line with federal and state laws and regulations. Students examine the implications of technological developments for including diverse populations in the use of new technologies to include the disabled. By the course's end you should understood how demographic and cultural issues affect organizational performance in a diverse world.

HRM 415. Organizational Design and Development. 3 credits, 3 contact hours (3;0;0).
Prerequisite: HRM 301. Focuses on the design of modern organizations with an emphasis on effectively responding to environmental and technological change. Design issues include analyzing organizational structures, understanding the process of organizational learning, and evaluating organizational cultures. Development issues focus on employee empowerment, vertical and horizontal communication in organizations, and self-managed work teams.

HRM 485. Special Topics in Human Resource Management. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of business and their application not regularly covered in any other business course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course.

MGMT 116. Quantitative Analysis Appl Bus. 4 credits, 5 contact hours (3;2;0).
Prerequisite: Freshman standing. This course introduces statistical concepts, basic optimization modeling and tools that can be leveraged for business data analytics. The emphasis is on knowing what analytical techniques to use to address specific business questions, on the use of computer software to perform statistical analysis, and on the interpretation and communication of the results of such analysis. The use of Excel and other software tools is emphasized. The course covers statistical techniques that are often used to solve problems in business areas such as finance, marketing, and operations management.

MGMT 190. Introduction to Business. 3 credits, 3 contact hours (3;0;0).
Restriction: Freshman business and fintech majors except with permission of MTSM undergraduate advisor. Organizational structures, governance, financial systems, marketing, and government interactions. Economic, political, psychological, and social influences on business. This course is restricted to freshmen BUSINESS and FINTECH majors except with permission of MTSM's undergraduate advisor.

MGMT 216. Business Data Analytics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MGMT 116 or MATH 105. This course introduces statistical concepts and tools that can be leveraged for business data analytics. The emphasis is on knowing what analytical techniques to use to address specific business questions, on the use of computer software to perform business statistical analysis. In particular, it covers descriptive statistics, confidence interval estimation, hypothesis testing, inferential statistics and regression analysis. It ends with a brief introduction to time-series analysis and forecasting.

MGMT 290. Business Law I. 3 credits, 3 contact hours (3;0;0).
The basic principles of common and statutory law applicable to business and professional relationships, emphasizing contracts, negotiable instruments, sales of goods, agency and business organizations.

MGMT 310. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Completion of at least 30 credits at NJIT, approval of the school and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report.

MGMT 316. Business Research Methods. 3 credits, 3 contact hours (2;1;0).
Prerquisites: MGMT 216, MIS 245. This course covers business research methodologies with an emphasis on data collection/mining and data analysis. It offers the knowledge skills to conduct research in all applicable fields from the traditional areas of business, such as, marketing, finance, human resources, operations and service management, as well as web-based e-commerce related research applications. Upon completion, students will be able to: (1) understand business research methodologies, (2) conduct business research studies, (3) present the results, analyses and recommendations to management.

MGMT 330. Real Estate Principles. 3 credits, 3 contact hours (3;0;0).
Restrictions: Sophomore standing. The Real Estate Principles course provides an overview of fundamental real estate concepts, terminology, and real estate practices. Specifically, the course will be surveying real estate law, appraisal, marketing, brokerage, management, finance, and investment analysis. As an introductory course, it will provide you with the foundation needed for the other real estate courses that are required for the real estate specialization in the B.S. program.

MGMT 340. Real Estate Information Systems. 3 credits, 3 contact hours (3;0;0).
Restrictions: Sophomore standing. This course will provide a comprehensive overview of the various types of internal (endogenous) information systems used by today's leading real estate companies to operate effectively and efficiently. The course will take a micro approach to the application of technology within a real estate company to support business operations and managerial decision-making. This focus contrasts with taking a macro view of the industry and the role emergent technologies and innovations play in driving competition, new businesses, and new market opportunities. Information systems are used by all functioning departments and are designed to support the property management, construction, acquisition, and tenant lifecycles that real estate companies manage. This is in addition to traditional business processes that take place daily. These systems and their uses will be evaluated to see how they are integrated and used to support various business processes that flow across departments and organizations. Students will learn to identify these various systems, identify the data used, and develop dashboards and processes to aid management decision-making. The focus is on understanding concepts as opposed to implementing the actual computer processes that implement the concepts.

MGMT 345. Real Estate Tech Innovation & Entrepreneurship. 3 credits, 3 contact hours (3;0;0).
Restrictions: Sophomore standing. Course content and exercises are focused on providing a business manager and innovator with understanding of how technology has fundamentally changed real estate economics as an asset class for future real estate professionals and entrepreneurs, whether as investors, developers, operators, brokers, lenders, facility managers, designers, planners or other roles yet to emerge. The topics presented during the semester are designed to spark curiosity and awareness regarding the intersection of technology innovation and entrepreneurship, and its effect on local and international real estate economics.

MGMT 350. Knowledge Management. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MIS 245. The purpose of this course is to introduce students to Knowledge Management. This term is used to refer to the ways in which organizations create, gather, manage and use the knowledge. Emphasis is placed on the information systems needed to capture and distribute knowledge and how knowledge can be used to gain competitive advantage.

MGMT 360. Business Law II. 3 credits, 3 contact hours (3;0;0).
The course will cover concepts required for the CPA Exam. Current cases will illustrate legal principles and how courts make decisions. Topics include corporate information and termination, agency and employment issues and forms of discrimination, comparisons of U.S. laws with those in other countries, the ethical context for business decisions, insider trading, online securities fraud, and disclosure of financial information on corporate blogs and tweets, including the tax consequences.

MGMT 390. Principles of Business. 3 credits, 3 contact hours (3;0;0).
This course explores strategies that allow companies to grow and compete in today's global marketplace, along with skills you will need to turn ideas into action for success in business. You will get an overview of key business processes, and an understanding of how they work together. Learning will be reinforced by real time case studies. A comprehensive project-based learning exercise will allow you to act as a management consultant and relate what you cover in class to a real company.

MGMT 391. International Business. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MGMT 190 or MGMT 390 or HRM 301, FIN 315, ECON 266 or ECON 201. A basic understanding of the activities in international business providing a framework for understanding them from the perspective of a company manager. Covers international trade, multinational enterprises, foreign exchange, foreign direct investment, international financial institutions, barriers to international trade, accounting of taxation, industrial relations, multinational enterprise, and world order.

MGMT 399. Career Planning and MFT. 1 credit, 1 contact hour (1;0;0).
Prerequisites: Junior or senior standing. A one credit, satisfactory/unsatisfactory course that will allow students to get the career training they need prior to entering work force, as well as review for the Major Fields Test and to actually take the Major Field Test in the course. This course runs for the first 10 weeks of the semester.

MGMT 410. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: MGMT 310 or equivalent, approval of the school, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as a co-op/intern. Mandatory participation in seminar and completion of requirements that include a report and/or project.

MGMT 416. Artificial Intelligence for Business Decisions. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MIS 245 and MGMT 216. Every industry is being affected by AI including finance, cybersecurity, manufacturing and services. The course explores common uses of AI in enterprises using Natural Language Processing (NLP), Chatbots (very useful in marketing and customer service), computer vision, and big data. Course content and exercises are focused on providing a business manager with understanding and tools to effectively use Artificial Intelligence systems to solve business problems and aid in decision-making. This course focuses on using AI systems from a manager's perspective.

MGMT 480. Managing Technology and Innovation. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Junior standing(57 credits). Introduction to an array of technologies affecting management functions to provide an appreciation and understanding of the importance of new technologies as critical success factors for modern organizations. An integrative approach is taken in analyzing how changes in technology affect individual, group, and organizational effectiveness.

MGMT 485. Special Topics in Management. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of business and their application not regularly covered in any other business course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course.

MGMT 490. Independent Study in Management. 3 credits, 3 contact hours (0;0;3).
Prerequisites: HRM 301 and approval of proposal by the SOM faculty member or lecturer who will supervise the study. Self-paced study on some aspect of managing organizations. Cannot substitute for any required course nor duplicate the coverage of any regularly offered course. Accepted proposals and project results are kept in a file available to all SOM faculty and instructional staff and to students contemplating starting an independent study project.

MGMT 492. Business Policy. 3 credits, 3 contact hours (3;0;0).
Prerequisite: senior standing. A capstone course in the area of business administration focusing on the integration of concepts taught in various functional courses such as marketing, finance, operations management, accounting, organizational behavior. Issues related to corporate responsibilities and ethical behavior are also incorporated in this course. Emphasis on application of concepts to real life situation is achieved through case discussion and projects. All SOM students need to earn a C or better in MGMT 492 in order to graduate.

MIS 245. Introduction to Management Information Systems. 3 credits, 3 contact hours (3;0;0).
Concepts of information systems, business process, hardware, software, systems analysis, e-commerce, enterprise systems and computer applications in organizations, techniques of systems analysis, systems designs, implementations, and information management (both technical and behavioral)are studied in the organizational context of management information needs.

MIS 363. Project Management for Managers. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Junior standing (57 credits). This course covers theories, tools, and techniques to manage projects in organizations. Students will learn how to put together a project charter, define project goals, and develop project teams, schedules, and budgets. The course will illustrate the key aspects of project lifecycles (initiation, planning, execution, monitor and control, and closing). It will also emphasize aspects of team, performance, risk, and quality management.

MIS 385. Database Systems for Managers. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 103 or CS 100 and MIS 245. This course introduces fundamentals of database systems for business applications. The course will also introduce the concepts of database evaluation, assessment and governance issues for business needs, as well as, database privacy, security and visualization for managerial applications. Students will gain hands-on experience on database systems management through course assignments.

MIS 445. Dec Supprt Tool & Tech Mngrs. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MIS 245 and OM 375. Introduces students to the use of decision support systems (DSS) to support management decisions. Topics include: DSS software tools, model management, and DSS design and use.

MIS 485. Special Topics in Management Information Systems. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of business and their application not regularly covered in any other business course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course.

MIS 490. Independent Study in MIS. 3 credits, 3 contact hours (0;0;3).
Prerequisites: MIS 245 and approval of proposal by the SOM faculty member or lecturer who will supervise the study. Self-paced study on some aspect of managing organizations. Cannot substitute for any required course nor duplicate the coverage of any regularly offered course. Accepted proposals and project results are kept in a file available to all SOM faculty and instructional staff and to students contemplating starting an independent study project.

MRKT 330. Principles of Marketing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MGMT 190 or MGMT 390 or departmental approval. Provides an understanding of how environmental factors (political, legal, economy, competition, socio-cultural, and technology) influence the design of product, pricing, promotion and distribution strategies. Topics discussed include strategies to satisfy target markets, market segmentation, buyer behavior, marketing ethics, and an introduction to global marketing issues. Fundamentals of marketing are integrated using cases, videos, and class projects.

MRKT 331. Customer Insights. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 105 or MGMT 116 and MRKT 330. Provides coverage of frameworks, concepts, tools, and techniques to discover and communicate business-relevant customer insights. Included are strategies for understanding the customer journey to gain insights from customer behavior (including Business to Business, Business to Customer, and Business to Me [individual]), and from experiences that allow marketers to understand buyer propensity and behavior.

MRKT 332. Advertis Theory & Techn. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330 This course addresses the total marketing communications function. It discusses the importance of integrated marketing communications (IMC) and provides coverage of advertising, sales promotion, public relations/publicity, direct response, interactive advertising and personal selling.

MRKT 338. New Product Design and Development. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330. The course focuses on the marketing aspects of designing and launching new products. It covers key activities carried out by product managers: product positioning, market opportunity identification, demand and growth forecasting, marketing research for testing and improving new products, product launch management, and product portfolio decisions. This course should also be useful in providing a marketing perspective to students planning an entrepreneurial career.

MRKT 339. Selling. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330. Provides an understanding of multifaceted roles salespeople play and prepares students for sales careers in business-to-business firms. Discusses the personal selling process that include prospecting and qualifying, sales call planning, approaching prospects, giving sales demonstrations and presentations, negotiating sales resistance, confirming and closing "win-win" agreements. Places emphasis on building customer relationships and partnerships by providing customer service and to ensure satisfaction and build customer loyalty.

MRKT 360. Digital Marketing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330. Provides an overview of fundamental principles of digital marketing for the contemporary business environment. Topics include digital marketing fundamentals and digital user behavior, online market research, digital marketing strategies, digital marketing plan, and development of digital marketing programs.

MRKT 378. Marketing Analytics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MRKT 330, MGMT 216 and MGMT 316. The goal of this course is to immerse students in the technical challenges associated with contemporary marketing analytics as applied to business processes and data-driven decision making. To achieve this mission, the course will introduce modules covering the state-of-the-art in R programming applied to data analysis for marketing problems.

MRKT 420. Product & Brand Management. 3 credits, 3 contact hours (3;0;0).
Pre-requisite: MRKT 330. The aim of the course is to equip students with theoretical and practical knowledge necessary for the successful and efficient management of products and brands. It provides the framework for the analysis of the main factors determining success of a brand in the market and introduces techniques and tools necessary for management of products and brands. This course will provide a fundamental understanding of how to build, measure, and manage a brand. The course will also provide an understanding of the role of product management/manager.

MRKT 430. Marketing Research. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330. The process of marketing research is studied in detail from study design through report preparation. A hands-on, experiential approach is taken with an emphasis on primary and secondary data and multivariate statistical methods such as regression and ANOVA. Data are analyzed using SAS or SPSS.

MRKT 432. Sales Management. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 339. This course helps the student to understand the various sales management activities that sales managers are responsible for in their important role as revenue generation managers. Key topics that are discussed within the realm of organizing, managing and controlling the sales force include sales forcasting, budgeting, sales force organization, time and territory management, recruitment, selection and training the salespeople, leadership, motivation, compensation, and sales force performance evaluation. Sales ethics and customer relationship management issues are also addressed.

MRKT 433. Marketing Channel Management. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330 This course develops a managerial framework to the field of marketing. Theory, research and practice are integrated to disucss distribution channel decision making implications. Students will understand the role played by the distribution system or network of alliances among agents, wholesalers, distributors and retailers to attain a firm's distribution of objectives. The course discusses the flow of goods through a distribution channel from the producer to the final consumer. Key topics include marketing channel strategy, channel design, channel management as a well as selecting, motivating, and evaluating the performance of marketing intermediaries. It also discusses the importance of electronic channels that have become prominent in the distribution process.

MRKT 434. Business to Business Marketing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330. Industrial or business-to-business (B2B) markets account for more than half the economic activity in the US. They differ from consumer markets in characteristics such as number and size of buyers, demand, buying patterns, and processes. Thus understanding the distinction between business markets and consumer markets and the impact these differences have will be discussed during the course. Various industrial contexts and ethical issues are also discussed as are other course concepts using cases, videos and role playing.

MRKT 435. International Marketing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330. This course will help students understand how the product, pricing, promotion and distribution elements of the marketing mix are influenced by international forces (cultural, political-legal, economic, competitive, and technological environment). Topics discussed include global market segmentation, marketing ethics, standardization or adaptation of the marketing mix as well as global information systems and market research, segmentation, targeting, and foreign market entry strategies (importing, exporting, licensing, and strategic alliances). Course concepts are integrated using cases, videos, and class projects.

MRKT 470. Data-driven Marketing Decision Making. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MRKT 330 or departmental approval. This course focuses on using data-rich findings to make marketing-related decisions. Students will learn how to use results derived from data analytics to make a variety of strategic and tactical decisions, such as marketing mix, market segmentation, new product design, and customer value assessment. This course aims to help students integrate knowledge of marketing concepts with analytical problem solving.

MRKT 485. Special Topics in Marketing. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of business and their application not regularly covered in any other business course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course.

MRKT 490. Independent Study in Marketing. 3 credits, 3 contact hours (0;0;3).
Prerequisites: MRKT 330 and approval of proposal by the SOM faculty member or lecturer who will supervise the study. Self-paced study on some aspect of managing organizations. Cannot substitute for any required course nor duplicate the coverage of any regularly offered course. Accepted proposals and project results are kept in a file available to all SOM faculty and instructional staff and to students contemplating starting an independent study project.

OM 375. Business Operations Management and Analytics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MGMT 216. The course emphasizes decision modeling and how to apply modeling and process simulation techniques to solving various classes of problems that arise in operational functions in business settings. It covers decision modeling techniques that range from deterministic to probabilistic models. It also emphasizes the ability to recognize what modeling skills and techniques to use to answer specific business operation and process questions, the use of computer tools and process simulation techniques to solve problems, and on the interpretation and communication of model solutions.

Management

The degree programs and research efforts at NJIT's Martin Tuchman School of Management (MTSM) are directed toward understanding the effects of technology and technological change on business. MTSM's goal is to prepare a new generation of technology-savvy business leaders who are ready for the challenges of the continuing technological revolution.

MTSM is committed to providing a solid foundation in business and management within a hands-on, experiential learning environment. Small class sizes and opportunities to co-op or intern with major corporations throughout the region and to work with startup companies in) VentureLink allow students to learn first-hand about entrepreneurship and product innovation. Currently, there are over 700 students enrolled in the school's undergraduate and graduate programs. In addition, almost 200 students majoring in engineering, computing, social science, and the applied and design sciences are pursuing a business minor. Joint B.S./M.S. or B.S./M.B.A. options allow students in several departments across the university to accelerate their studies and earn a master's degree in management or an M.B.A. in addition to their undergraduate degree.

MTSM offers an undergraduate program leading to the B.S. degree in Business with concentrations in accounting systems, finance, innovation and entrepreneurship, management information systems, and marketing and a B. S. degree in Financial Technology (FinTech). At the master's level, MTSM offers two programs leading to an M.S. degree in management (M.S.M.) with concentrations in Web Systems and Media, Global Project Management, Business Analytics and Financial Technology, and a Master of Business Administration (M.B.A.) with concentrations in MIS, finance, marketing, innovation and entrepreneurship, IT sales and analytics, or a custom concentration. The MBA program is available on-campus or online. MTSM also offers a PhD in Business Data Science.

NJIT Faculty

A

Anandarajan, Asokan, Professor

B

Bandera, Cesar, Associate Professor

Bonitsis, Theologos H., Associate Professor

C

Casal, Jose C., Senior University Lecturer

Caudill, Reggie, Professor Emeritus

Cavaleiro, Marta Sofia Pimentel, Senior University Lecturer

Chakrabarti, Alok K., Distinguished Professor Emeritus

Chang, Ai Chih, Assistant Professor

Chen, Yi, Professor

Chou, Porchiung B., Senior University Lecturer

Cordero, Rene, Associate Professor Emeritus

E

Egbelu, Pius J., Distinguished Professor

Ehrlich, Michael A., Associate Professor

F

Fjermestad, Jerry L, Professor

Fox, Wayne, Senior University Lecturer

Fresneda Fernandez, Jorge, Assistant Professor

G

Gopalakrishnan, Shanthi, Professor

K

Kudyba, Stephan P., Associate Professor

L

Lawrence, Kenneth, D., Professor

M

Mehta, Rajiv, Professor

Micale, Joseph, Assistant Professor

R

Rotter, Naomi G., Professor Emeritus

Roy, Raja, Assistant Professor

Rudna, Olena, Senior University Lecturer

S

Schachter, Hindy L., Professor

Shi, Junmin, Associate Professor

Somers, Mark, Professor

Sylla, Cheickna, Professor

T

Tamke, William, Senior University Lecturer

Tao, Xinyuan, Assistant Professor

Taylor, Ming, Assistant Professor

Thomas, Ellen J., Associate Professor

Tukel, Oya, Professor

U

Uddin, Ajim, Assistant Professor

W

Wang, Jinghua, Assistant Professor

Y

Yu, Dantong, Associate Professor

Z

Zhang, Haisu, Associate Professor

Zhang, Xi, University Lecturer

Management Courses

ACCT 115. Fundamentals of Financial Accounting. 3 credits, 3 contact hours (3;0;0).
This is an introductory-level financial accounting course designed to develop fundamentals of financial accounting. This course will help students develop skills in applying financial accounting principles to record basic economic transactions, summarize and present such transactions in financial statements as well as to analyze reported accounting information from a user's perspective to make informed financial decisions. Students will also learn to appreciate accounting as a dynamic, changing discipline rather than an inflexible set of rules.

ACCT 117. Principles Of Fin Accountng. 3 credits, 3 contact hours (3;0;0).
This is an introductory course designed to develop fundamentals of financial accounting-a process of identifying, recording, and communicating economic events of an organization. This course will provide students with an opportunity to develop skills in applying financial accounting principles to record basic economic transactions, summarize and present such transactions in financial statements as well as analyze reported accounting information by using ratios.

ACCT 215. Managerial Accounting I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ACCT 115 or ACCT 117. This course introduces fundamentals of cost and managerial accounting, including an introduction to job orders and process costing systems, cost allocation, cost behavior, managerial decision models, cost and budgetary planning and control, standard costing, analysis of variance, and responsibility accounting. The course is designed to develop the fundamentals of managerial accounting and provide students with a working knowledge of how accounting data are used by management in planning, decision-making and operational control.

ACCT 325. Intermediate Accounting I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ACCT 215. This course provides an in-depth study of generally accepted accounting principles in the classification, presentation and disclosure of assets required by external users of financial statements. Students will learn to complete accounting cycle activities; prepare and evaluate financial statements with data from an accounting information system; apply financial accounting functions and theory to recognize and measure different types of assets; calculate earnings per share; carry out income tax accounting; and understand the nature and effect of accounting errors.

ACCT 335. Managerial Accounting II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ACCT 215. A study of the concepts and techniques used by cost accountants to assist decision-makers within the organization. In-depth, real-world scenarios will be discussed including process accounting, job-order accounting, measuring quality costs, activity-based costing, and evaluating performance. Students will be introduced to methods currently being used by American businesses, including service firms, as well as manufacturers.

ACCT 340. Accounting Data Analytics and Visualization. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ACCT 115; ACCT 215; MGMT 216. Pre or Corequisites: MIS 385 . The combination of computerization and automation of many accounting tasks as well as the explosion of available data is changing the accounting profession. To address this, accountants are increasingly required to have an analytics mindset to perform their jobs. Building upon the fundamentals of accounting learned in prior courses, ACCT 340 Accounting Data Analytics and Visualization explores accounting concepts through the application of data analytics. This course intends to help students to develop the skills to ask the right questions, to learn how to use tools they may encounter in the workplace such as Excel and Tableau to examine and analyze data, and then to effectively interpret results to make business decisions. This analytics mindset is crucial early in the study of accounting to meet the demands of today’s accounting jobs.

ACCT 403. Financial Statement Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218; FIN 315. This course offers comprehensive coverage of analysis of financial statements so that students can: a)evaluate the financial position of a firm; b) assess the firm's inherent value and the value of its securities; c) assess the firm's obligations and its ability to meet them; and d) analyze sources and uses of cash.

ACCT 415. Auditing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ACCT 435. An examination of current auditing theory and procedures employed in carrying out the audit. The course will cover the life cycle of the audit from accepting an audit, gathering evidence to giving an opinion on a company's financial reports.

ACCT 425. Tax Accounting I. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ACCT 215 or ACCT 116. This course is the first part of the two tax accounting courses, with a focus on federal individual income taxation. It is designed to give the students a comprehensive understanding of personal income tax laws and to able him to prepare personal income tax returns of considerable complexity. Topics covered in this course will include gross income, property transactions, capital gains/losses, itemized deductions employee expenses, depreciation, accounting methods and tax credits, among others.

ACCT 435. Intermediate Accounting II. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ACCT 325. This is the second part of the two intermediate level financial accounting courses designed to review the basic financial required statements and provide accounting students with in-depth study of accounting principles advanced by responsible professional organizations. Topics covered include the classification, presentation and disclosure of assets, liabilities and stockholders' equity for external users of financial information.

ACCT 490. Independent Study in Acct. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ACCT 325 and approval of proposal by the SOM faculty member or lecturer who will supervise the study. Self-paced study on some aspect of managing organizations. Cannot substitute for any required course nor duplicate the coverage of any regularly offered course. Accepted proposals and project results are kept in a file available to all SOM faculty and instructional staff and to students contemplating starting an independent study project.

ECON 201. Economics. 3 credits, 3 contact hours (3;0;0).
The nature of a market economy. Microeconomics, demand theory, production possibilities, cost and price, equilibrium analysis, and applications to decision making in the firm. Macroeconomics, national income accounts, consumption, investment, government monetary and fiscal policy, and problems of employment and price levels. Economic analysis leading to an understanding of current developments in the United States economy and international trade and currency problems. Students who have received credit for ECON 265 or ECON 266 may not subsequently receive credit for ECON 201. Students majoring within Martin Tuchman School of Management are not allowed to register this course.

ECON 265. Microeconomics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 135 or MATH 138 or MATH 111. The theory of price determination and resource allocation under various market structures. The theory of demand, production, costs, factor and product pricing, income distribution, market failure, implications of government intervention in the market, and comparison of the free enterprise and alternative systems. Students who have received credit for SS 201 may not subsequently receive credit for ECON 265.

ECON 266. Macroeconomics. 3 credits, 3 contact hours (3;0;0).
The theory of national income determination. The determinants of aggregate production, employment and prices, as well as money and banking, business cycles and monetary and fiscal policy. Students who have received credit for ECON 201 may not subsequently receive credit for ECON 266.

ECON 485. Special Topics in Economics. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of business and their application not regularly covered in any other business course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course.

ENTR 210. Introduction to Entrepreneurship. 3 credits, 3 contact hours (3;0;0).
Provides an understanding of the processes with which to bring technological innovation to market through a new venture. Emphasis is on opportunity recognition, business model validation, and the strategic management of new ventures. Students will form virtual companies, learn the protocols of technological innovation concepts including securing funding and intellectual property protection, and engage the regional entrepreneurship ecosystem.

ENTR 320. Financing New Venture. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENTR 410 or ENTR 210. This course teaches students how to estimate the funding required to bring an innovation to market, how to secure such funding, and how to track the venture's progress through financial metrics. The course covers the entire life cycle of new ventures, from bootstrapping through growth to harvesting.

ENTR 330. Entrepreneurial Strategy. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENTR 410 or ENTR 210. Integrates knowledge of the different aspects of business learned in previous course work. In addition, provides an understanding of the decisions that guide the overall operations of a business organization and how the organization interacts with its markets, competitors, and suppliers. For the student who is considering starting or managing a small business. Combines classroom instruction in business strategy along with case analysis of small firms.

ENTR 440. Lean Startup Accelerator. 3 credits, 3 contact hours (3;0;0).
This is a hands-on workshop to help students get their new business idea launched. It utilizes the Lean Startup Methodology where students are expected to interview and acquire actual customers during the course.

ENTR 485. ST in Entrepreneurship. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of innovation and entrepreneurship and their application not regularly covered in any other business or entrepreneurship course. The precise topics to be covered, along with prerequisites, are announced in the semester prior ro the offering of the course.

ENTR 490. Independent Study in ENTR. 3 credits, 3 contact hours (0;0;3).
Prerequisites: ENTR 410 and approval of proposal by the SOM faculty member or lecturer who will supervise the study. Self-paced study on some aspect of managing organizations. Cannot substitute for any required course nor duplicate the coverage of any regularly offered course. Accepted proposals and project results are kept in a file available to all SOM faculty and instructional staff and to students contemplating starting an independent study project.

FIN 218. Financial Markets and Institutions. 3 credits, 3 contact hours (3;0;0).
This course provides an overview of the main features of financial markets and institutions in the United States, including interest rates and rates of return and how they are determined. It also covers securities traded on the U.S. financial markets including bonds, stocks, and derivatives and discusses how financial institutions, especially commercial banks work, along with the role of government in regulating financial markets and institutions.

FIN 306. Blockchain Technology for Business. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MGMT 216 and FIN 218. In this course, students will delve into the world of blockchain technology and the promise it holds for business. In particular, students will study how cryptocurrencies like Bitcoin make use of the blockchain to facilitate peer-to-peer digital transactions. With a solid understanding of the mechanics of the crypocurency blockchain protocol, students will discover the problems blockchain technologies aim to solve and determine how they can support the business goals. Student will do this by learning about smart contracts and the most important use cases. Students will analyze how smart contracts work, how they're used today, and how to reason about their capabilities, and what ongoing technical challenges they pose. In the course project, students will come up with their own application and outline the challenges that might exist in its adoption. For the practical skill of Blockchain leverage, the blockchain techniques and system development will be illustrated by IBM Skills Academy Platform through Blockchain Design and Lab sessions.

FIN 310. Data-Driven Financial Modeling. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MGMT 216, MGMT 316, and FIN 315 or FIN 218. This course equips students with new analytic and modeling tools to tackle rapidly changing and dynamic financial markets. In particular, this course delivers modelling frameworks such as regression analysis, forecasting, Monte-Carlo simulation, optimization, and binomial trees; and it illustrates how to apply these frameworks in financial contexts such as portfolio management, term-structure estimation, capital budgeting, risk measurement, risk analysis in discounted cash flow models, and pricing of European, American, exotic, and real options.

FIN 315. Fundamentals of Corporate Finance. 3 credits, 3 contact hours (3;0;0).
This course focuses on how companies invest in real assets and how they raise the money to pay for those investments. Topics covered include the firm and the financial manager, time value of money, bonds, stocks, and net present value. International finance, risk management, capital structure strategy and case studies of technology-based companies will be introduced.

FIN 320. Fin Data Analytics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 100 or CS 103, MATH 333 or MGMT 216, and FIN 218. This course covers data analytics for common finance applications using popular programming languages, such as Python or R. It consists of two stages: Stage 1 for introducing programming basics; Stage 2 for covering commonly used analytical skills for applications in finance. Two real-data applications will strengthen the students' hands-on experiences. The course provides students with essential analytics training as needed for financial applications.

FIN 401. Securities in Financial Markets. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218 and FIN 315. This course offers a quantitative approach to evaluating fixed income securities and to managing bond portfolios. Specific topics include: modern theory of bond pricing, pricing of high risk bonds, derivatives, and risk management.

FIN 402. Financial Risk Measurement and Management. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218 and FIN 315. This course offers an in-depth analysis of the measurement and management of risk in financial markets. Topics include: assessing overall market risk, credit risk, liquidity risk, settlement risk, volatility risk, measuring portfolio risk, and extreme value risk.

FIN 403. Financial Statement Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218 and FIN 315. This course offers comprehensive coverage of analysis of financial statements so that students can: a) evaluate the financial position of a firm; b) assess the firm's inherent value and the value of its securities; c) assess the firm's obligations and its ability to meet them; and d) analyze sources and uses of cash.

FIN 410. Data Mining & Machine Learning. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 111 or MATH 135, FIN 310 and FIN 320. FIN 410 provides an in-depth study of data mining and machine learning, with a focus on finance applications. This course is practice-oriented and develops the required skills to apply contemporary analysis tools of data mining & machine learning tools in financial data and facilitate decision making in stock market. Coverage includes data mining and machine learning concepts, processes, methods, and techniques; tools and metrics; and integration with Big Data.

FIN 416. Advanced Corporate Finance. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218 and FIN 315. Advanced corporate finance with an emphasis on the financial management of technology-based organizations. Case studies are used for comparative analysis. Emphasis is on organizational productivity and profitability.

FIN 417. Investments Management. 3 credits, 3 contact hours (3;0;0).
Pre or Corequisites: FIN 315. The course is intended to introduce students to key concepts, valuation methods and models and practical issues in investments from an investor's perspective. The course has two main components. First, the course will cover the theories of investments where the students will learn the main ideas proposed in academic literature to construct well-diversified portfolios. Second, the course will provide students the necessary tools to put the theoretical concepts covered in this course into practice.

FIN 422. International Finance. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218 and FIN 315. Introduction to the international financial management of the firm with an emphasis on technology-based organizations. Topics covered include hedging currency risk, capital budgeting internationally, raising funds internationally. Global competitiveness is addressed with comparative analysis of the financial management practices of American, European and Japanese firms.

FIN 423. Risk Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: FIN 315. The management of risk in the business enterprise. Topics include meas-urement of risk and hedging strategies, sources of liability, property and liability insurance, and insurance administration.

FIN 430. Options and Futures Markets. 3 credits, 3 contact hours (3;0;0).
Prerequisites: FIN 218, FIN 315, MATH 135 (or MATH 138, MATH 111). This course covers options, forward contracts, futures contracts and swaps, and will give students a working knowledge of how these contracts work, how they are used, and how they are priced. Students will learn how corporations and portfolio managers can hedge different kinds of risks or alter the distribution of returns on their portfolios using various techniques.

FIN 485. Special Topics in Finance. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of business and their application not regularly covered in any other business course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course.

FIN 490. Independent Study in Finance. 3 credits, 3 contact hours (0;0;3).
Prerequisites: FIN 218, FIN 315 and approval of proposal by the SOM faculty member or lecturer who will supervise the study. Self-paced study on some aspect of managing organizations. Cannot substitute for any required course nor duplicate the coverage of any regularly offered course. Accepted proposals and project results are kept in a file available to all SOM faculty and instructional staff and to students contemplating starting an independent study project.

HRM 301. Organizational Behavior. 3 credits, 3 contact hours (3;0;0).
Restrictions: Junior or Senior standing. A foundation course in individual and group behavior in organizations. Processes such as perception, motivation and leadership are examined with a focus on issues central to technology-based organizations (innovation, creativity, managing technical professionals).

HRM 303. Human Resources Management. 3 credits, 3 contact hours (3;0;0).
Covers basic human resources concepts including recruitment, selection, EEO, training, labor relations, and human resources information systems. Human resources management practices in technology-based firms are studied in detail.

HRM 310. Managing Diversity and Inclusion in Organizations. 3 credits, 3 contact hours (3;0;0).
The course analyzes issues that arise in managing a diverse work force and including diverse people in senior positions throughout the organization. Through class discussions, readings, group projects, and talks from outside industry speakers you learn about interpersonal skills and strategies to recruit, train, motivate, promote, and include employees with diverse characteristics. You learn major organizations' best practices in line with federal and state laws and regulations. Students examine the implications of technological developments for including diverse populations in the use of new technologies to include the disabled. By the course's end you should understood how demographic and cultural issues affect organizational performance in a diverse world.

HRM 415. Organizational Design and Development. 3 credits, 3 contact hours (3;0;0).
Prerequisite: HRM 301. Focuses on the design of modern organizations with an emphasis on effectively responding to environmental and technological change. Design issues include analyzing organizational structures, understanding the process of organizational learning, and evaluating organizational cultures. Development issues focus on employee empowerment, vertical and horizontal communication in organizations, and self-managed work teams.

HRM 485. Special Topics in Human Resource Management. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of business and their application not regularly covered in any other business course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course.

MGMT 116. Quantitative Analysis Appl Bus. 4 credits, 5 contact hours (3;2;0).
Prerequisite: Freshman standing. This course introduces statistical concepts, basic optimization modeling and tools that can be leveraged for business data analytics. The emphasis is on knowing what analytical techniques to use to address specific business questions, on the use of computer software to perform statistical analysis, and on the interpretation and communication of the results of such analysis. The use of Excel and other software tools is emphasized. The course covers statistical techniques that are often used to solve problems in business areas such as finance, marketing, and operations management.

MGMT 190. Introduction to Business. 3 credits, 3 contact hours (3;0;0).
Restriction: Freshman business and fintech majors except with permission of MTSM undergraduate advisor. Organizational structures, governance, financial systems, marketing, and government interactions. Economic, political, psychological, and social influences on business. This course is restricted to freshmen BUSINESS and FINTECH majors except with permission of MTSM's undergraduate advisor.

MGMT 216. Business Data Analytics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MGMT 116 or MATH 105. This course introduces statistical concepts and tools that can be leveraged for business data analytics. The emphasis is on knowing what analytical techniques to use to address specific business questions, on the use of computer software to perform business statistical analysis. In particular, it covers descriptive statistics, confidence interval estimation, hypothesis testing, inferential statistics and regression analysis. It ends with a brief introduction to time-series analysis and forecasting.

MGMT 290. Business Law I. 3 credits, 3 contact hours (3;0;0).
The basic principles of common and statutory law applicable to business and professional relationships, emphasizing contracts, negotiable instruments, sales of goods, agency and business organizations.

MGMT 310. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Completion of at least 30 credits at NJIT, approval of the school and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a report.

MGMT 316. Business Research Methods. 3 credits, 3 contact hours (2;1;0).
Prerquisites: MGMT 216, MIS 245. This course covers business research methodologies with an emphasis on data collection/mining and data analysis. It offers the knowledge skills to conduct research in all applicable fields from the traditional areas of business, such as, marketing, finance, human resources, operations and service management, as well as web-based e-commerce related research applications. Upon completion, students will be able to: (1) understand business research methodologies, (2) conduct business research studies, (3) present the results, analyses and recommendations to management.

MGMT 330. Real Estate Principles. 3 credits, 3 contact hours (3;0;0).
Restrictions: Sophomore standing. The Real Estate Principles course provides an overview of fundamental real estate concepts, terminology, and real estate practices. Specifically, the course will be surveying real estate law, appraisal, marketing, brokerage, management, finance, and investment analysis. As an introductory course, it will provide you with the foundation needed for the other real estate courses that are required for the real estate specialization in the B.S. program.

MGMT 340. Real Estate Information Systems. 3 credits, 3 contact hours (3;0;0).
Restrictions: Sophomore standing. This course will provide a comprehensive overview of the various types of internal (endogenous) information systems used by today's leading real estate companies to operate effectively and efficiently. The course will take a micro approach to the application of technology within a real estate company to support business operations and managerial decision-making. This focus contrasts with taking a macro view of the industry and the role emergent technologies and innovations play in driving competition, new businesses, and new market opportunities. Information systems are used by all functioning departments and are designed to support the property management, construction, acquisition, and tenant lifecycles that real estate companies manage. This is in addition to traditional business processes that take place daily. These systems and their uses will be evaluated to see how they are integrated and used to support various business processes that flow across departments and organizations. Students will learn to identify these various systems, identify the data used, and develop dashboards and processes to aid management decision-making. The focus is on understanding concepts as opposed to implementing the actual computer processes that implement the concepts.

MGMT 345. Real Estate Tech Innovation & Entrepreneurship. 3 credits, 3 contact hours (3;0;0).
Restrictions: Sophomore standing. Course content and exercises are focused on providing a business manager and innovator with understanding of how technology has fundamentally changed real estate economics as an asset class for future real estate professionals and entrepreneurs, whether as investors, developers, operators, brokers, lenders, facility managers, designers, planners or other roles yet to emerge. The topics presented during the semester are designed to spark curiosity and awareness regarding the intersection of technology innovation and entrepreneurship, and its effect on local and international real estate economics.

MGMT 350. Knowledge Management. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MIS 245. The purpose of this course is to introduce students to Knowledge Management. This term is used to refer to the ways in which organizations create, gather, manage and use the knowledge. Emphasis is placed on the information systems needed to capture and distribute knowledge and how knowledge can be used to gain competitive advantage.

MGMT 360. Business Law II. 3 credits, 3 contact hours (3;0;0).
The course will cover concepts required for the CPA Exam. Current cases will illustrate legal principles and how courts make decisions. Topics include corporate information and termination, agency and employment issues and forms of discrimination, comparisons of U.S. laws with those in other countries, the ethical context for business decisions, insider trading, online securities fraud, and disclosure of financial information on corporate blogs and tweets, including the tax consequences.

MGMT 390. Principles of Business. 3 credits, 3 contact hours (3;0;0).
This course explores strategies that allow companies to grow and compete in today’s global marketplace, along with skills you will need to turn ideas into action for success in business. You will get an overview of key business processes, and an understanding of how they work together. Learning will be reinforced by real time case studies. A comprehensive project-based learning exercise will allow you to act as a management consultant and relate what you cover in class to a real company.

MGMT 391. International Business. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MGMT 190 or MGMT 390 or HRM 301, FIN 315, ECON 266 or ECON 201. A basic understanding of the activities in international business providing a framework for understanding them from the perspective of a company manager. Covers international trade, multinational enterprises, foreign exchange, foreign direct investment, international financial institutions, barriers to international trade, accounting of taxation, industrial relations, multinational enterprise, and world order.

MGMT 399. Career Planning and MFT. 1 credit, 1 contact hour (1;0;0).
Prerequisites: Junior or senior standing. A one credit, satisfactory/unsatisfactory course that will allow students to get the career training they need prior to entering work force, as well as review for the Major Fields Test and to actually take the Major Field Test in the course. This course runs for the first 10 weeks of the semester.

MGMT 410. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: MGMT 310 or equivalent, approval of the school, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as a co-op/intern. Mandatory participation in seminar and completion of requirements that include a report and/or project.

MGMT 416. Artificial Intelligence for Business Decisions. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MIS 245 and MGMT 216. Every industry is being affected by AI including finance, cybersecurity, manufacturing and services. The course explores common uses of AI in enterprises using Natural Language Processing (NLP), Chatbots (very useful in marketing and customer service), computer vision, and big data. Course content and exercises are focused on providing a business manager with understanding and tools to effectively use Artificial Intelligence systems to solve business problems and aid in decision-making. This course focuses on using AI systems from a manager’s perspective.

MGMT 480. Managing Technology and Innovation. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Junior standing(57 credits). Introduction to an array of technologies affecting management functions to provide an appreciation and understanding of the importance of new technologies as critical success factors for modern organizations. An integrative approach is taken in analyzing how changes in technology affect individual, group, and organizational effectiveness.

MGMT 485. Special Topics in Management. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of business and their application not regularly covered in any other business course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course.

MGMT 490. Independent Study in Management. 3 credits, 3 contact hours (0;0;3).
Prerequisites: HRM 301 and approval of proposal by the SOM faculty member or lecturer who will supervise the study. Self-paced study on some aspect of managing organizations. Cannot substitute for any required course nor duplicate the coverage of any regularly offered course. Accepted proposals and project results are kept in a file available to all SOM faculty and instructional staff and to students contemplating starting an independent study project.

MGMT 492. Business Policy. 3 credits, 3 contact hours (3;0;0).
Prerequisite: senior standing. A capstone course in the area of business administration focusing on the integration of concepts taught in various functional courses such as marketing, finance, operations management, accounting, organizational behavior. Issues related to corporate responsibilities and ethical behavior are also incorporated in this course. Emphasis on application of concepts to real life situation is achieved through case discussion and projects. All SOM students need to earn a C or better in MGMT 492 in order to graduate.

MIS 245. Introduction to Management Information Systems. 3 credits, 3 contact hours (3;0;0).
Concepts of information systems, business process, hardware, software, systems analysis, e-commerce, enterprise systems and computer applications in organizations, techniques of systems analysis, systems designs, implementations, and information management (both technical and behavioral)are studied in the organizational context of management information needs.

MIS 363. Project Management for Managers. 3 credits, 3 contact hours (3;0;0).
Prerequisite: Junior standing (57 credits). This course covers theories, tools, and techniques to manage projects in organizations. Students will learn how to put together a project charter, define project goals, and develop project teams, schedules, and budgets. The course will illustrate the key aspects of project lifecycles (initiation, planning, execution, monitor and control, and closing). It will also emphasize aspects of team, performance, risk, and quality management.

MIS 385. Database Systems for Managers. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 103 or CS 100 and MIS 245. This course introduces fundamentals of database systems for business applications. The course will also introduce the concepts of database evaluation, assessment and governance issues for business needs, as well as, database privacy, security and visualization for managerial applications. Students will gain hands-on experience on database systems management through course assignments.

MIS 445. Dec Supprt Tool & Tech Mngrs. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MIS 245 and OM 375. Introduces students to the use of decision support systems (DSS) to support management decisions. Topics include: DSS software tools, model management, and DSS design and use.

MIS 485. Special Topics in Management Information Systems. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of business and their application not regularly covered in any other business course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course.

MIS 490. Independent Study in MIS. 3 credits, 3 contact hours (0;0;3).
Prerequisites: MIS 245 and approval of proposal by the SOM faculty member or lecturer who will supervise the study. Self-paced study on some aspect of managing organizations. Cannot substitute for any required course nor duplicate the coverage of any regularly offered course. Accepted proposals and project results are kept in a file available to all SOM faculty and instructional staff and to students contemplating starting an independent study project.

MRKT 330. Principles of Marketing. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MGMT 190 or MGMT 390 or departmental approval. Provides an understanding of how environmental factors (political, legal, economy, competition, socio-cultural, and technology) influence the design of product, pricing, promotion and distribution strategies. Topics discussed include strategies to satisfy target markets, market segmentation, buyer behavior, marketing ethics, and an introduction to global marketing issues. Fundamentals of marketing are integrated using cases, videos, and class projects.

MRKT 331. Customer Insights. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MATH 105 or MGMT 116 and MRKT 330. Provides coverage of frameworks, concepts, tools, and techniques to discover and communicate business-relevant customer insights. Included are strategies for understanding the customer journey to gain insights from customer behavior (including Business to Business, Business to Customer, and Business to Me [individual]), and from experiences that allow marketers to understand buyer propensity and behavior.

MRKT 332. Advertis Theory & Techn. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330 This course addresses the total marketing communications function. It discusses the importance of integrated marketing communications (IMC) and provides coverage of advertising, sales promotion, public relations/publicity, direct response, interactive advertising and personal selling.

MRKT 338. New Product Design and Development. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330. The course focuses on the marketing aspects of designing and launching new products. It covers key activities carried out by product managers: product positioning, market opportunity identification, demand and growth forecasting, marketing research for testing and improving new products, product launch management, and product portfolio decisions. This course should also be useful in providing a marketing perspective to students planning an entrepreneurial career.

MRKT 339. Selling. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330. Provides an understanding of multifaceted roles salespeople play and prepares students for sales careers in business-to-business firms. Discusses the personal selling process that include prospecting and qualifying, sales call planning, approaching prospects, giving sales demonstrations and presentations, negotiating sales resistance, confirming and closing "win-win" agreements. Places emphasis on building customer relationships and partnerships by providing customer service and to ensure satisfaction and build customer loyalty.

MRKT 360. Digital Marketing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330. Provides an overview of fundamental principles of digital marketing for the contemporary business environment. Topics include digital marketing fundamentals and digital user behavior, online market research, digital marketing strategies, digital marketing plan, and development of digital marketing programs.

MRKT 378. Marketing Analytics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MRKT 330, MGMT 216 and MGMT 316. The goal of this course is to immerse students in the technical challenges associated with contemporary marketing analytics as applied to business processes and data-driven decision making. To achieve this mission, the course will introduce modules covering the state-of-the-art in R programming applied to data analysis for marketing problems.

MRKT 420. Product & Brand Management. 3 credits, 3 contact hours (3;0;0).
Pre-requisite: MRKT 330. The aim of the course is to equip students with theoretical and practical knowledge necessary for the successful and efficient management of products and brands. It provides the framework for the analysis of the main factors determining success of a brand in the market and introduces techniques and tools necessary for management of products and brands. This course will provide a fundamental understanding of how to build, measure, and manage a brand. The course will also provide an understanding of the role of product management/manager.

MRKT 430. Marketing Research. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330. The process of marketing research is studied in detail from study design through report preparation. A hands-on, experiential approach is taken with an emphasis on primary and secondary data and multivariate statistical methods such as regression and ANOVA. Data are analyzed using SAS or SPSS.

MRKT 432. Sales Management. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 339. This course helps the student to understand the various sales management activities that sales managers are responsible for in their important role as revenue generation managers. Key topics that are discussed within the realm of organizing, managing and controlling the sales force include sales forcasting, budgeting, sales force organization, time and territory management, recruitment, selection and training the salespeople, leadership, motivation, compensation, and sales force performance evaluation. Sales ethics and customer relationship management issues are also addressed.

MRKT 433. Marketing Channel Management. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330 This course develops a managerial framework to the field of marketing. Theory, research and practice are integrated to disucss distribution channel decision making implications. Students will understand the role played by the distribution system or network of alliances among agents, wholesalers, distributors and retailers to attain a firm’s distribution of objectives. The course discusses the flow of goods through a distribution channel from the producer to the final consumer. Key topics include marketing channel strategy, channel design, channel management as a well as selecting, motivating, and evaluating the performance of marketing intermediaries. It also discusses the importance of electronic channels that have become prominent in the distribution process.

MRKT 434. Business to Business Marketing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330. Industrial or business-to-business (B2B) markets account for more than half the economic activity in the US. They differ from consumer markets in characteristics such as number and size of buyers, demand, buying patterns, and processes. Thus understanding the distinction between business markets and consumer markets and the impact these differences have will be discussed during the course. Various industrial contexts and ethical issues are also discussed as are other course concepts using cases, videos and role playing.

MRKT 435. International Marketing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MRKT 330. This course will help students understand how the product, pricing, promotion and distribution elements of the marketing mix are influenced by international forces (cultural, political-legal, economic, competitive, and technological environment). Topics discussed include global market segmentation, marketing ethics, standardization or adaptation of the marketing mix as well as global information systems and market research, segmentation, targeting, and foreign market entry strategies (importing, exporting, licensing, and strategic alliances). Course concepts are integrated using cases, videos, and class projects.

MRKT 470. Data-driven Marketing Decision Making. 3 credits, 3 contact hours (3;0;0).
Prerequisites: MRKT 330 or departmental approval. This course focuses on using data-rich findings to make marketing-related decisions. Students will learn how to use results derived from data analytics to make a variety of strategic and tactical decisions, such as marketing mix, market segmentation, new product design, and customer value assessment. This course aims to help students integrate knowledge of marketing concepts with analytical problem solving.

MRKT 485. Special Topics in Marketing. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in the various fields of business and their application not regularly covered in any other business course. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course.

MRKT 490. Independent Study in Marketing. 3 credits, 3 contact hours (0;0;3).
Prerequisites: MRKT 330 and approval of proposal by the SOM faculty member or lecturer who will supervise the study. Self-paced study on some aspect of managing organizations. Cannot substitute for any required course nor duplicate the coverage of any regularly offered course. Accepted proposals and project results are kept in a file available to all SOM faculty and instructional staff and to students contemplating starting an independent study project.

OM 375. Business Operations Management and Analytics. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MGMT 216. The course emphasizes decision modeling and how to apply modeling and process simulation techniques to solving various classes of problems that arise in operational functions in business settings. It covers decision modeling techniques that range from deterministic to probabilistic models. It also emphasizes the ability to recognize what modeling skills and techniques to use to answer specific business operation and process questions, the use of computer tools and process simulation techniques to solve problems, and on the interpretation and communication of model solutions.

B.S. in Business

(120 credit minimum)

First Year		
1st Semester		**Credits**
ACCT 115	Fundamentals of Financial Accounting	3
CS 103	Computer Science with Business Problems	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 135	Calculus for Business	3
MGMT 190	Introduction to Business	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
ACCT 215	Managerial Accounting I	3
MGMT 116	Quantitative Analysis Appl Bus	4
ECON 266	Macroeconomics	3
ENGL 102	English Composition: Introduction to Writing for Research	3
MGMT 290	Business Law I	3
	Term Credits	**16**
Second Year		
1st Semester		
MIS 245	Introduction to Management Information Systems	3
ECON 265	Microeconomics	3
History and Humanities GER 200 level (p. 106)		3
MGMT 216	Business Data Analytics	3
Natural Science GER (p. 113)		3
	Term Credits	**15**
2nd Semester		
FIN 315	Fundamentals of Corporate Finance	3
MRKT 330	Principles of Marketing	3
MGMT 316	Business Research Methods	3
Free Elective		3
Natural Science GER (p. 113)		4
	Term Credits	**16**
Third Year		
1st Semester		
FIN 218	Financial Markets and Institutions	3
HRM 301	Organizational Behavior	3
MGMT 391	International Business	3
MIS 385	Database Systems for Managers	3
MGMT 399	Career Planning and MFT	1

Business Concentration Elective		3
	Term Credits	**16**
2nd Semester		
MIS 363	Project Management for Managers	3
OM 375	Business Operations Management and Analytics	3
Business Concentration Elective		3
History and Humanities GER 300+ level (p. 108)		3
Free Elective		3
	Term Credits	**15**
Fourth Year		
1st Semester		
MIS 445	Dec Supprt Tool & Tech Mngrs	3
History and Humanities GER 300+ level (p. 108)		3
Business Concentration Elective Course [1]		3
Business Concentration Elective Course [1]		3
Free Elective		3
	Term Credits	**15**
2nd Semester		
MGMT 492	Business Policy	3
MGMT 480	Managing Technology and Innovation	3
Business Concentration Elective		3
Humanities and Social Science Senior Seminar GER (p. 112)		3
	Term Credits	**12**
	Total Credits	**120**

Business Concentration Courses

Choose 5 courses in your concentration.

- Accounting Concentration (p. 672)
- Finance Concentration (p. 673)
- Innovation and Entrepreneurship Concentration (p. 673)
- Management Information Systems Concentration (p. 673)
- Marketing Concentration (p. 674)

See the **General Education Requirements** “Refer to the General Education Requirements for specific information for GER courses"

Accounting Concentration

Accounting Concentration

Code	Title	Credits
Select five of the following: [1]		15
ACCT 325	Intermediate Accounting I	
ACCT 425	Tax Accounting I	
ACCT 403	Financial Statement Analysis	
ACCT 415	Auditing	
ACCT 335	Managerial Accounting II	
ACCT 340	Accounting Data Analytics and Visualization	
ACCT 435	Intermediate Accounting II	
MGMT 360	Business Law II	
MGMT 310	Co-op Work Experience I	
Total Credits		**15**

[1] Accounting majors seeking to sit for the certified public accountant exam should take all concentration courses.

Finance Concentration

Finance Concentration

Code	Title	Credits
Select five of the following:		15
FIN 403	Financial Statement Analysis	
FIN 416	Advanced Corporate Finance	
FIN 417	Investments Management	
FIN 422	International Finance	
FIN 430	Options and Futures Markets	
ENTR 320	Financing New Venture	
MGMT 310	Co-op Work Experience I	
Total Credits		**15**

Innovation and Entrepreneurship Concentration

Innovation and Entrepreneurship Concentration

Take five from the following list of courses:

Code	Title	Credits
ENTR 210	Introduction to Entrepreneurship	3
ENTR 320	Financing New Venture	3
ENTR 330	Entrepreneurial Strategy	3
ENTR 440	Lean Startup Accelerator	3
FIN 403	Financial Statement Analysis	3
or FIN 416	Advanced Corporate Finance	
MRKT 338	New Product Design and Development	3
MRKT 339	Selling	3
MGMT 310	Co-op Work Experience I	3

Management Information Systems Concentration

Management Information Systems Specialization

Code	Title	Credits
Select five of the following:		15
CS 113	Introduction to Computer Science	
FIN 310	Data-Driven Financial Modeling	
MRKT 360	Digital Marketing	
or MRKT 378	Marketing Analytics	
IS 390	Requirements Analysis and Systems Design	
MGMT 350	Knowledge Management	
IS 455	IS Mgmt & Business Processes	
MGMT 310	Co-op Work Experience I	
Total Credits		**15**

Marketing Concentration

Marketing Concentration

Code	Title	Credits
Select five of the following:		15
ENTR 210	Introduction to Entrepreneurship	
MRKT 331	Customer Insights	
MRKT 332	Advertis Theory & Techn	
MRKT 338	New Product Design and Development	
MRKT 339	Selling	
MRKT 360	Digital Marketing	
MRKT 378	Marketing Analytics	
MRKT 420	Product & Brand Management	
MRKT 430	Marketing Research	
MRKT 432	Sales Management	
MRKT 434	Business to Business Marketing	
MRKT 435	International Marketing	
MGMT 310	Co-op Work Experience I	
Total Credits		**15**

B.S. in Financial Technology

The FinTech degree program not only includes traditional finance coursework, but also provides an in-depth knowledge and understanding of the theories and evolution of FinTech, data-driven financial modeling, financial data mining and machine learning, financial data analytics, and new innovations in the financial sector. The primary goal of the program is to develop students who have the necessary skills and knowledge to pursue competitive professional and academic careers. Graduates from this program may work for FinTech startups which concentrate in cryptocurrency management and trading, blockchain technologies, open banking, insurtech, Robo-advisement, machine learning and data mining applications and cybersecurity. Some may work for traditional financial services companies, which are in need of staff with technical skill sets to improve existing business practices and/or develop new processes related to technological innovations.

(120 credit minimum)

First Year		
1st Semester		**Credits**
ACCT 115	Fundamentals of Financial Accounting	3
CS 103	Computer Science with Business Problems	3
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 135	Calculus for Business	3
MGMT 190	Introduction to Business	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	**15**
2nd Semester		
MGMT 116	Quantitative Analysis Appl Bus	4
ECON 266	Macroeconomics	3
MGMT 290	Business Law I	3
CS 113	Introduction to Computer Science	3
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	**16**
Second Year		
1st Semester		
MIS 245	Introduction to Management Information Systems	3
ECON 265	Microeconomics	3
MGMT 216	Business Data Analytics	3
History and Humanities GER 200 level (p. 106)		3

Natural Science GER (p. 113)		3
	Term Credits	**15**
2nd Semester		
FIN 315	Fundamentals of Corporate Finance	3
MRKT 330	Principles of Marketing	3
OM 375	Business Operations Management and Analytics	3
CS 114	Introduction to Computer Science II	3
Natural Science GER (p. 113)		4
	Term Credits	**16**
Third Year		
1st Semester		
FIN 218	Financial Markets and Institutions	3
HRM 301	Organizational Behavior	3
FIN 310	Data-Driven Financial Modeling	3
ENTR 320	Financing New Venture	3
MGMT 399	Career Planning and MFT	1
Free Elective		3
	Term Credits	**16**
2nd Semester		
MIS 385	Database Systems for Managers	3
FIN 320	Fin Data Analytics	3
FIN 306	Blockchain Technology for Business (pending approval)	3
CPT 373	Web App Development for Mobile	3
History and Humanities GER 300+ level (p. 108)		3
	Term Credits	**15**
Fourth Year		
1st Semester		
FIN 430	Options and Futures Markets	3
FIN 417	Investments Management (the proposed new course title of FIN417 is "Investments Management")	3
FIN 410	Data Mining & Machine Learning	3
History and Humanities GER 300+ level (p. 108)		3
Free Elective		3
	Term Credits	**15**
2nd Semester		
MGMT 480	Managing Technology and Innovation	3
MGMT 416	Artificial Intelligence for Business Decisions (pending approval)	3
Humanities and Social Science Senior Seminar GER (p. 112)		3
Free Elective		3
	Term Credits	**12**
	Total Credits	**120**

Business Minor

(15 credits) Choose 5 of the courses

Code	Title	Credits
ACCT 117	Principles Of Fin Accountng [3]	3
FIN 218	Financial Markets and Institutions [1]	3
or MGMT 390	Principles of Business	
FIN 315	Fundamentals of Corporate Finance [4]	3
or OM 375	Business Operations Management and Analytics	
MIS 245	Introduction to Management Information Systems [5]	3

MRKT 330	Principles of Marketing [6]	3
MGMT 3XX, MGMT 4XX or HRM 3XX:	Management or HRM Elective [7]	3

1 At least one course must be in Finance
2 CCS students should complete MIS 363 Project Management for Managers or an alternate course.
3 ACCT 615 Management Accounting (MSM/MBA Option)
4 FIN 600* or MIS 680 or MGMT 630
Corporate Finance I or Management Science or Decision Analysis (MSM/MBA Option)
5 MIS 645 Information Systems Principles (MSM/MBA Option)
6 MRKT 620 Global Marketing Management (MSM/MBA Option)
7 MGMT 6XX or HRM 6XX Management or HRM Elective (MSM/MBA Option)
8 The MSM/MBA option is only for students in the BS/MS or BS/MBA programs. NJIT policies on the maximum number of graduate courses an undergraduate student can take will be followed.

Students should consult with their major advisor to find out if minor courses can fulfill requirements within their primary curriculum.

More information on this minor can be found on the School of Management's website (http://management.njit.edu/academics/undergraduate/minorbusiness.php).

Economics Minor

(15 credits)

Five intermediate /advanced economics courses (ECON 201 Economics, ECON 265 Microeconomics and ECON 266 Macroeconomics do not qualify) approved by the minor coordinator.

Innovation and Entrepreneurship Minor

Code	Title	Credits
ENTR 210	Introduction to Entrepreneurship	3
ENTR 320	Financing New Venture	3
ENTR 330	Entrepreneurial Strategy	3
MRKT 330	Principles of Marketing	3
or MRKT 338	New Product Design and Development	
ENTR 440	Lean Startup Accelerator	3
or BME 498	ST:	
or CS 485	Selected Topics In CS	
Total Credits		**15**

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