Main Links

- About the University
- Academic Calendar
- Academic Minors
- Academic Policies and Procedures
- Accreditation
- Admissions
- Campus Directory
- Continuing Professional Education / Online Learning
- Course Code Explanation
- Financial Aid Services
- General University Requirements
- Research Centers and Labs
- Residence Life
- Special Programs
- Tuition and Fees
- Undergraduate Certificates
- Undergraduate Studies

Directory

- Administrative Staff
- Board of Overseers
- Board of Trustees
- Emeritus Faculty
- Faculty
- Professional/ Instructional Staff, University and Special Lecturers
- University Advisory Committees
- University Boards of Visitors
- Visiting / Research Professors and Others

Abbreviations

The following abbreviations are used in this catalog:

GMAT	-	Graduate Management Admission Test
GPA	-	Grade Point Average
GRE	-	Graduate Record Examinations
GUR	-	General University Requirements
LSAT	-	Law School Admission Test
MCAT	-	Medical College Admission Test
TOEFL	-	Test of English as a Foreign Language
Rutgers-New Brunswick	-	Rutgers University, New Brunswick campus
UMDNJ	-	University of Medicine and Dentistry of New Jersey

Degree Programs

- Applied Physics
- Architecture
- BioChemistry
- BioInformatics
- Biology
- Biomedical Engineering
- BioPhysics
- Business
- Business and Information Systems
- Chemical Engineering
- Chemistry
- Civil Engineering
- Communication and Media
- Computational Sciences
- Computer Engineering
- Computer Science
- Computing and Business
- Digital Design
- Electrical Engineering
- Engineering Science
- Engineering Technology
  - Computer Technology
  - Concrete Industry Management
  - Construction Engineering Technology
  - Construction Management Technology
  - Electrical and Computer Engineering Technology
  - Mechanical Engineering Technology
  - Medical Informatics Technology
  - Surveying Engineering Technology
  - Technology Education Option
  - Telecommunications Management Technology
- Environmental Science
- Fine Arts
- History
- Human-Computer Interaction
- Industrial Design

Courses

- Accounting
- Aerospace Studies
- Afro-American and African Studies
- Anthropology
- Architecture
- Art Design
- BioInformatics
- Biology
- Biomedical Engineering
- Career Development Services
- Chemical Engineering
- Chemistry
- Civil Engineering
- Classics
- Communication and Media
- Computer Science
- Co-op
- Criminal Justice
- Digital Design
- Economics
- Education, Science, Technology and Society
- Electrical and Computer Engineering
- Engineering Design
- Engineering Graphics
- Engineering Science
- Engineering Technology
  - Computer Technology
  - Concrete Industry Management
  - Construction Engineering Technology
  - Construction Management Technology
  - Electrical and Computer Engineering Technology
  - Manufacturing Engineering Technology
  - Mechanical Engineering Technology
  - Medical Informatics Technology
  - Surveying Engineering Technology

About the University

New Jersey Institute of Technology
NJIT's history spans the Industrial Revolution to the Information Age. Newark was a factory town when the tuition-free evening school was founded in 1881 to support local industries. The first 90 students - including machinists, draftsmen, carpenters, printers, electricians and clerks - studied algebra, geometry, trigonometry, chemistry, physics and drawing. The range of courses offered is testimony to the fact that, from the beginning, NJIT's programs have provided a broad-based foundation to prepare students for success in the workplace. From those early days, science and technology have been the engines fueling the university's development.

Over time, the university both anticipated and responded to change by expanding its curriculum and mission. Most notably, in 1919 the university established baccalaureate programs in three engineering fields. By 1975, NJIT offered a broad range of undergraduate and graduate degrees including architecture, engineering, computer science, management and other science-oriented programs. All of these programs included significant research and public service components with the goal of providing an academic environment that fostered intellectual depth and breadth, as well as social responsibility.

Today, continuing a fourfold mission of instruction, research, economic development and public service, NJIT is among the leading comprehensive technological universities in the nation. With well over 8,000 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 45-acre campus in Newark, and a solar observatory in Big Bear, California. With robust distance education programs, NJIT's degree and non-degree programs are available throughout the world.

NJIT Mission Statement

NJIT is a **public, urban, research university** committed to the **pursuit of excellence** in:

- Undergraduate, graduate and continuing professional **education**, preparing students for productive careers and amplifying their potential for lifelong personal and professional growth.
- The conduct of **research** in such multidisciplinary areas as environmental engineering, materials science, manufacturing, productivity enhancement, infrastructure systems, communications technologies, and an array of biorelated sciences and technologies.
- Service to both local communities and the broader society of the state and nation by conducting public policy studies, making educational opportunities widely available and initiating community-building projects.
- Contributing to the state's **economic development** through partnerships and joint ventures with the business community and through the development of intellectual property.

NJIT **prepares its graduates** for positions of leadership as professionals and as citizens; **provides educational opportunities** for a broadly diverse student body; responds to needs of large and small businesses, state and local governmental agencies and civic organizations; and **advances the uses of technology** as a means of improving the quality of life.

NJIT offers a **comprehensive array of programs** in engineering and engineering technology, computer science, architecture, applied sciences, mathematics, management, policy studies, and related disciplines throughout New Jersey and the nation.

NJIT's Six Colleges
NJIT's roots are in engineering education. For more than eight decades, **Newark College of Engineering (NCE)** has been preparing engineering students to use science, mathematics, technology and problem-solving skills to design, construct, test and maintain products, services and information systems. NCE alumni lead major corporations, hold senior public positions, own their own businesses and teach at universities.

NJIT's **New Jersey School of Architecture**, established in 1974, is one of the largest architecture schools in the nation -- nationally recognized for integrating computer technology into its design curriculum. The college's design curriculum was so successful that in 2008 it changed its name to the **College of Architecture and Design**, now comprised of the **NJ School of**

Architecture and the **School of Art and Design**.

The **College of Science and Liberal Arts (CSLA)**, established in 1982, is moving into the forefront of many national research activities from solar astronomy to mathematical modeling. CSLA provides students with the skill sets for the professional marketplace, including literacy in the mathematical, physical and biological sciences, as well as traditional liberal arts disciplines.

The **School of Management**, established in 1988, combines the best of traditional business disciplines (e.g., finance, marketing, accounting, e-commerce) with the power of information and technology management to develop professionals who can manage and communicate effectively.

The **Albert Dorman Honors College**, established in 1993, offers one of the nation's leading technologically oriented honors programs for students who are prepared to undertake a rigorous and individualized course of study.

The **College of Computing Sciences**, established in 2001, has one of the largest educational programs in the nation, with approximately 2,000 students in 13 degree programs.

A Public Research University

NJIT is designated as a "Research Intensive" University by the Carnegie Foundation and ranks among the "best national universities" by *US News and World Report*. The university expends more than $75 million in a panoply of research and development partnerships with industry, government and other universities. NJIT researchers are making important advances in a wide range of areas, including the biosciences, manufacturing, microelectronics, multimedia, transportation, computer science, solar astrophysics, environmental engineering and science, and architecture and building science.

As a public research university, NJIT is educating leaders for a technology-driven economy. The university is constantly updating educational programs to emphasize marketplace skills, and redesigning its methods of delivering education. Indeed, computing and information technology underpin every facet of the NJIT mission.

Computing-Intensive Campus

As one of America's most computing-intensive universities, NJIT is nationally recognized as a pioneer in the use of information technologies from developing complex algorithms to reducing simulation times on large-scale parallel computers, to advancing the frontiers of visualization technology in computer-aided design, to patenting optics-based sensors, to developing computer-based infrastructure management systems, to developing advanced computer-mediated communications systems.

NJIT's Information Services and Technology (IST) division provides members of the university community with universal access to a wealth of resources and services available over the NJIT network and the advantages of a highly computing-intensive environment.. EDUCAUSE recently recognized the university for streamlining student processes "with creativity, efficiency, and effectiveness worthy of emulation."

At NJIT, the latest advances in telecommunications and multimedia technologies are used to enhance the delivery of courses and the overall educational experience, allowing students to experience many aspects of a "virtual university" in a traditional campus setting. Computers and information technology play an important role in virtually every task performed on campus, from cutting-edge research to applying for on-campus student employment. Computers assist in teaching and independent study, campus communication, library research, engineering and architectural designs. Students register for classes, check the status of financial aid, run degree audits, ask questions of academic advisors, and pay their bill – all online. Students can access the tools they need to design new buildings, develop complex solutions to engineering problems or compile detailed management analyses – all by logging on to the NJIT network. With connectivity to Internet2, students have the opportunity to work closely with faculty and researchers as new families of advanced applications are developed for an increasingly networked and information-based society.

NJIT's multi-gigabit network connects more than 6,500 nodes in classrooms, laboratories, residence halls, faculty and staff offices, the library, student organization offices and others. The campus wireless network blankets the university's public, classroom and outdoor areas. Both networks provide access to a wealth of shared information services. Included among these are high-performance, multi-processor servers used for simulation and computational research; disk arrays for storage of large data sets; communication servers for computer conferencing and e-learning, and a digital library with access to over 19,000 online journals. A virtual private network combined with Internet access extends access to network services to faculty, staff and students at home, work, any of the university's extension sites or throughout the world.

Students, faculty, staff, and alumni receive a single university computing ID (UCID) that authenticates them as members of the NJIT community and authorizes them to role-based campus services. Highlander Pipeline, the NJIT portal, is the starting point for most online services. Students have access to hundreds of computer workstations in public-access computer labs across the campus, supplemented by special-purpose departmental facilities. A healthy mix of Windows, Mac, Linux, and other Unix operating environments support the diverse needs of a technological research university. Campus-wide software licenses provide

NJIT faculty and students with the latest versions of the most popular Microsoft products, as well as software tools for virus-protection, statistical analysis, mathematical programming, computer-aided design and visualization, and much more. Advanced software libraries support the computational research needs of faculty and students in mathematics, engineering, and the sciences.

The Office of Instructional Technology and Media services provides several facilities used for live and recorded broadcast of e-courses as well as satellite downlinks for a wide variety of video conferences and other educational and public service satellite broadcasts. Several interactive television studio classrooms provide distance learning facilities. Multi-media capability is now being deployed to all areas on campus via network based video technologies.

In addition to these extensive resources, several departments have special facilities for the support of individual academic programs, including the New Jersey School of Architecture's award winning Imaging Laboratory that provides students an opportunity to explore new media and images that alter the way buildings are visualized, interpreted and created.

NJIT is one of the founding members and administrative home to NJEDge.Net, New Jersey's higher education network. NJEDge.Net provides collaborative resources and networked information services to its members and affiliates in support of education; research and development; outreach and public service; as well as economic development throughout the state of New Jersey. With 53 connected institutions including all of New Jersey's research universities, NJEDge.Net leverages economies of scale and supports new and emerging technology-enabled forms of inter-institutional collaboration among members and affiliates.

Library Services

The University Library is composed of two modern library facilities in Newark and extensive online resources which may be accessed on campus or remotely at www.library.njit.edu. The main library, the Van Houten Library, is located in the Central Avenue Building. Erected in 1992, it provides a modern facility for individual and group study, research and browsing. The Barbara and Leonard Littman Architecture Library, redesigned and relocated in 1998, is found on the fourth floor of Weston Hall, part of the Architecture and Building Sciences Complex.

The collections include more than 150,000 volumes of print and electronic books plus maps, slides, models, images, theses and dissertations, product catalogs, CDs, DVDs and an historical archive. The Libraries have over 19,000 subscriptions to journals, databases, and other serials, almost all available online remotely. These focus on NJIT's curriculum and research areas of architecture, engineering science, computer science and technology, management, and liberal arts.

Library staff acquire and organize books and other materials in print and electronic format and make them accessible to the NJIT community. Though the library and online collections form the backbone of research support at the university, NJIT librarians consider the world their resource and help faculty and students obtain materials from other libraries or online sources whenever necessary through the Library's Inter-Library Loan and Document Delivery services.

Through collaborative agreements, NJIT students and faculty have access and borrowing privileges, with some limitations, at several other nearby academic libraries. These include Rutgers-Newark's Dana Library, UMDNJ's Smith Library, and Newark Public Library. Students may also borrow from the libraries of Jersey City University, Kean University, Ramapo College, Rowan University, Stockton State College, William Paterson University, College of New Jersey, and Montclair State University. Arrangements can be made for special privileges at other institutions in the New York area, when appropriate, through an NJIT Reference Librarian.

The libraries are truly academic centers. They are popular places to study, with comfortable chairs, tables, study carrels, rooms for group study, quiet work areas, and a computer lab called the Information Commons.

The Information Commons at the Van Houten Library consists of 120 computer workstations designed to satisfy student computing and online research needs. Both libraries are wireless to facilitate the collaboration so characteristic of the NJIT community. The Van Houten Library's Information Commons provides a convenient and relaxed atmosphere to check e-mail, search the Web, view digital archives of lectures, or retrieve scholarly publications from the university's digital library collections. Reference librarians are available on-line and in-person to help students and researchers sort through the vast amounts of information resources available and access what they need.

A team of highly trained information and research assistants, reference and instructional librarians bridge the gaps between research resources and users. They provide ad hoc assistance in person via the Research Helpdesk at the Van Houten Library and the service desk at the Littman Architecture Library, or by phone (973-596-3210 for Van Houten and 973-596-3083 for Littman), email, and instant messaging. The online library is available 24/7 as is the chat help line at www.QandANJ.org, a New Jersey librarians' collaborative providing research assistance round the clock.

Reference Librarians are subject specialists and work closely with departmental faculty in all of NJIT's curriculum and research areas to ensure that the right information resources are accessible to the right people at the right time. They teach research techniques and resources in the classroom in conjunction with course content and in small groups. They are also available for individual in-depth consultation sessions. Contact information for departmental liaisons can be found on the library website.

More information about the library can be found at www.library.njit.edu or by calling (973) 596-3210.

Consortium with Rutgers-Newark and UMDNJ

NJIT, Rutgers-Newark and UMDNJ, 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.

The three institutions are partners in University Heights Science Park, designed as a mixed-use, multi-sponsor science and technology park. University Heights Science Park is a partnership among academia, the community, private industry, and local, state and federal governments, which provide opportunities to transfer university-based research and technology to public uses. The 50-acre University Heights Science Park is adjacent to the NJIT campus. Each year, thousands of students from NJIT, Rutgers-Newark and UMDNJ take courses at the institutions. NJIT and Rutgers-Newark cosponsor common seasons of theatrical productions, as well as "World Week," and a variety of other cultural and social activities.

NJIT Campus

Located in the University Heights section of Newark, NJIT's 45-acre campus is adjacent to the campuses of Rutgers-Newark and Essex County College and a short distance from UMDNJ. The campus is reached easily via interstate highways and public transportation. New Jersey Transit's City Subway stops on campus, the Pennsylvania Railroad Station is 5 minutes from campus and Newark International Airport is within 5 miles of NJIT.

The expansion and improvement of NJIT's campus facilities have been vigorous, proceeding pursuant to a carefully drawn long-range plan, providing an environment conducive to accomplishment of the university's mission. A new student center is under construction.

NJIT's campus is home to some 20 R&D centers supported with industry, state, federal, foundation and university funding. NJIT's three-story Otto H. York Center for Environmental Engineering and Science houses a number of state and federally funded research centers.

The 187,000-square-foot William S. Guttenberg Information Technologies Center houses the Center for Manufacturing Systems and the Multi-lifecycle Engineering Research Center. The building is the site of the College of Computing Sciences and industrial and manufacturing engineering instruction and research facilities.

The Campus Center houses the food court, dining room and a more informal eating facility, The Highlander Cafe. In addition, there is a campus theater in which student productions are staged, an athletic field, tennis courts, and indoor recreational facilities, including a swimming pool, racquetball courts, weight rooms, track, aerobics room and more. The residence halls provide dormitory and apartment-style coed living accommodations for more than 1,400 students.

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Academic Calendars

Home » Registrar » Academic Calendars

2012-2013 Academic Year

2012 Summer Semester

2012 Fall Semester

2013 Winter Session

2013 Spring Semester

2013-2014 Academic Year

2013 Summer Semester

2013 Fall Semester

2014 Winter Session

2014 Spring Semester

Rutgers-Newark Academic Calendar

Registrar @ Your Service

Online:Highlander Pipeline

24-Hour Email

Student Mall Staff

Spring/Fall Office Hours:
M-Th-F, 8:30 a.m.-4:30 p.m.
T-W, 8:30 a.m.-6:00 p.m.

Summer Hours
M-Th, 8:30 a.m.-5:00 p.m

NJIT Privacy Policy
Campus Directory
Customer Service Credo
Visiting NJIT: Maps and Directions

MORE »

Academic Minors at NJIT

Consult with the appropriate minor coordinator for further information about specific minors.

General rules on administration of minors

APPLIED MATHEMATICS (16 - 18 credits)

Math 222, Math 244 or Math 333, Math 337 and two additional courses approved by the minor coordinator.

Faculty Coordinators:

Yassine Boubendir
Cullimore Hall, Room 609
Phone: (973) 596-3499
E-mail: yassine.boubendir@njit.edu

Wenge Guo
Cullimore Hall, Room 210B
Phone: (973) 596-3498
E-mail: wenge.guo@njit.edu

Yuan-Nan Young
Cullimore Hall, Room 519
Phone: (973) 642-7034
E-mail: yyoung@njit.edu

More information on this minor can be found on the Mathematical Sciences website.

APPLIED STATISTICS (16 - 17 credits)

Math 222 or Math 226, and Math 333, Math 337, Math 344, and one additional statistics course approved by the minor coordinator.

Faculty Coordinators:

Yassine Boubendir
Cullimore Hall, Room 609
Phone: (973) 596-3499
E-mail: yassine.boubendir@njit.edu

Wenge Guo
Cullimore Hall, Room 210B
Phone: (973) 596-3498
E-mail: wenge.guo@njit.edu

Yuan-Nan Young
Cullimore Hall, Room 519
Phone: (973) 642-7034
E-mail: yyoung@njit.edu

More information on this minor can be found on the Mathematical Sciences website.

BIOLOGICAL SCIENCES (22 credits)

Required Core Courses (12 credits)

R120:101 - General Biology I, 4cr

R120:102 - General Biology II, 4cr
R120:201 - Foundations of Cell and Molecular Biology Lecture, 3cr
R120:202 - Foundations of Cell and Molecular Biology Laboratory, 1cr

Additional Courses (10 credits)

One course from each of the categories below:

A. **Ecology and Evolution - 3 credits**
    - BIOL 222 - Evolution
    - 120:280 - Ecology
    - 120:282 - Animal Behavior
    - 120:370 - Plant Ecology
B. **The Functional Organism - 4 credits**
    - 120:230 - Biology of Seed Plants
    - 120:330 - Plant Physiology
    - 120:335 - Microbiology
    - 120:340 - Mammalian Physiology
    - 120:342/343 - Developmental Biology/Lab
C. **Molecular and Cellular Mechanisms - 3 credits**

- 120:356 - Molecular Biology

    - 120:352 - Genetics
    - 120:355 - Cell Biology
    - 120:360 - or CHEM 475 - Biochemistry

Faculty Coordinator: Jorge Golowasch
Cullimore Hall, Room 627
Phone: (973) 596-5404
E-mail: jorge.p.golowasch@njit.edu

BIOMEDICAL ENGINEERING FOR ENGINEERING SCIENCE STUDENTS ONLY (18 credits)

Students must be honors students in the 7-year accelerated ESC premed or dental program. Requires a minimum of 18 credits of Biomedical Engineering courses:

BME 105 - Introduction to Human Physiology I (2-0-2)
BME 106 - Introduction to Human Physiology II (1-0-1)
BME 301 - Electrical Fundamentals of Biomedical Engineering (1-3-3)
BME 302 - Mechanical Fundamentals of Biomedical Engineering (1-3-3)

Two of the following courses:

BME 310 - Biomedical Computing (3-1-3)
BME 381 - Engineering Models in Physiology I (3-2-3)
BME 382 - Engineering Models in Physiology I (3-2-3)
BME 383 - Measurement Lab for Physiological Systems & Tissue (1-3-3)

BME 3xx or BME 4xx (upper-division BME course)

Faculty Coordinator: Alev Erdi
Fenster Hall, Room 608
Phone: (973) 596-3556
E-mail: alev.k.erdi@njit.edu

BUSINESS (15 - 18 credits)

Acct 117, Mgmt 190 or Fin 218 ***,** Fin 315 ***** or OM 375, MIS 245 ******, Mrkt 330 and either a 300 or 400 level business/management elective

Faculty Coordinator: Mike Sweeney
Central Avenue Building, 3007
Phone: (973) 596-8238
E-mail: michael.t.sweeney@njit.edu

***** At least one course must be in Finance
****** CCS students should complete MIS 363 Project Management or an alternate course.
******* 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.

CHEMISTRY (16 -17 credits)

For majors *other than* Chemical Engineering

Requirements A and B must be satisfied:

A. **Complete set of A1 or A2**
    - A1. Chem 231, Chem 235, Chem 243, and Chem 235A
    - A2. Chem 243, Chem 244, Chem 244A, Chem 337
B. **Choose two courses among the following:**
    - Chem 473, Chem 222, Chem 480, Chem 336, Chem 412, Chem 440, Chem 491

Faculty Coordinator: Dr. Roumiana Petrova
Tiernan Hall, Room 366
Phone: (973) 642-4076
E-mail: roumiana.s.petrova@njit.edu

CHEMISTRY (10 -12 credits)

For Chemical Engineering majors

Choose four courses from the following:

R160:207, Chem 222, Chem 336, Chem 360, Chem 361, Chem 412, Chem 440, Chem 443, Chem 473, Chem 480, Chem 484, Chem 491

Faculty Coordinator: Dr. Roumiana Petrova
Tiernan Hall, Room 366
Phone: (973) 642-4076
E-mail: roumiana.s.petrova@njit.edu

COMMUNICATION (15 credits)

Five courses in Language and Communication approved by the minor coordinator.

Faculty Coordinator: Chris Funkhouser
Cullimore Hall, Room 425
Phone: (973) 596-6335
E-mail: christopher.t.funkhouser@njit.edu

More information on this minor can be found on the Humanities website.

COMPUTATIONAL MATHEMATICS (16 hours)

Math 222, Math 337, Math 340 and two approved electives such as:

Math 321 - Introduction to the Finite Element Methods (3-0-3)
Math 391 - Numerical Linear Algebra (3-0-3)
Math 440 - Advanced Applied Numerical Methods (3-0-3)
Math 448 - Stochastic Simultation (3-0-3)

Faculty Coordinators:

Yassine Boubendir
Cullimore Hall, Room 609
Phone: (973) 596-3499
E-mail: yassine.boubendir@njit.edu

Wenge Guo
Cullimore Hall, Room 210B
Phone: (973) 596-3498
E-mail: wenge.guo@njit.edu

Yuan-Nan Young
Cullimore Hall, Room 519
Phone: (973) 642-7034
E-mail: yyoung@njit.edu

More information on this minor can be found on the Mathematical Sciences website.

COMPUTER ENGINEERING (13 credits)

Open to Electrical Engineering majors only.

CS 116, CS 332, ECE 353, ECE 394, ECE 495

Faculty Coordinator: Marek Sosnowski
ECE Center, Room 200
Phone: (973)596-3541
E-mail: marek.sosnowski@njit.edu

COMPUTER ENGINEERING (16 credits)

Open to computer science majors only.

ECE 231 or ECE 271, ECE 291, ECE 252, ECE 353, ECE 394, ECE 395, ECE 495

Faculty Coordinator: Marek Sosnowski
ECE Center, Room 200
Phone: (973)596-3541
E-mail: marek.sosnowski@njit.edu

COMPUTER ENGINEERING (17 credits)

Open to all other majors except Electrical Engineering and Computer Science.

ECE 231, ECE 251, CS 251, ECE 252, ECE 291, ECE 353, ECE 394, ECE 495

Faculty Coordinator: Marek Sosnowski
ECE Center, Room 200
Phone: (973)596-3541
E-mail: marek.sosnowski@njit.edu

COMPUTER SCIENCE (18 credits)

Open to all other majors except computer engineering.

CS 114, CS 252, CS 332, CS 431 and two additional courses approved by the minor coordinator.

Faculty Coordinator: George Olsen
Guttenberg Information Technologies Center, Room 4414
Phone: (973) 596-3389
E-mail: george.olsen@njit.edu

COMPUTER SCIENCE (15 credits)

Open to computer engineering majors only.
CS 280, CS 431, CS 357 OR CS 458 and 2 additional courses approved by the minor coordinator.

Faculty Coordinator: George Olsen
Guttenberg Information Technologies Center, Room 4414
Phone: (973) 596-3389
E-mail: george.olsen@njit.edu

ECONOMICS (15 credits)

Five intermediate /advanced economics courses (SS 201, Econ 265 and Econ 266 do not qualify) approved by the minor coordinator.

Faculty Coordinator: Zeyuan Qiu
Cullimore Hall, Room 317
Phone: (973)596-5357
E-mail: quiz@njit.edu

ELECTRONIC CREATIVE WRITING (15 credits)

Choose five courses from the following:

- COM 303 Video Narrative
- COM 325 Special Topics in Communication (with permission of program director)
- COM 350 Digital Video Production
- COM 351 Documentary Studies
- COM 352 Photojournalism
- COM 369 Digital Poetry
- COM 390 Electronic Writing Workshop
- ENG 333 Cybertext
- ENG 336 Advanced Composition
- ENG 351 Online Journalism
- ENG 354 Composing Documents for the Web
- HUM 401 Independent Study
- STS 347 Music and Technology
- STS 349 Advanced Music Technology

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.

Faculty Coordinator: Chris Funkhouser
Cullimore Hall, Room 425
Phone: (973) 596-6335
E-mail: christopher.p.funkhouser@njit.edu

ELECTRICAL ENGINEERING (15 credits)

Open to Computer Engineering majors only.

ECE 333, ECE 341, ECE 361, ECE 372, ECE 374

Faculty Coordinator: Marek Sosnowski
ECE Center, Room 200
Phone: (973)596-3541
E-mail: marek.sosnowski@njit.edu

ELECTRICAL ENGINEERING (16 credits)

Open to all other majors except Electrical Engineering and Computer Engineering majors.

ECE 231, ECE 232, ECE 271, ECE 291

and choose TWO of the following courses:

ECE333, ECE 341, ECE 361, ECE 372, ECE 374

Faculty Coordinator: Marek Sosnowski
ECE Center, Room 200
Phone: (973)596-3541
E-mail: marek.sosnowski@njit.edu

ENVIRONMENTAL ENGINEERING (15 credits)

15 credits chosen from the following courses:

CE 320, CE 321, CE 322, EnE 262, EnE 360, EnE 361 or other courses approved by the minor coordinator.

Faculty Coordinator:
Taha Marhaba
Colton Hall, Room 233
Phone: (973) 642-4599
E-mail: taha.f.marhaba@njit.edu

ENVIRONMENTAL SCIENCE AND POLICY (15 credits)

Students are required to take **fifteen (15) course credits** from Environmental Science and Policy and related courses listed below.

Three core courses required:

EvSc 360 or EvSc 361 - Environmental Chemistry I or II * (3 credits)
EvSc 375 - Environmental Biology (3 credits)
EPS 202 - Society, Technology and Environment (3 credits)

Six credits from the following courses:

EvSc 484 - Environmental Analysis (2 credits)
Math 225 - Probability and Statistics (1 credit)
EvSc 416 - Environmental Toxicology (3 credits)
R460:206 - Environmental Geology (3 credits)
R460:207 - Environmental Geology lab (1 credit)
EvSc 385 - Environmental Microbiology (3 credits)
EvSc 360 or EvSc 361 - Environmental Chemistry I or II (3 credits)
R120:380 - Ecology (3 credits)
SS 362 - Environmental Economics (3 credits)

1. The first Environmental Chemistry Course counts against the core

2. The second can be used as an option course
3. Chem 360 is a prerequisite to Chem 361

Faculty Coordinator: Dr. Roumiana Petrova
Tiernan Hall, Room 366
Phone: (973) 642-4076
E-mail: petrova@njit.edu

More information on this minor can be found on the Chemistry & Environmental Science website.

ENVIRONMENTAL STUDIES AND SUSTAINABILITY (15 credits)

Five courses in environmental studies and sustainability approved by the minor coordinator

Faculty Coordinator:
Green Academic Council designee: Maurie Cohen
Cullimore Hall, Room 427
Phone: (973) 596-5281
E-mail: maurie.cohen@njit.edu

More information on this minor can be found on the College of Science and Liberal Arts website.

GEOSYSTEMS (15-18 credits)

Students are required to take **fifteen to eighteen (15-18) course credits** from Chemistry and Environmental Science, Civil and Environmental Engineering and related courses listed below.

Three core courses required:

- CE 342 – Geology (3 credits)
- R460:311 – Geology Field problems (3 credits)
- R460:206/207 – Environmental Geology and lab (4 credits total) or
- EVSC/CE 381 – Geomorphology (3 credits)

Six to eight credits from the following courses. Note that courses required for the BS degree in CE, CHEM, EVSC, or ET are not acceptable as elective courses for the Geosystems minor.

- R460:314 – Sedimentology and Stratigraphy (4 credits)
- R460:320 – Structural Geology (4 credits)
- R460:323 – Rocks and Minerals (4 credits)
- R460:331 – Oceanography (3 credits)
- R460:206/207 – Environmental Geology and lab (4 credits total)
- R460:401 – Introduction to Geochemistry (3 credits)
- R460:406 – Applied Geophysics (3 credits)
- R460:427 – Hydrogeology (3 credits)
- CE 321 – Water Resources Engineering (3 credits)
- CE 341 and 341A – Soil Mechanics and lab (4 credits total)
- CE 381 – Geomorphology (same as EVSC 381) (3 credits)
- CE 506 – Remote Sensing of Environment (3 credits)
- CE 545 – Rock Mechanics I (3 credits)
- CE 602 – Geographic Information Systems (3 credits, depending on space available)
- CE 644 – Geology in Engineering (3 credits)
- SET 420 – Land Information Systems (3 credits)
- EPS/STS 380 – Policy Issues in the Coastal Environment (3 credits)
- EPS/STS 382 – Geographical Perspectives on the Environment (3 credits)
- EVSC 381 – Geomorphology (same as CE 381) (3 credits)

Faculty Coordinators:

Priscilla Nelson

Colton Hall, Room 251
Phone: (973) 596-5864
E-mail: priscilla.nelson@njit.edu

Nancy Jackson
York Building, Room 126
Phone: (973) 596-8467
E-mail: nancy.jackson@njit.edu

GLOBAL STUDIES (15 credits)

Five courses with global content including four upper division courses approved by the minor coordinator.

Faculty Coordinator: Nancy Steffen-Fluhr
Cullimore Hall, Room 415
Phone: (973) 596-3295
E-mail: nancy.l.steffen@njit.edu

HISTORY (15 credits)

Five upper division courses, at least four in history, approved by the minor coordinator.

Faculty Coordinator: Richard B. Sher
Cullimore Hall, Room 329
Phone: (973) 596-3377
E-mail: sher@njit.edu

HUMAN-COMPUTER INTERACTION (15 credits)

Prerequisite: Computing GUR
Students must take Rutgers R830:101 (Principles of Psychology) or STS 210 (General Psychology) as their Social Science GUR; Current BA IS, BS BIS and BS WIS majors should substitute two BS HCI specialization courses listed in the catalog for IS 247 and IS 375;
Students outside CCS may substitute one course for a IS, CS or IT course approved by the IS Undergraduate Advisor

- IS 247 Designing the User Experience
- IS 375 Evaluating the User Experience
- IS 448 Design Studio for Ubiquitous Computing
- Rutgers R830:304 Cognitive Processes
- Rutgers R830:372 Perception

INDUSTRIAL ENGINEERING (15 credits)

IE 339, IE 355, IE 439, IE 461 and IE 466

Faculty Coordinator: Athanassios Bladikas
MEC, Room 212
Phone: (973) 596-3653
E-mail: bladikas@njit.edu

INFORMATION SYSTEMS FOR CCS MAJORS (15 credits)

Required Courses (15 credits or 5 courses):

- IS 265 Introduction to Information Systems
- IS 344 Computing Applications in Business
- IS 390 Requirements Analysis and Systems Design

- IS 455 IT Policy and Strategy
- IS 465 Advanced Information Systems

Faculty Coordinator: George Olsen
Guttenberg Information Technologies Center, Room 4414
Phone: (973) 596-3389
E-mail: george.olsen@njit.edu

Faculty Coordinator: Megan Summers
Guttenberg Information Technologies Center, Room 4400
Phone: (973) 596-3385
E-mail: megan.t.summers@njit.edu

More information on this minor can be found on the Information Systems website.

INFORMATION SYSTEMS FOR NON-CCS MAJORS (15 credits)

Required Courses (15 credits or 5 courses); Prerequisite: Computing GUR

- IS 265 Introduction to Information Systems
- IS 331 Database Design, Management, and Applications
- IS 390 Requirements Analysis and Systems Design
- IS 455 IT Policy and Strategy
- 1 additional IS, CS or IT course approved by the IS Undergraduate Advisor

Faculty Coordinator: George Olsen
Guttenberg Information Technologies Center, Room 4414
Phone: (973) 596-3389
E-mail: george.olsen@njit.edu

Faculty Coordinator: Megan Summers
Guttenberg Information Technologies Center, Room 4400
Phone: (973) 596-3385
E-mail: megan.t.summers@njit.edu

More information on this minor can be found on the Information Systems website.

INFORMATION TECHNOLOGY FOR COMPUTER SCIENCE MAJORS ONLY (15 credits)

IT 120, IT 202, IT 420, IT 490 and one additional upper division IT course approved by the minor coordinator.

Faculty Coordinator: George Olsen
Guttenberg Information Technologies Center, Room 4414
Phone: (973) 596-3389
E-mail: george.olsen@njit.edu

Faculty Coordinator: Megan Summers Van Hook
Guttenberg Information Technologies Center, Room 4400
Phone: (973) 596-3385
E-mail: megan.t.summers@njit.edu

INFORMATION TECHNOLOGY FOR NON-CS MAJORS (15 credits)

IT 114*****, IT 102*****, IT 120, IT 201, IT 310 and one additional upper division course approved by the minor coordinator.

**** Students must have completed CS 113***

Faculty Coordinator: George Olsen
Guttenberg Information Technologies Center, Room 4414
Phone: (973) 596-3389
E-mail: george.olsen@njit.edu

Faculty Coordinator: Megan Summers Van Hook
Guttenberg Information Technologies Center, Room 4400
Phone: (973) 596-3385
E-mail: megan.t.summers@njit.edu

INNOVATION AND ENTREPRENEURSHIP (18 credits)

Open to students **not enrolled in the IDS Program** in the Honors College

ACCT 115 or ACCT 117, ECON 201, MKT 330 or MKT 338, MGMT 390, ENTR 410 and ENTR 420

Faculty Coordinator: Mike Sweeney
Central Avenue Building, 3007
Phone: (973) 596-8238
E-mail: michael.t.sweeney@njit.edu

INNOVATION AND ENTREPRENEURSHIP (18 credits)

Open to Honors College students **in the IDS Program only.** Students must register for honors-designated course sections.

ACCT 115 or ACCT 117, STS 258 or ECON 201, MGMT 390, ENTR 420, ENTR 440 and Independent Study/Research *

*** Suggested option is Senior Capstone Design Course in student's major.**

Note: A student who leaves the IDS Program before completing these minor requirements may follow the minor requirements for non-IDS students.

Faculty Coordinator: Mike Sweeney
Central Avenue Building, 3007
Phone: (973) 596-8238
E-mail: michael.t.sweeney@njit.edu

JOURNALISM (15 credits)

- ENG 339: Practical Journalism
- ENG 350: The Newsroom
- ENG 349: Creative Writing or
- ENG 348: Literary Journalism or
- ENG 346: The Fourth Estate or,
- With departmental approval, any 300-level NJIT Humanities class or any 300-level literature class at Rutgers-Newark

Any two of the following:

- COM 352: Photojournalism
- COM 303: Video Narrative
- ENG 353: Composing Documents for Print
- ENG 351: Online Journalism
- ENG 302: Communication Theory
- STS 316: Mass Communications, Technology and Culture
  Note: Equivalent Rutgers-Newark courses may be taken with departmental approval.

Faculty Coordinator: Miriam Ascarelli
Cullimore Hall, Room 410
Phone: (973) 596-3374
E-mail: miriam.f.ascarelli@njit.edu

LEADERSHIP AND AEROSPACE STUDIES

Open only to AFROTC students

AS 100, AS 200, AS 300, AS 400, plus Leadership Lab and one elective course chosen with the approval of the minor coordinator.

Faculty Coordinator: Lt. Col. Marcus Myers
Faculty Memorial Hall, Room 208
Phone: (973) 596-3626
E-mail: mmyers@njit.edu

LEGAL STUDIES (15 credits)

Five law-related upper division courses approved by the minor coordinator.

Faculty Coordinator: Alison Lefkovitz
Cullimore Hall, Room 327
Phone: (973) 596-3292
E-mail: alefkovi@njit.edu

LITERATURE (15 credits)

Five upper division literature courses approved by the minor coordinator.

Faculty Coordinator: Jonathan Curley
Cullimore Hall, Room 409
Phone: (973) 596-3258
E-mail: jcurley@adm.njit.edu

MATERIALS ENGINEERING (15 credits)

ME 215, ME 438, ME 470, ME 471*, ME 490 *
(* *Non-ME majors can choose courses in their discipline with the approval of the minor coordinator.*)

Faculty Coordinator: Dr. A. Narh
Mechanical Engineering Center, Room 330
Phone: (973) 596-3353
E-mail: narh@njit.edu

MATHEMATICAL BIOLOGY (16 hours)

Math 222, Math 337, Math 373 and two approved electives such as:

Math 371 - Physiology and Medicine (3-0-3)
Math 372 - Population Biology (3-0-3)
Math 430 - Analytical and Computational Neuroscience (3-1-3)
Math 431 - Systems Computational Neuroscience (3-1-3)

Faculty Coordinators:

Yassine Boubendir
Cullimore Hall, Room 609
Phone: (973) 596-3499
E-mail: yassine.boubendir@njit.edu

Wenge Guo
Cullimore Hall, Room 210B
Phone: (973) 596-3498
E-mail: wenge.guo@njit.edu

Yuan-Nan Young
Cullimore Hall, Room 519
Phone: (973) 642-7034
E-mail: yyoung@njit.edu

More information on this minor can be found on the Mathematical Sciences website.

MATHEMATICS OF FINANCE AND ACTUARIAL SCIENCE (16 hours)

Math 222, Math 340, Math 346, and two approved electives such as:

Math 334 - Operations Research (3-0-3)
Math 347 - Mathematics of Finance II (3-0-3)
Math 432 - Mathematics of Financial Derivatives I (3-0-3)

Math 433 - Mathematics of Financial Derivatives II (3-0-3)
Math 441 - Actuarial Mathematics I (3-0-3)
Math 448 - Stochastic Simulation (3-0-3)
Math 477 - Stochastic Processes (3-0-3)

Faculty Coordinators:

Yassine Boubendir
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E-mail: yassine.boubendir@njit.edu

Yuan-Nan Young
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Wenge Guo
Cullimore Hall, Room 210B
Phone: (973) 596-3498
E-mail: wenge.guo@njit.edu

More information on this minor can be found on the Mathematical Sciences website.

NANOTECHNOLOGY (18 credits)

Requires approval by Nanotechnology minor coordinator and academic advisor in student's major.

BME 488 - Introduction to Nanotechnology

Select 5 from the 3-credit courses below; choose up to one Independent Research course (research topic must be nanotechnology related)

BME 420 - Biomaterials and biocompatibility
BME 430 - Fundamentals of Tissue Engineering
BME 479 - BioMEMS
BME 491 - Research and Independent Study I
BME 492 - Research and Independent Study II
ChE 375 - Structure, properties, and processing of materials
ChE 380 - Introduction to Biotechnology
ChE 491 - Research and Independent Study I
ChE 492 - Research and Independent Study II
ChE 619 - Nano-scale Characterization of Materials
CHEM 340 - Chemistry and Engineering of Materials
CHEM 437 - Applications of Computational Chemistry and Molecular Modeling
CHEM 473 - Biochemistry
CHEM 491 - Research and Independent Study I
CHEM 492 - Research and Independent Study II
ECE 374- Electronic Devices
ECE 659 - Fabrication Principles of Electronic and Optoelectronic Devices
ECE 463 - Optoelectronics
EvSc 335 - Environmental Law
EvSc 416 - Environmental Technology
EvSc 391 - Research and Independent Study
EvSc 492 - Research and Independent Study II
MATH 448 - Stochastic Simulation
MATH 491 - Independent Study in Mathematics
ME 438 - Introduction to Physical Metallurgy
MtSE 301 - Principles of Material Science and Engineering
OPSE 301 - Introduction to Optical Science and Engineering
OPSE 402 - High Power and Photonics Applications
OPSE 410 - Biophotonics
PhEn 501 - Pharmaceutical Engineering Fundamentals II
PhEn 502 - Pharmaceutical Engineering Fundamentals III
Phys 350 - Biophysics I

Phys 418 - Fundamentals of Optical Imaging
Phys 490 - Independent Study

Faculty Coordinator: Raquel Perez-Castillejos
Fenster Hall, Room 613
Phone: (973) 596-2982
E-mail: raquelpc@njit.edu

PHILOSOPHY / APPLIED ETHICS (15- 18 credits)

Five or six upper division courses in Philosophy and STS chosen with approval of minor coordinator.

Faculty Coordinator: Eric Hetherington
Cullimore Hall, Room 429
Phone: (973) 596-5318
E-mail: erich@njit.edu

SCIENCE, TECHNOLOGY & SOCIETY (15 credits)

Five upper division STS courses or substitutes approved by the minor coordinator.

Faculty Coordinator: Maurie Cohen
Cullimore Hall, Room 427
Phone: (973) 596-5281
E-mail: maurie.cohen@njit.edu

More information on this minor can be found on the Honors College website.

TECHNOLOGY, GENDER AND DIVERSITY (15 credits)

Five upper division courses in relevant fields chosen with approval of minor coordinator.

Faculty Coordinator: Nancy Steffen-Fluhr
Cullimore Hall, Room 415
Phone: (973) 596-3295
E-mail: nancy.l.steffen@njit.edu

THEATER ARTS and TECHNOLOGY (15 credits)

Five upper division courses in drama approved by the minor coordinator.

Faculty Coordinator: Michele Rittenhouse
Kupfrian Hall, Room 133
Phone: (973)596-3457
E-mail: michele.r.rittenhouse@njit.edu

WEB AND INFORMATION SYSTEMS (15 credits)

Required Courses (15 credits or 5 courses); Prerequisite: Computing GUR required for all courses except IS 117

Current BA IS, BS BIS and BS HCI majors should substitute one of the latter courses for IS 390

- IS 117 Introduction to Website Development
- IS 390 Requirements Analysis and Systems Design

Any 3 of the following courses:

- IS 217 Advanced Website Development
- IS 218 Building Web Applications

- IS 322 Mobile Applications: Design, Interface, Implementation
- IS 333 Social Networking: Apps and Interface Design
- IS 373 Web Standards
- IS 392 Web Mining and Information Retrieval
- IS 421 Advanced Web Applications

Faculty Coordinators:

George Olsen
Guttenberg Information Technologies Center, Room 4414
Phone: (973) 596-3389
E-mail: george.olsen@njit.edu

Megan Summers
Guttenberg Information Technologies Center, Room 4411
Phone: (973) 596-3385
E-mail: summersm@njit.edu

More information on this minor can be found on the Information Systems website.

Academic Policies and Procedures

Academic Advising

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 Campus Pipeline. 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. The office is open when classes are in session, Monday through Thursday, from 8:30 a.m. to 6 p.m. and Friday, 8:30 a.m. to 4:30 p.m.

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.

Academic departments will need to keep accurate records on their students. This will ensure that academic advisors know which curriculum their advisees are following as they proceed toward graduation.

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. Students who fail to comply with these instructions are charged a late fee. Instructions for the summer session are provided with the fall registration materials.

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 Registration in Graduate Courses
Undergraduate students who wish to take 500- or 600-level courses must obtain the written approval of the graduate advisor for the program that offers the course, their undergraduate advisor and submit an "Approval for Undergraduates Taking Graduate

Courses" form. If undergraduates wish to take 600-level courses, they must also obtain written approval from the chairperson of the department offering the course. Undergraduates are not permitted to take 700-level courses.

The undergraduate and academic advisor will review the student's academic record prior to approval. Approval can be granted only to students who have completed the appropriate prerequisites for the course and are in satisfactory academic standing. The approval will be noted on an "Approval for Undergraduates Taking Graduate Courses" form that requires appropriate signatures and reports the student's cumulative undergraduate GPA. Students shall have a cumulative undergraduate GPA of 2.5 to be approved for registration in 500-level courses (500G for Architecture) and 2.8 for registration in 600-level courses.

Students whose undergraduate GPA is below the 2.5 or 2.8 minima, are considering courses out of the student's current major, are lacking appropriate prerequisites, have completed any prior graduate courses with a grade below a B, or have already completed 9 or more credits at the 500 level and above (15 credits for those in the B.S./M.S. program), or have an excessive number of credits for the undergraduate degree will also require review by the associate provost of graduate studies and the program advisors.

Undergraduate students who enroll in graduate courses for undergraduate credit pay tuition at the undergraduate rate. Grades will follow the graduate grading system.

Undergraduate students should be aware that need-based financial aid may not be sustainable for registration in graduate courses.

Graduate Registration in Undergraduate Courses
Graduate students may be asked to register in undergraduate courses as conditions of admission, as bridge courses or by direction of the graduate advisor for their current program. Enrollment in other undergraduate courses requires the approval of the associate provost of graduate studies or the graduate advisor, and the undergraduate department offering the course. Tuition for these courses is assessed at the graduate rate.

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*** and a schedule change fee will be assessed during late registration as determined by the Registrar.

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 penalty by the end of the ninth 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.

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.

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 or who have been granted a leave of absence will comply with this requirement by registering for "maintaining registration". Students 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.

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.

Responsibility for Registration
NJIT emails notices in advance to NJIT student email accounts, but cannot guarantee delivery. Regardless, 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
The university does not guarantee offering all or any of the courses listed in this catalog. When there is inadequate registration for a course, it may be cancelled without notice. The registrar 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***.

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 will be taken before ME 455 or SS 431).

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 and EE 210) shall be taken in alphabetical order of the prefix of the course number (e.g. CE 210 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 other than those included in the cross-registration program must:

1. Obtain an Approval for Courses at other Colleges Form 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. First semester, full-time transfer students who wish to take FALL OR SPRING SEMESTER courses at a college or university other than those included in the cross-registration program must also obtain approval from the Dean of Freshman Studies.

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 or cumulative GPA, nor do they affect the NJIT Undergraduate Repeat Policy. Repeated courses must be taken at NJIT in order for the NJIT Undergraduate Repeat Policy to apply.

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 111,112,113 and114) 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 and 121) 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 GUR-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.

Approval Form For Undergraduate Courses At Another School

***** Exclusive of cross-registration at Rutgers-Newark College of Arts and Sciences, Essex County College, UMDNJ.

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 University of Medicine and Dentistry of New Jersey. Eligible students who wish to do so should follow current procedures as described on the Registrar's website.

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" 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
Transfer credit may be awarded at the time of admission for courses that are equivalent to those offered by NJIT. 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. Further information regarding evaluations may be obtained from the Registrar's office.

Students may request additional transfer credit by completing a request for transfer credit form and submitting it to the Registrar's office along with the appropriate documentation. Transfer credit is not factored in the calculation of the NJIT semester or cumulative GPA.

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 (Eng 095 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 Eng 095, if required).

The ESL Program offers ESL sections of a number of courses in the humanities and social sciences 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, HUM 212, Hist 213, Eng 352, Lit 320, and Lit 350.

Freshman Placement
Upon deposit, 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.

Academic Standing

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.

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:

A	Superior
B+	Excellent
B	Very Good
C+	Good
C	Acceptable
D	Minimum
F	Inadequate
AUD	Audit
INC	Grade deferred--given in rare instances to students who would normally have completed the course work but who could not do so because of special circumstances. If this grade is not removed during 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 not be accepted after 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.

Academic Standing / Probation
Undergraduate students are required to maintain a GPA of 2.0. Students who earn a GPA of less than 2.0 in their most recent semester will be given a “Warning” by their academic advisors, as long as their CUM GPA remains at 2.0 or above. The first time the CUM GPA falls below 2.0, the student will be placed in the academic status termed "Probation." If the “Probation” student does not raise the Cum GPA to a 2.0 the following semester, he/she will be suspended. Probationary status will be removed when the cumulative GPA is raised to 2.0.

Academic Suspension
The Committee on Academic Standing reviews the academic record of students, and students are subject to suspension from the university whenever they have been placed on probation for two successive semesters or earn a GPA of less than 1.5 in their most recent semester.

When the record of a student has been reviewed, the Committee on Academic Standing may: assign the academic status of "probation"; suspend the student from the university; or stipulate specific requirements, which the student will be obliged to fulfill in order to retain the privilege of initiating or maintaining registration in any following semester. In extreme cases where student performance is deteriorating rapidly, suspension will be made effective immediately.

Academic Dismissal
A student who is suspended on two or more occasions is subject to Academic Dismissal. Only in the most exceptional circumstances should dismissed students be readmitted.

Appeals
Decisions relating to a student's status are made in accordance with regulations approved by faculty. Students may appeal decisions made by the Committee on Academic Standing by consulting with the Office of the Dean of Student Services within five days of receiving notice of the original decision.

The decision of the Committee on Student Appeals is final. The committee will communicate in writing to the student within 15 days of the hearing.

Students wishing to appeal should prepare a letter stating accurately and completely the decision being appealed, noting when it was taken, by whom, etc., and clearly but succinctly stating the reason they believe that justice has not been fully served. Transcripts, test scores and other information which form part of the student's record will also be distributed to the committee members for their consideration.

Reinstatement After Academic Suspension
Students who are suspended from the university may apply for reinstatement after a lapse of at least one regular semester. Students may apply for reinstatement on an application form obtainable from the Office of University Admissions.

Such applications must be submitted to the Office of University Admissions according to the schedule governing readmission.

Courses taken at another college while a student is under academic suspension at NJIT may be counted as transfer credit only. Students are strongly urged to consult with an NJIT department advisor before registering for courses at other institutions while on suspension.

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
A student may take a single course no more than four times including withdrawals. If an undergraduate course is repeated, then the lower of the first two grades is excluded in computation of the cumulative GPA and all other grades are included. All grades are shown on the student's transcript. **(Effective Fall 2011)**

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.

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.

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 university 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. 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 which is available from, and should be returned to, the Registrar's Office.

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 Professional Conduct

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, a Code of Professional Conduct. The policies and procedures governing this code are contained in a separate publication, the Student Handbook, and are deemed incorporated into this catalog. A copy of the handbook may be obtained from the Office of the Dean of Student Services or online at http://www.njit.edu/handbook/.

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 sexual harassment policy and procedures, 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 full copy of the university's policy prohibiting sexual harassment, please contact the Office of General Counsel and/or the Office of Compliance and Community Relations.

Drug Abuse Prevention Program

New Jersey Institute of Technology prohibits the use of illegal drugs on its premises. 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 can receive information and referral assistance from the Office of the Dean of Student Services, the Counseling Center, the office of Health Services, or the Stop-In Center. The Counseling Center professional staff provides assessment and counseling for some substance abuse problems, relapse prevention support for students in recovery, and referral to off-campus resources as needed. With limited exceptions, services of the Counseling Center are confidential. A full description of confidentiality exceptions is included in the Student Handbook. Questions about confidentiality may be discussed with professional staff prior to receiving services.

In addition, the university, through the Division of Student Services, 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 Federal Family Educational Rights and Privacy Act of 1974 gives students the right to inspect any educational records about them maintained by NJIT. Students have the right to a hearing to challenge the contents of these records, and also have the right to add to their records an explanation of information they challenge. Unless specifically exempted by the public law, NJIT is mandated to keep student records strictly confidential. The university registrar is responsible for student records. Educational records are defined as transcripts, admission files and registration forms. To review their files, students must contact the registrar, in writing, to specify the items they want to see. Student health records are maintained by the director of health services and may only be examined by a health professional chosen by the student.

Educational records defined by the public law must be made available within 45 days after a student requests to see them. A catalog of educational records kept by NJIT is available from the registrar. Exceptions to the right of inspection include financial aid records and records of institutional, supervisory, and administrative personnel, and ancillary educational personnel. For a nominal service fee, copies of these records may be made for students. The law further permits release of certain information involving disciplinary violations, including violations concerning alcohol or controlled substances of students under the age of 21.

Only those at NJIT acting in the student's interest are allowed access to student files, including personnel in the registrar's, admissions, student services, and finance offices; and academic personnel within the limitations of their need to know.

With the exceptions stated in the law, no one outside NJIT shall have access to a particular student's educational record without the written consent of the student, except in exceptional circumstances such as emergencies. Accrediting agencies carrying out their accrediting function and certain state and federal officials are permitted access. A record of, and reasons for, granting access will be kept by the university and will be available to the student.

The university, 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 who desire directory information to be withheld should notify the registrar in writing within the first two weeks of initial registration.

Request for non-disclosure will be honored by the university for ONLY ONE ACADEMIC YEAR AT A TIME. Authorization to withhold directory information must be filed annually in the Office of the Registrar.

Students who disagree with an entry may challenge its accuracy with the Office of the Registrar. If this remedy fails, either NJIT or the student may request a formal appeal hearing. The law mandates that such hearings be held within 30 days of requests, and be conducted by a university official or other person with no direct interest in the outcome. Students will be given a full and fair opportunity to present relevant evidence and be represented by their own counsel.

Students may include a written statement in their file explaining a disputed entry following an unfavorable determination of an appeal. A written decision will be rendered within 15 working days after the hearing of an appeal.

Students who believe that they are treated unfairly or improperly and contrary to the provisions of the law may request, in writing, assistance from the provost of the university or the provost's designee. Students who believe that their rights have been abridged may file complaints with the appropriate federal agency.

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 http://www.njit.edu/officetech/). 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/officetech/inventors/).

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

Accreditation

NJIT is accredited by the Middle States Association of Colleges and Schools (MSACS) Commission on Higher Education.

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.

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 Association of Colleges and Schools
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

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 www.njit.edu/admissions/applyonline.php

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

STANDARDIZED EXAMINATION REQUIREMENTS
All applicants must take the Scholastic Assessment Test. The American College Test is also accepted.

Architecture Majors

Same general requirements with the following exception:

Requirement	Units
Lab sciences, physics and biology preferred	2 units

History, Business, and Communication Majors
Same general requirements with the following exceptions:

Requirement	Units
College preparatory mathematics	3 units
Science including one lab science	2 units

Science, Technology and Society Majors
Same general requirements with the following exception:

Requirements	Units
College preparatory mathematics	3 units

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 complete an Application for Undergraduate Admission form 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 credit may be found at www.njit.edu/admissions/docs/APOS.pdf. Policies for awarding IB credit may be found at http://www.njit.edu/admissions/pdf/IBpolicy.pdf.

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 or on the paper Application for Undergraduate Admission.

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 **c**andidates 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: www.njit.edu/admissions/undergraduate/applying/community-colleges.php.

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: www.njit.edu/admissions/undergraduate/applying/internationalstudents.php.

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 the University of Medicine and Dentistry of New Jersey (UMDNJ) or St. George's University School of Medicine (SGUSOM). Students spend three years at NJIT in an established accelerated curriculum, followed by either four years at UMDNJ 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 UMDNJ or New York University College of Dentistry, 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 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.

Combined Seven-Year BS/JD or BA/JD
NJIT and the Rutgers-Newark School of Law offer a program providing combined admission to both institutions and leading to the Bachelor of Science (BS) or Bachelor of Arts (BA) and the Doctor of Law (JD) following completion of a prescribed seven-year course of study.

Admission to all combined accelerated programs is highly competitive, and there is an early application deadline. Students must apply through the Albert Dorman Honors College. For a detailed description of these accelerated programs, see the Special Programs section of the catalog, the Albert Dorman Honors College web site or contact the College.

Accelerated BS/DPT in Physical Therapy at NJIT and UMDNJ
NJIT and UMDNJ have established an accelerated 6-year program leading to a BS degree from NJIT and a Doctor of Physical Therapy (DPT) degree from UMDNJ. The program includes three years of undergraduate education at NJIT followed by three years of professional education in physical therapy at UMDNJ. 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 UMDNJ
NJIT and UMDNJ have established a 6-year program leading to a BS degree from NJIT and a Master of Science degree – Physician Assistant from UMDNJ. The program includes three years of undergraduate education at NJIT followed by three years of professional education in physical therapy at UMDNJ. 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.

Campus Directory

University Mailing Address

New Jersey Institute of Technology
University Heights
Newark, New Jersey 07102-1982

University Switchboard

(973) 596-3000
In New Jersey: 1 (800) 925-NJIT

NJIT on the Internet: http://www.njit.edu

Many academic and administrative departments have home pages on NJIT's Web site and are accessible from the address above.

Main Offices	Extension
Admissions: Graduate and Undergraduate	3300
Alumni Affairs, Office of	3441
Biological Sciences, Division of	5612
Biomedical Engineering, Department of	5268
Bookstore	3200
Bursar, Office of the	3157
Campus Center	3605
Career Development Services, Division of	3100
Chemical Engineering, Otto H. York Department of	3568
Chemistry and Environmental Science, Department of	3595
Civil and Environmental Engineering, Department of	2444
College of Computing Sciences, Office of the Dean	5304
College of Science and Liberal Arts, Office of the Dean	3677
Computer Science, Department of	3366
Computing Help Desk	2900
Continuing Professional Education, Division of	3061
Cooperative Education and Internships, Office of	3100
Electrical and Computer Engineering, Department of	3513
Employment, Student	3474
Engineering Science Program	3228
Engineering Technology, Department of	3228
Financial Aid, Office of	3479
Graduate Studies, Office of	3462

History, Federated Department of	3377
History, Federated Department of Rutgers-Newark	353-5410
Honors College, Albert Dorman	642-4448
Human Resources, Office of	3140
Humanities, Department of	3266
Industrial and Manufacturing Engineering, Department of	3660
Information Systems Department of	3368
Information Technology Program	5764
Intellectual Property, Office of	5825
International Students and Faculty, Office of	3579
Library, Architecture	3083
Library, Robert W.Van Houten	3206
Mathematical Sciences, Department of	5782
Mechanical Engineering, Department of	3331
Microelectronics Fabrication Center (MFC)	5696
New Jersey School of Architecture, Office of the Dean	3080
Newark College of Engineering, Office of the Dean	3226
Physical Education and Athletics	3636
Physics, Department of	3562
Public Safety, Department of	3111
Registrar, Office of	3236
Research and Development, Office of	3429
Residence Life	3039
School of Management, Office of the Dean	3019
University Advancement, Office of	3400
University Communications, Office of	3433

Continuing Professional Education/Online Learning

NJIT's Division of Continuing Professional Education provides enriching career-long learning opportunities through extension programs, Online Learning, graduate certificates, and through its professional development training and corporate customized training.

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. Taught throughout the year, individual classes typically last one to five days. Certificates and license review programs can entail a significant number of hours of instruction spanning several months.

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 non-credit courses that meet technology-based organizations' needs for high-quality, lifelong workforce education. 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 the Division of Continuing Professional Education, at (800) 624-9850 or http://cpe.njit.edu.

Online Learning

Online Learning offers five graduate degrees (MS in Computer Science, MS in Engineering Management, MS in Information Systems, MS in Management and MS in Professional and Technical Communication), select Graduate Certificates, and graduate courses in many disciplines including communication, computer science, information systems, information technology, humanities, management, and engineering management. Online Learning offerings can be viewed at http://adultlearner.njit.edu/locations/onlinelearning.php.

Online Learning provides students the opportunity to earn college credit through enrollment in online electronic-based courses. These courses are virtual learning communities with instructor-led online classrooms that utilize various technologies such as WebCT or Moodle for presenting course material, online quizzes, asynchronous and synchronous communication. Online courses are flexible and rigorous educational experiences suited to motivated students.

The program's reach is worldwide. Course material can be accessed through the Internet via learning managements systems utilizing multimedia presentations. Material is also downloadable as podcasts through NJIT on iTunes U and other venues as well streaming video, CD ROM and DVD..

Online Learning furnishes a convenient alternative to graduate distance learners and students who have scheduling conflicts. For more information, contact the Division of Continuing Professional Education at (800) 624-9850 or email cpe@njit.edu.

Course Code Explanation

NJIT Courses

ALPHABETICAL CODES

Acct	Accounting
Arch	Architecture
AS	Aerospace Studies
ART	Art
Biol	Biology
BME	Biomedical Engineering
CE	Civil Engineering
CET	Construction Engineering Technology
ChE	Chemical Engineering
Chem	Chemistry
CIS	Computer and Information Sciences
CMT	Construction Management Technology
COOP	Cooperative Education
CPT	Computer Technology
ECON	Economics
ECE	Electrical and Computer Engineering
ECET	Electrical and Computer Engineering Technology
EG	Engineering Graphics
EnE	Environmental Engineering
Entr	Entrepreneurship
Eng	English
ESC	Engineering Sciences
EPS	Environmental Policy Studies
FED	Fundamentals of Engineering Design
FIN	Finance
Frsh	Freshmen Seminar
Hist	History
HRM	Human Resource Management
HSS	Humanities and Social Sciences
HUM	Humanities
IE	Industrial Engineering
IM	Industrial Management

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
MtSE	Materials Science and Engineering
OM	Operations Management
OPSE	Optical Science and Engineering
PE	Physical Education
Phil	Philosophy
Phys	Physics
SET	Surveying Engineering Technology
SS	Social Sciences and Policy Sciences
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 (e.g., 3-3-4) represent the lecture/ recitation hours, laboratory/ studio hours, and credit hours respectively.

Rutgers-Newark Courses

The current Rutgers-Newark Schedule of Courses can be viewed for cross-registration along with the Rutgers catalog when planning for cross-registration.

Financial Aid Services

Application procedures, types of financial aid, and other financial aid policies and procedures are available on the Student Financial Aid Website. Click here to go to financial aid information

General University Requirements

Philosophy

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. Graduates must understand the complexities of contemporary society and have a deep understanding of and appreciation for science and technology and the ethical and societal issues involved in their pursuit. A fundamental guiding principle in the development of the General University Requirements (GUR) is the formulation of a foundational curriculum encompassing the necessary preconditions for success in undergraduate disciplines, a curriculum that establishes a devotion to lifetime intellectual discovery and personal development. In a larger sense, the GUR 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 GUR 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.

COMPUTING SCIENCES ---- 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. Depending on the discipline, the student should also develop an ability to design algorithms, to write programs, and to use software tools.

CULTURAL HISTORY ---- All educated individuals are expected to understand and appreciate history and the world's cultures.

ENGLISH ---- The ability to communicate ideas is an essential characteristic of educated individuals. All students are expected to achieve proficiency in both oral and written English.

HUMANITIES ---- The ideals of a liberal education transcend particular major fields and career goals. All students are expected to develop an interest in specific areas within the humanities.

MANAGEMENT ---- All students are expected to develop the management skills needed to function effectively in an organizational setting.

MATHEMATICS ---- The ability to reason qualitatively and quantitatively, to understand probability, 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.

NATURAL SCIENCES ---- The natural sciences provide 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.

PHYSICAL EDUCATION ---- Physical education conveys to students the importance of good health and fitness through planned exercise and recreational activities.

SOCIAL SCIENCES ---- An understanding of the social sciences is essential in order to understand the economic, social, and political forces at work in our world.

Specific General University Requirements

Courses that satisfy the General University Requirements are so certified by the University Curriculum Review Committee at the time they are first approved to be offered.

Computing Sciences:

At least three (3) credits in an introductory course in the computing sciences (CS 100, CS 101, CS 103, CS 104, CS 111, CS 113, CS 115 or IS 118).

English Composition and Cultural History (Lower-level):

At least nine (9) credits, including at least six (6) credits in English Composition (HUM 101 and HUM 102) and at least three (3) credits in cultural history, all at the 100- or 200-level (HIST 213, HUM 211, HUM 212 or any Rutgers-Newark 200-level history course with prefix 510 or 512).

Humanities and Social Sciences Electives (Upper-level):

At least nine (9) credits in upper-level Humanities and Social Sciences, including

1. Three (3) credits in a 300-level course in literature (LIT); history (HIST); philosophy (PHIL); or science, technology and society (STS). Any Rutgers-Newark 300- or 400-level course with prefix 350 (English Literature), 352 (American Literature), 510 (History), 512 (American History) or 730 (Philosophy).
2. Three (3) credits in a 300-level course in english (ENG); history (HIST); literature (LIT); philosophy (PHIL); science, technology and society (STS); social science (SS) or theater (THR). Any 300-level Rutgers-Newark course in humanities, social sciences, fine arts or performing arts (prefixes 070, 080, 081, 202, 220, 350, 352, 420, 510, 512, 560, 570, 700, 701, 370, 790,, 810, 830, 861, 920, 940 , 965, 988).
3. Three (3) credits in a 400-level senior seminar in the humanities and social sciences (HSS 401; HSS 402, HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 491).

No more than three (3) of the nine required credits in this category may be fulfilled with a course that is specifically required by a student's degree program or college.

Management

At least three (3) credits in management (HRM 301, MGMT 390, ENTR 410 or IE 492). Students in the aerospace option take AS 333 and those in the dual degree program between architecture and management take HRM 301.

Mathematics

At least six (6) credits, including at least one (1) credit in probability and statistics.

Probability and Statistics courses: MATH 105, MATH 114, MATH 120, MATH 225, MATH 244, MATH 279, MATH 305, MATH 333, IE 331, ECE 321 or MNET 315).

Natural Sciences:

At least seven (7) credits in natural sciences, including a laboratory experience.

Biology Courses: R120:101, R120:102, R120:109, R120:110, R120:205, R120:206, R120:207, R120:208, R120:237, R120:241, R120:242

Chemistry Courses: CHEM 122, CHEM 123, CHEM 124, CHEM 125, CHEM 126

Physics Courses: PHYS 102, 102A, PHYS 103, PHYS 103A, PHYS 111, PHYS 111A, PHYS 121, PHYS 121A, PHYS 202, PHYS 202A, PHYS 203, PHYS 203A, PHYS 204

Geology Courses: R460:101, R460:103, R460:104, R460:206, R460:207

Physical Education

At least two (2) credits in physical education. Students who register as full time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course.

Social Sciences (lower-level):

At least six (6) credits in basic (100- and 200-level) social sciences (ECON 201, ECON 265, ECON 266, EPS 202, STS 201, STS 210, STS 221 or any of the following Rutgers-Newark courses R070:203, R070:204, R202:201, R790:201, R790:202, R830:101, R830:102, R920:201, R920:202. Students may take R220:101 or R220:102 instead of ECON 265 or ECON 266).

Notes:

1. Each college or department may set additional requirements that exceed the GUR.
2. All first-time, full-time freshman students are required to attend Freshman Seminar. This course assists students in adjusting to the academic program and introduces them to university life.

Research Centers and Labs

Major Research and Public Service Centers

Engineering and Applied Science

Center for Applied Mathematics and Statistics (CAMS)
Fosters and supports the application of advanced mathematical and statistical methods to scientific, engineering and management problems. The statistical consulting facility assists internal and external clients with problems in data analysis, time series, design of experiments and estimation and reliability theory. (973) 596-8465

Center for Membrane Technologies[1]
The center focuses on research in new membrane structures, materials and devices, novel membrane-based processes and techniques and applications, development of membrane technologies for separations and other applications. NJIT leads an academic consortium whose other members include Rowan, Rutgers-New Brunswick and Stevens. Training of professionals, graduate and undergraduate students, developing new membrane technologies and their applications and transferring them to corporate partners are prime objectives of the center. (973) 596-8479

Center for Solar-Terrestrial Research
The center focuses on observational and theoretical astrophysics and operates the Big Bear Solar Observatory, at Big Bear Lake, California, and a dedicated array of solar radio telescopes at Owens Valley Radio Observatory, in Owens Valley, California. The facilities at both locations have the unique capacity to study the sun and its extended magnetic atmosphere simultaneously. (973) 596-3565

New Jersey Center for Engineered Particulates[1]
The center focuses on fundamental and applied research in particle technology for industry and promotes technology development and transfer to industrial partners. The research thrust areas include particle storage and transport, particle and surface property modification (engineered particulate materials), particle segregation, mixing and separations, simulations and modeling. Undergraduate and graduate education and professional training complement the research. (973) 596-3352

New Jersey Center for Wireless Networking and Internet Security
New approaches and new software tools for integrated wireless and wired network management, including data and network security, are the goals of the newly established New Jersey Center for Wireless Networking and Internet Security. A partnership between NJIT's Department of Electrical and Computer Engineering and Princeton University, the center is supported by a $2.6 million R&D Excellence Grant from New Jersey Commission on Science and Technology. Its main objective is to provide optimized efficiency and security in the multimedia environment. Led by Atam Dhawan, professor and chair of electrical and computer engineering, the new center builds on NJIT's established strengths in wireless communication, signal processing, multimedia and networking. Other NJIT members of the center team include Associate Professors Constantine Manikopoulos and Yun-Qing Shi and Assistant Professors Symeon Papavassiliou and Sirin Tekinay, all of electrical and computer engineering. Center researchers are collaborating with leading organizations, including Panasonic, Prediction Systems, AT&T, the U.S. Army and Mitre Corp. (973)596-3524.

New Jersey Center for Microflow Control
Research at the New Jersey Center for Micro-Flow Control (MFC), an increasingly important technology, involves the manipulation of fluid --- gas or liquid --- flow fields by creating small disturbances in the flow.

The New Jersey Commission on Science and Technology R&D excellence program partially builds upon the work of the W.M. Keck Foundation Laboratory for Electro-Hydrodynamics of Suspensions, headed at NJIT by Nadine Aubry, F. Leslie and Mildred Jacobus Professor of mechanical engineering, professor of mathematics and chair of the Mechanical Engineering Department, and Boris Khusid, associate professor of mechanical engineering. The laboratory is funded by a $500,000 grant from the W.M. Keck Foundation. The New Jersey MFC Center is led by professor Aubry.

MFC technology has a wide range of applications, including devices for medical diagnosis and treatment, telecommunications, environmental remediation, chemical and materials processing. In collaboration with researchers from Princeton University and industrial partners, the NJIT center will focus on the development of new technologies such as miniaturized systems on a microchip for the characterization and manipulation of cells, bacteria, spores or other microscopic particles, and high-precision microprocessing tools using microjets.

With their collaborators from the City University of New York, the research team has also received funding from the U.S. Office of Naval Research to develop an electro-hydrodynamic technology for monitoring and cleaning contaminants from oils, lubricants and coolants and other fluids used in shipboard equipment. Many machine failures are caused by contamination of hydraulic fluids, coolants and other liquids with micron- or sub-micron-sized particles due to corrosion or aging of fluids, but mechanical filtering is ineffective for such fine debris. In contrast, a strong high-gradient AC electric field can be used to control and manipulate the motion and aggregation of particles in flowing liquids. The team is developing a field prototype of online filtering hardware and will test it aboard a naval ship. (973) 642-7268.

Environmental Engineering and Science

Otto H. York Center for Environmental Engineering and Science (CEES)
CEES is the home for many of NJIT's environmental centers, programs and initiatives. The $11 million center, containing $2.4 million in state-of-the-art laboratory equipment, is the first building in the nation especially constructed for cooperative public and private research in hazardous waste management. (973) 596-3233

Manufacturing

Center for Manufacturing Systems (CMS)[1]
CMS is NJIT's focal point for industrial interaction in research, technology extension, education and training pertinent to manufacturing. Project work spans aspects of materials production, component part fabrication and automated assembly. (973) 596-2874

Polymer Engineering Center (PEC)
PEC seeks to advance the foundations of design and control of polymer production and part-fabrication technologies with facilities that include a production scale, multilayer co-extrusion line with thermoforming unit and extruders, injection molding machines, and test and characterization equipment. (973) 642-4582

Polymer Processing Institute (PPI)
PPI is a not-for-profit institute with special areas of expertise in the development of high-performance products and processes for advanced compounding, property characterization and computer modeling. PPI includes the professionally managed Characterization Lab, Computer Center and Process Lab, which contains a number of single- and twin-screw extruders and several injection machines along with downstream equipment. (973) 642-4582

Transportation

International Intermodal Transportation Center (IITC)
The institute conducts interdisciplinary research on the transportation needs of the public and private sectors. Affiliated centers include the National Center for Transportation and Industrial Productivity, which investigates methods for increasing productivity through transportation improvements and provides technical, administrative and fiscal management necessary to conduct research projects in the field of transportation (973) 596-3355; and the New Jersey Center for Transportation Information and Decision Engineering (TIDE) Center, a partnership of NJIT, Princeton and Rutgers that develops and markets technologies that will help individuals and commercial enterprises make better transportation-related decisions. (973) 642-7214.

New Jersey Transportation Planning Authority
The North Jersey Transportation Planning Authority is the federally authorized Metropolitan Planning Organization for 6 million people in the 13-county northern New Jersey region. Each year, the NJTPA oversees more than $2 billion in transportation improvement projects and provides a forum for interagency cooperation and public input into funding decisions. It also sponsors and conducts studies, assists county planning agencies and monitors compliance with national air quality goald. (973) 639-8400.

Electronics and Communications

Center for Communications and Signal Processing Research
The center promotes research on the theoretical and practical aspects of communications and signal processing in collaboration with government organizations and local industry with emphasis on wireless and personal communications. (973) 596-8474

Electronic Imaging Center
The center's research emphasizes novel diffractive methods in spectral filtering, which are combined with visible and infrared

imaging systems. Of particular interest are applications of infrared imaging and radiometry with industrial and commercial partners. (973) 596-3538

Microelectronics Fabrication Center
Research focuses on advanced semiconductor and micromachined device design, simulation and fabrication. The center features a complete Class 10 cleanroom with 6-inch silicon wafer processing capability, one of only a few such university cleanrooms in the nation. Recent state-of-the-art equipment additions include wafer bonding and deep reactive etching tools. The center provides industry and university clients with technical support and prototype development in MEMS and/or CMOS technologies. (973) 596-5736

Architecture
Center for Architecture and Building Science Research
This applied research group investigates the building environment within a social and economic context. Major areas of study include housing, learning environments, healthcare and aging, disabilities, preservation technologies and the utilization of waste materials for construction and infrastructure. (973) 596-3097

Public Policy

Small Business Assistance
Center for Information Age Technology (CIAT)
CIAT provides impartial, professional computer-related assistance to government, education, non-profit and business organizations. The center assists with a wide range of projects such as assessment of current hardware and software, identification of systems requirements, vendor and package evaluation, implementation, training and Web site development. (973) 596-3035

Defense Procurement Technical Assistance Center
The center provides individualized marketing, contractual and technical assistance to businesses currently selling or seeking to sell goods/services to the federal, state or local government and prime contractors. (973) 596-5807

Enterprise Development Centers (EDC I, II & III)
EDC I,II and III operate technology-oriented small business incubators committed to the long-term economic vitality and growth of entrepreneurial ventures in New Jersey. EDC addresses problems inherent to these businesses and helps to commercialize companies' new products, processes and services. (973) 596-5740

New Jersey Manufacturing Extension Program, Inc. (MEP)
MEP is a not-for-profit organization headquartered at NJIT that serves as a gateway for small to medium-sized manufacturers to access statewide services in the public and private sectors that address business, financial and technical issues essential to forming high-performance firms. (973) 642-7099

1. Supported by the N.J. Commission on Science and Technology
2. A National Science Foundation Industry/University Cooperative Research Center
3. Supported by the U.S. Environmental Protection Agency
4. Supported by the U.S. Department of Transportation
5. Supported by the N.J. Department of Environmental Protection

Residence Life

Over 1450 students live on campus in four co-ed residence halls. More than 50 percent of first year students live on campus. Rooms are fully furnished, air-conditioned and wired for networking to the University's main computer system and to the Internet. Each hall has common areas and facilities including lounges, study areas, kitchens and laundry rooms. Rooms are wired for phone and provided approximately 50 cable TV channels, including HBO. Other services include: washers and dryers, snack and soda machines, recreational equipment (pool, ping-pong, large screen televisions, etc.) and mail service Monday-Friday.

First year students live in Cypress and Redwood halls. Upper class students can live in every building, but often choose to live in Laurel and Oak halls.

Redwood Hall has approximately 209 first year and upper class students in double and triple rooms. Residents share two (gender specific) community bathrooms on each floor.

Cypress Hall is a suite-style building with approximately 430 first year and upper class students in double and triple rooms. Suites are comprised of two bedrooms and a shared bathroom and foyer.

Laurel Hall is a suite-style building with approximately 597 upper class students in single and double rooms. Any combination of two types of rooms can make a suite. Suites have a shared bathroom and foyer

Oak Hall has approximately 207 upper class and graduate students housed in both suite-style rooms and apartments. Each suite-style room has a kitchenette and shared bathroom. Each apartment has a kitchen, living room and bathroom. Suites are comprised of two doubles or a double and triple bedroom. Apartment can have: a single with a double bedroom, two doubles or a double with a triple bedroom.

NJIT students use electronic cards for access to a residence hall. 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 photo ID and must be signed into the residence hall by a resident host. Guests must be accompanied by their hosts at all times.

Residence Life has staff on-duty in each hall during non-business hours. In addition, NJIT's Public Safety Office has patrols by their force of police officers and public safety officers, 24 hours a day. Patrols are conducted on foot, in cars, motor scooters and bicycles. Rooftop surveillance cameras are mounted throughout campus and monitored around the clock.

Once you have been admitted to NJIT, you can complete the Housing Application and Contract: https://mis3.njit.edu/housingapplication/login.aspx. A $50 non-refundable deposit is required and can be paid by credit card or check/money order payable to NJIT. Checks/money orders must be sent to the Residence Life Office, 180 Bleeker Street, Newark, NJ 07103-3514.

Applications for first year students postmarked by May 1 are guaranteed housing. After May 1, housing is assigned based on the distance you live from campus, need and date of application. Applications for transfer students and returning students are assigned housing based on the distance you live from campus, need and date of application. We anticipate a wait list for the fall for all students. You may also be assigned to a triple room. You will receive a confirmation email (NJIT email address) and confirmation ID number if you submitted your online application successfully.

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

Food Services

Dining facilities are located in the Campus Center. NJIT's private food services vendor, Gourmet Dining Services, operates the Dining Room, The Highlander Club, Leafs, Grains, The Grill, The Tech Café, Hershey's Ice Cream, the Trattoria and the Convenience Store.

For 2008-2009 the "all you can eat" board plan will feature continuous dining with unlimited returns. This means if you are on Meal Plans A-E, you have unlimited access to the board dining area all day long, seven days a week. The board plan dining hall will feature the following food service stations that will be open various times during the day:

- Bread and Breakfast
- Grill
- Halal Grill
- Fruitopia
- Waffle Bar
- Deli and Panini's
- Organic "Steamed to Perfection"
- Salad Bar
- Sweet Dreams
- Beverage Stations
- Create Your Own Soup
- Pasta
- Vegan
- International
- Chef's Choice Entrees
- Baked to Perfection
- Baked Potato Bar
- Brick Oven Pizza
- Make Your Own Pizza
- Wok It Up
- Sushi
- Carving and Rotisserie
- Fajita Island
- Beverages

Flex dollars can be used at the Dining Room, The Highlander Club, Leafs, Grains, The Grill, The Tech Café, Hershey's Ice Cream, the Trattoria and the Convenience Store. For hours and a complete listing of what is available via flex, please check http://www.njitdining.com.

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 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 and AS 112, introductory courses that explore the mission and organizational structure of the US Air Force; AS 221 and AS 222, 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 and AS 334, 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 and AS 444, 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, followed by AS 334,AS 443, and AS 444 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 up to two full-time work experiences during which up to 6 additive or degree credits can be earned. In some majors, co-op may be taken on a part-time work schedule.

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.
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**. 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.
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. Arch 310, 410; Bio 310; BME 311,411; CE 311, 413; CET 497; ChE 310, 311; Chem 310, 311; CIMT 497; CS 310, 410, 485; CPT 395; ECE 310, 410; ECET 395, 495; Eng 490, 491; ESc 310, 410; IE 310, 411; IS 310, 410; IT 311, 411; Math 310, 410; Mgmt 310, 410; ME 310, 410; MET 395, 495; MNET 395, 495; Phys 311, 411; STS 311, 411.
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 www.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 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.

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 http://www.njit.edu/CDS.

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 http://www.njit.edu/CDS.

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

Overview
Students with demonstrated high standards of personal and academic achievement can be candidates for the highly competitive Albert Dorman Honors College. Admission depends upon academic record, school activities, and service to the community. Significant financial support is available.

The Honors College offers challenging course work, research possibilities, and the opportunity to meet leaders from the worlds of engineering, science, the arts, architecture, industry, and government. Faculty who teach honors classes are selected for their scholarship, enthusiastic teaching, and ability to engage students in the process of learning. Independent study and research are strongly encouraged. Honors students have exclusive use of the James A. Kennedy Honors Resource Center, which provides space for study and social interaction and includes an exclusive networked computer center. Honors students have their own governing body, publish their own newsletter, and are offered the opportunity to live on a special honors floor in one of the residence halls.

The more than 600 highly qualified students enrolled in the Honors College have been active in high school research projects, extracurricular clubs, academic competitions, and community service. More than one-fourth are women. The average SAT score on entry is 1315.The average GPA upon graduation is 3.6. More than half have continued their studies at graduate or professional schools, including NJIT, Columbia, Cornell, Georgia Tech, Johns Hopkins, MIT, Penn State, Rutgers, Stanford, UMDNJ-RWJ Medical School, Seton Hall Law School, Yale Law School, and Rutgers Law School. Other graduates have accepted positions at Allied Signal, AT&T, BASF, Exxon, Hoffmann-LaRoche, IBM, Nabisco, Prudential, Proctor & Gamble, PSE&G, Union Carbide, and others.

The Honors Curriculum
Honors scholars are enrolled in both the Honors College and in the college or school offering their major.Students are guided throughout their university experience by both an Honors advisor and an advisor in their major. Advisement begins in the summer before the first year at NJIT. In their first meeting, student and advisor review high school performance, and both Advanced Placement (AP) and NJIT placement test scores to determine the best course of study. At this time, students also have the opportunity to discuss choice of major as well as special research and learning opportunities. Advisement is supplemented by a 10-week freshman seminar, in which students learn more about their curriculum, research and project opportunities, and co-curricular, extra-curricular and community service opportunities. By the end of the seminar, students complete an Individual Education Plan for their educational and co-curricular experience at NJIT. This Plan serves as a guide to their program of study, and is subject to revision through the HonorsCollege advising process.
Honors students choose from over forty specially designed courses that satisfy both the General University Requirements and the major. These honors courses have limited enrollment, allow in-depth study, and encourage students to take more responsibility for their learning. Honors courses are offered throughout the entire curriculum, allowing students to work in those areas in which they

are strongest and have the greatest interest. A limited number of courses may be converted to Honors through a contract with the professor.

Accelerated Medical and Law Programs
The following is a general description of NJIT's accelerated medical programs available only to Honors scholars. For a full description of admissions and degree requirements, please see http://honors.njit.edu/academics/accel_programs.

Accelerated Seven-Year Programs in Medicine, Dentistry and Optometry
Students who have done exceptionally well in high school may apply for an accelerated seven-year program. Three years of study will be at NJIT, where students must follow an approved accelerated pre-health curriculum and meet all Honors College and NJIT requirements. The remaining four years of the seven-year program are spent at UMDNJ/New Jersey Medical School, UMDNJ/New Jersey Dental School, the State University of New York (SUNY) College of Optometry, the New York University College of Dentistry (NYUCD), or St. George's University School of Medicine, Grenada (two years at St. George's, and the remaining two years at St. Michael's Hospital, Newark). Admissions requirements include standing in the top 10% of the class, and SAT scores ranging from 1250 to 1400, depending on the program. A choice of many majors is offered.

Prior to acceptance, the student must be interviewed and accepted by the Albert Dorman Honors College and by the medical, dental or optometry school in which the student wishes to enroll. Final admission decisions are made by the professional school itself, not NJIT.When students finish their first year at their professional school, they will be awarded an Honors bachelor's degree in their major from NJIT. After successfully completing all of the degree work at the professional school, they will be awarded the appropriate doctoral degree.
Students who do not begin their studies as accelerated students but who do exceptionally well in their first year at NJIT may apply to join most of the accelerated programs.

Accelerated Program in Law with Seton Hall University
Students interested in law may apply for an accelerated six-year program. Applicants for the program must have a combined SAT score of 1300 and rank in the top 10% of their class.Three years of study are spent at NJIT, where students must follow an approved accelerated curriculum and meet all Honors College and NJIT requirements. To remain eligible for early entry into law school, students also must earn, by the end of their junior year in college, a score on the LSAT that ranks them in the 80th percentile or above of all those taking the LSAT in that year.

Final admission is dependent on continued satisfactory academic performance and completion of an approved accelerated pre-law curriculum. Students who do not begin their studies as accelerated law students but who do exceptionally well in their first year at NJIT or elsewhere may apply to join the accelerated law program.

Honors Courses
Honors students admitted as freshmen take 11 honors courses, encompassing both GUR and major-related courses. Students in the New Jersey School of Architecture, however, take a total of just eight such courses.

Examples of First and Second Year Honors Courses

Chemistry
More comprehensive and rigorous than the regular freshman and sophomore chemistry offerings, these honors courses and an honors lab include field trips, molecular model building, readings in professional journals, oral and/or written reports, and the completion of an individual research project. Honors General Chemistry I and II, Honors General Chemistry Lab, and Honors Organic Chemistry.

Computer Science
The Departments of Computer Science and Information Systems offers honors versions of CIS 101,CIS 104,CIS 113, and CIS 114. All four courses cover the material in greater depth. Advanced CIS courses are offered on a rotating basis.

History
An honors version of Hist 213: The 20th Century World introduces students to advanced analysis of the main global issues that have shaped our time. Advanced History courses are offered on a rotating basis.

Humanities and Social Science
Honors curses are available in the following subjects: freshman composition, economics, basic social science, and great-books-oriented courses studying the literature, history and philosophy of ancient, medieval, and early modern and modern civilization. All require greater emphasis on student reading and oral and written presentation than their non-honors counterparts. HSS 101H (English composition), HSS 202H (basic social science), SS 201H (economics), and HSS 211H, 212H,213H (cultural history).

Mathematics
The integrated four-course program in honors calculus and differential equations usually allows students to stay with the same professor and cadre of fellow students for two years. Math 111H, Math 112H, Math 213H, and Math 222H.

Physics
This sequence of three honors physics courses offers greater use of mathematics and vector analysis, as well as in-depth study of selected topics such as electromagnetic field and the wave-particle duality in nature. Phys 111H, Phys 121H and Phys 231H, and associated labs.

Third- and Fourth-Year Honors Courses
The course of study during the third and fourth years is primarily in the student's major. Many Honors courses are available within the majors. As juniors and seniors, honors scholars also select two seminars: one in humanities and the other in STS (science, technology, and society); history; management; English; Philosophy; or other areas.
Honors scholars complete their professional preparation by taking a senior-level capstone course in the major. This course can involve independent research or the writing of a senior thesis.

Honors Humanities and History Seminars
Limited to 20 students, these interdisciplinary seminars (HSS491H-499H) follow the research interest of the professor leading the seminar, such as classic great books (e.g., Shakespeare), modern media (e.g., film), the social history of medicine and health, or contemporary issues (e.g., professional ethics). Any one of these courses is used to fulfill the GUR Capstone Seminar in Humanities and Social Science.

Honors STS Courses and Seminars
These honors courses and seminars allow students to explore new trends in science and technology as they affect economic life, government policies, environmental issues, ethical decisions, professional careers, and the individual and society.

Honors History Courses
Junior-level History courses include in-depth examinations of the history of technology, environment, and medicine/health.

Honors Management Courses and Seminars
Both Honors Principles of Management (Mgmt 390H) and Engineering Management (IE 492H) allow honors students to study the dynamics of management in greater depth and with increased classroom interaction.

Required Honors Architecture Seminars
Honors architecture students take special architecture honors seminars in both the fourth and fifth years.

The Honors Capstone for the Major
Nearly every department at NJIT requires its seniors to enroll in a seminar, participate in a research project, write a thesis, or be a part of a special activity that allows them to bring together the skills, insights, and information they have developed in college. Honors students are expected to enroll in honors sections of their departments' offerings, to conduct independent study or to participate in research in an industrial, business, or medical setting. Students in these Honors courses are expected to do work at a level suitable for publication or conference presentation.

The Honors Faculty

Honors scholars are encouraged and challenged by faculty members selected for their teaching skills, enthusiasm, and national and international reputations for scholarship in their fields. They represent all the academic disciplines and research fields at NJIT. Since classes are small, they provide close contact with honors faculty in a seminar-like setting. Independent academic interests are encouraged. Honors faculty often select honors scholars to work on faculty research projects.

Research and Projects

Honors scholars have the opportunity to work with faculty and in the university's more than 20 research centers, and/or to work in an industry or government setting on projects related to their major field. This work can be independent study or a capstone project offered by the students' major.

James A. Kennedy Honors Resource Center
A specially equipped suite of rooms is set aside for honors students near the Honors College offices in Fenster Hall. A comfortable social lounge for relaxation and friendly exchanges of ideas includes stereo and video equipment, collections of

magazines and journals, games and recreational equipment. There is also a room for quiet study. A separate computer facility for course work and academic research includes PCs with Internet access, an advanced suite of software, laser printers, scanners, and peripherals directly connected to the university's centralized computer system. The entire center is equipped with wireless internet transmission.

Colloquium Series
While at NJIT, honors students attend a minimum of 2 colloquia each semester. These special lectures, seminars, panel discussions, trips, concerts, and site visits are designed to enrich the students' academic experience. Students meet leaders in government, research, business, industry, academe, and the arts. Recent colloquia have introduced students to developments in climate change, wireless sensing devices, various areas of medicine, computing technology, science and the law, pharmaceutical development, entrepreneurship, and many others. In the colloquia, experts help students to go beyond their normal course of study and to gain insights into the nature of conducting research, running businesses, or developing special talents. An annual study tour to Washington, DC has become a regular part of the series, as have nights at the NJIT/Rutgers Theater and roundtables with Honors alumni and Board members.

Service
Honors students participate in service to the college, university or community. Scholars are expected to take an active role and report on their contributions, experiential learning and personal growth.

Admissions Information
Applicants should contact the Albert Dorman Honors College as early as possible in their senior year. Please ask for the Honors College brochure.

Phone: (973) 642-4448
Fax: (973) 642-4452
E-mail: mailto:honors@njit.edu

The Honors application is part of the NJIT application form, which can be completed on paper or online at: http://www.njit.edu/admissions/undergrad/undergrad_apply.php.

For more information about Honors, please see http://honors.njit.edu.

The Albert Dorman Honors College considers students who have SAT scores of 1250 or higher, are in the top 15 percent of their high school class, and have a wide range of interests, leadership activities, and community service. An exceptional student whose SAT scores or class rank are close to these standards, and students from specialized academic high schools in which rank is not a true measure of excellence, are encouraged to apply.

For the accelerated law, medical, dental, and optometry programs, candidates must rank within the top 10 percent of their high school class and have minimum SAT scores as follows: law, 1300; medical (UMDNJ), 1400 at one sitting, (St. George's) 1300; dental, optometry, and physical therapy, 1250. Some experience in a medical setting is helpful.

Deadlines for completed applications:
Accelerated programs November 1.

Regular Honors College applicants: candidates are considered year round but application by Jan. 15 is highly recommended for students who wish to be considered for additional scholarships. All other students should consider April 1 as the deadline for applications. Students may be interviewed as early as September of their senior year.

Candidates who qualify for admission to the Honors College will be contacted for an on-campus interview, or phone interview if the candidate lives far away. Successful candidates normally receive acceptance and scholarship notification from NJIT and the Honors College at separate times.

Financial Support
Honors scholars who are US citizens or permanent residents receive a scholarship package that ranges from one-half to full in-state tuition. Out-of-state US citizens or permanent residents may also be eligible for a presidential scholarship, which will reduce their tuition to the in-state rates. International students are also eligible for Honors scholarships.

Housing
More than half of the current honors scholars live in residence halls. They are guaranteed space in the residence halls as long as they apply by the deadline indicated on the application. Each first-year and second-year honors scholar is usually assigned a

room with another honors student on the Honors floor.

Bursar

Policies and Procedures
About the Bursar's Office
Bursar Communications
Staff
1098-T
FAQ
How To Tutorials
Tuition and Fees Fall and Spring
Undergraduate 2013-2014
Undergraduate 2012-2013
Graduate 2013-2014
Graduate 2012-2013
Tuition and Fees Summer and Winter
Refund Information
Payment Plan Information
Credit Card Payments
Title IV Authorization Options
Health Insurance Waiver
Parent Information

2012-2013 Undergraduate Tuition & Fees

Home » Bursar » Tuition and Fees Fall and Spring » Undergraduate 2012-2013

Tuition & Fees Assessed *(Per Semester)*

	In-State			Out-of-State		
Credits	**Tuition**	**Fees**	**Total**	**Tuition**	**Fees**	**Total**
1	472.00	243.00	715.00	1,060.00	243.00	1,303.00
1.5	708.00	301.00	1,009.00	1,590.00	301.00	1,891.00
2	944.00	359.00	1,303.00	2,120.00	359.00	2,479.00
3	1,416.00	475.00	1,891.00	3,180.00	475.00	3,655.00
4	1,888.00	591.00	2,479.00	4,240.00	591.00	4,831.00
5	2,360.00	707.00	3,067.00	5,300.00	707.00	6,007.00
6	2,832.00	823.00	3,655.00	6,360.00	823.00	7,183.00
7	3,304.00	939.00	4,243.00	7,420.00	939.00	8,359.00
8	3,776.00	1,055.00	4,831.00	8,480.00	1,055.00	9,535.00
9	4,248.00	1,171.00	5,419.00	9,540.00	1,171.00	10,711.00
10	4,720.00	1,287.00	6,007.00	10,600.00	1,287.00	11,887.00
11	5,192.00	1,403.00	6,595.00	11,660.00	1,403.00	13,063.00
12-19 (Full-Time)	6,200.00	1,170.00	7,370.00	12,400.00	1,170.00	13,570.00

Health Insurance Fees: Full-Time students will be assessed an $828 Health Insurance fee in the Fall. International students on F-1 or J-1 Visa will be assessed a $912.00 fee when registered for 3 or more credits. You may waive this fee by providing proof of coverage and filling out a waiver form ONLINE ONLY. Please click here for more information: Health Insurance

Additional credits above 19 are assessed at the appropriate per credit rate.

Academic Fees Itemized *(Per Semester)*

Part-time Fee Structure	Full-time Fee Structure
Flat charge ($127.00 total):	
$105.00 Registration Fee	$105.00 Registration Fee
$22.00 Health Services Fee	$546.00 Academic Facilities Fee
	$70.00 Student Services Fee
Per-credit ($116.00 total):	$55.00 Activities Fee
$58.00 Academic Facilities Fee	$160.00 Athletics Fee
$9.00 Student Services Fee	$210.00 Technology Infrastructure Fee
$6.00 Activities Fee	$24.00 Health Services Fee
$14.00 Athletics	$125.00 International Students Fee
$29.00 Technology Infrastructure Fee	

NOTE: **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.**

Summer / Winter Session Fees

During the summer & winter sessions there is a flat fee of $192.00 in lieu of the fees noted above. Full-time Tuition rates do not apply during the summer/winter sessions. The fees are broken down as follows: Registration $105, Academic Facilities $58 and Technology Infrastructure $29

Additional Fees

$70.00 Application/Readmit/N-Matric U/G	$100 Payment Plan
$120.00 Commencement Fee	$225 Reinstatement Fee (in addition to the Late Payment and Late Registration Fee if assessed)
$85.00 Distance Learning Fee*	$195.00 Parking Full-time
$100.00 Late fee	$100.00 Parking Part-time
$200.00 First Year Student Fee	** 7% Commuter Parking Tax
$25.00 Maintaining Registration Fee UG	$25.00 Schedule Change Fee
$30.00 Transfer Orientation Fee	$125.00 BJUT English Placement Test
$125.00 International Student Fee	

* Fees for students who are taking courses via Distance Learning, at Extension sites or in Certificate programs will be applied to administrative and technological expenses directly associated with these programs

** The state of New Jersey mandates a 7% sales tax for commuting students parking on campus.

New Jersey Institute of Technology
University Heights Newark, New Jersey 07102

Contact Us

Maps & Directions

Professional Development Certificates

The Weekend University Program

It's hard for working adults to find time to take college courses, but NJIT's Program for Professional Advancement: "The Weekend University," makes it convenient for adults to earn either undergraduate certificates leading to bachelor's degrees or graduate certificates leading to select master's degrees. All classes are available on Friday evening and Saturdays and either meet on campus once per week or every other week while students also study online throughout the semester. As a result, this flexible study schedule permits students to take more classes per semester and to earn a certificate and degree faster.

Our Weekend University Program offers twenty-four credit undergraduate certificates in Essentials of Information Security or Information Systems Management leading to a BS in Information Technology, and Essentials of Business Application Design, or Essentials of Web Application Development leading to a BS or BA in Information Systems. On the graduate level, twelve-credit graduate certificates are available in Project Management leading to a MS in Engineering Management and a graduate certificate in Business and Information Systems Implementation leading to a MS in Information Systems. For more information about the Weekend University Program, log onto http://cpe.njit.edu/weekend/.

Degree Programs at NJIT

NJIT offers advanced studies in numerous disciplines leading to bachelor's degrees, master's degrees and doctoral degrees. There are also certificate programs and other courses of specialized study. Programs are available to full-time students and to working professionals who are interested in part-time study. Some programs are offered jointly with Rutgers-Newark or other universities. All undergraduate programs at NJIT are overseen by the Office of the Provost, East Building, Room 380, 973-596-3220.

Undergraduate Degrees

The bachelor's degree programs offered at NJIT are listed below. Most of these lead to the Bachelor of Science. The exceptions are the Bachelor of Architecture and the the Bachelor's of Arts degrees in applied mathematics, biology, computer science, history, information systems and professional and technical communication. The degree program descriptions appear later in this catalog.

Major:	Degree:	Department:
Accounting	Bachelor's	School of Management
Applied Math	Bachelor's	Mathematical Sciences
Applied Physics	Bachelor's	Physics
Applied Statistics	Bachelor's	Mathematical Sciences
Architecture	Bachelor's	NJ School of Architecture
Biocomplexity	Bachelor's	Chemistry & Environmental Science
Bioinformatics	Bachelor's	Computer Science
Biology	Bachelor's	Biological Sciences
Biomedical Engineering	Bachelor's	Biomedical Engineering
Business	Bachelor's	School of Management
Business and Information Systems	Bachelor's	Information Systems
Chemical Engineering	Bachelor's	Chemical Engineering
Chemistry	Bachelor's	Chemistry & Environmental Science
Chemistry of the Environment	Bachelor's	Chemistry & Environmental Science
Civil Engineering	Bachelor's	Civil Engineering
Communication & Media	Bachelor's	Humanities
Computational Sciences	Bachelor's	Mathematical Sciences
Computer Engineering	Bachelor's	Electrical and Computer Engineering
Computer Science	Bachelor's	Computer Science
Computer Technology	Bachelor's	Engineering Technology
Computing and Business	Bachelor's	Computer Science
Concrete Industry Management	Bachelor's	Engineering Technology
Construction Engineering Technology	Bachelor's	Engineering Technology
Construction Management Technology	Bachelor's	Engineering Technology
Digital Design	Bachelor's	NJ School of Architecture
Electrical & Computer Engineering Technology	Bachelor's	Engineering Technology
Electrical Engineering	Bachelor's	Electrical and Computer Engineering

Engineering Science	Bachelor's	Engineering Science Program
Engineering Technology	Bachelor's	Engineering Technology
Environmental Policy Studies	Bachelor's	Chemistry and Environmental Science
Environmental Science	Bachelor's	Chemistry and Environmental Science
Finance	Bachelor's	School of Management
Fine Arts	Bachelor's	NJ School of Architecture
History	Bachelor's	Federated History Dept of Rutgers-Newark & NJIT
Human-Computer Interaction	Bachelor's	Information Systems
Industrial Design	Bachelor's	NJ School of Architecture
Industrial & Manufacturing Engineering	Bachelor's	Industrial & Management Systems Engineering
Information Systems	Bachelor of Arts Bachelor of Science	Information Systems
Information Technology	Bachelor's	Information Technology Program
Interior Design	Bachelor's	NJ School of Architecture
International Business	Bachelor's	School of Management
Law, Technology & Culture	Bachelor's	Federated Department of History
Management Information Systems	Bachelor's	School of Management
Manufacturing Engineering Technology	Bachelor's	Engineering Technology
Marketing	Bachelor's	School of Management
Mathematical Biology	Bachelor's	Mathematical Sciences
Mathematics of Finance & Actuarial Science	Bachelor's	Mathematical Sciences
Mechanical Engineering	Bachelor's	Mechanical Engineering
Mechanical Engineering Technology	Bachelor's	Engineering Technology
Medical Informatics Technology	Bachelor's	Engineering Technology
Science, Technology & Society	Bachelor's	Humanities
Surveying Engineering Technology	Bachelor's	Engineering Technology
Sustainable Earth	Bachelor's	Chemistry and Environmental Science
Technological Entrepreneurship	Bachelor's	School of Management
Technology Education	Bachelor's	Engineering Technology
Telecommunications Management Technology	Bachelor's	Engineering Technology
Web and Information Systems	Bachelor's	Information Systems

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Graduate Studies

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Rebecca Thompson
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Director, University Information Systems

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Ann D. Hoang
Assistant University Librarian

Maya Gervits
Director, Architecture Library

Doreen Mettle
Director, Projects and Grants

William Reynolds
Director, Instructional Technology and Media Services

Professorships, Foundation Chairs and Sponsored Chairs

Yeshekel Bar-Ness, Ph.D.
Foundation Professor of Communications & SIgnal Processing

Joseph Bozzelli
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NJIT

Katia Passerini, PhD
Hurlburt Professor of Management Information Systems

William V. Rapp, Ph.D.
Henry J. Leir Chair in International Trade and Business

Kamalesh Sirkar, PhD
Foundation Chair of Membrane Seperations

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Director, Center for Applied Mathematics and Statistics, Mathematical Sciences

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Web Content Manager

Robert Florida
Web Content Manager

John Krane
Assistant Director

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New Media Producer

Ryan Walton
Web Developer

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Paula Krongard
Senior Associate Director

Mary Barrington
Associate Director

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Interim Vice President for Academic and Student Services

Career Development Services

Gregory Mass
Executive Director

Jo-Ann Raines
Director, Students and Alumni Career Development

Rosalind Newton
Director, Community Services and Operations Team

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Associate Vice President, Distance And Continuing Professional Education

Education Opportunity Program

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Executive Director

Kathleen Hoffman
Director, Student Support Services Program

Craig A. Stanley
Director, Consortium for Pre-College in Newark

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Associate Vice President for Enrollment Services
Dean of Admissions

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Director, University Admissions

Ivon Nunez
Acting Director, Student Fiancial Aid Services

Joseph Thompson
University Registrar

Physical Education and Athletics

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Senior Administrator for Athletics, Intramurals, Physical Education and Recreation

Alexis Schug
Associate Director, Athletics

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Assistant Vice President, Pre-College Programs

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Director, TRIO Education
Director, Upward Bound

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Director, International Students and Faculty, Graduate Studies

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Associate Dean

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Director, Residence Life

Barbara Davis, M.D.
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Marybeth Boger, Ph.D.
Director, University Learning Center

Donna Minnich-Spuhler
Acting Assistant Dean and Director, Campus Center

Center for First Year Students

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Associate Dean for First Year Students

Margo Burnett
Coordinator, Testing and Placement

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Brian Tierney, J.D.
Assistant General Counsel for Legal Affairs

Christine S. Li, J.D.
Assistant Counsel for Legal Affairs

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Robert Florida
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John Krane
Assistant Director

James E. Marko
New Media Producer

Ryan Walton
Web Developer

About

Board of Overseers

Home » About » Administration » Governing Boards » Board of Overseers

The NJIT Board of Overseers serves as the governing body for the Foundation at NJIT, a 501(c) (3) tax-exempt organization which is the fundraising arm of the university. The Board of Overseers has fiduciary responsibility for the Foundation, provides a leadership role in fundraising, and provides a critical link between academe and the business community, providing information on corporate and state priorities and assisting NJIT in meeting research and funding goals.

- Bylaws (pdf, 27 KB)
- Excellence in Research Prize and Medal
- Excellence in Service Award
- Membership
- 2013 Schedule of Meetings
- Presentations to the Board

Related Links

- Organizational Chart (pdf)

Quick Facts About NJIT
Board of Trustees
History & Mission
Administration
Office of the President
Senior Administration
Governing Boards
Board of Trustees
Board of Overseers
- Excellence in Research Prize and Medal
- Excellence in Service Award
Boards of Visitors
Faculty Council
Administrative Departments
Academic Departments
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STUDENT PROFILE

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ALUMNI PROFILE

His Hardware Is On Mars

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

Related Links

- Organizational Chart (pdf)

All documents are in PDF format. Download the free PDF reader.

LATEST:

- July 25, 2013 -- Public Session Document
- June 06, 2013 -- Public Session Document
- May 23, 2013 -- **Special Meeting Notice**
- Apr 12, 2013 -- Public Session Document
- Mar 06, 2013 -- **Special Meeting Notice**

- Membership
- Schedule of Meetings, 2012-2014
- Minutes of Meetings, 2013-2014
  - Minutes Archives

- Resolutions, 2013-2014
  - Resolutions Archives

- By-Laws of the NJIT Board of Trustees
- Procedures for Public Participation
- FY12 Campus Budget Hearing

Emeritus Faculty

Badenhausen, Otto
Assistant Professor Emeritus, Federated History (1967).
Hamilton College, B.A., 1954.
Berlin Free University, M.A., 1959.

Barkan, Herbert
Professor Emeritus, Mathematical Sciences, Mathematical Sciences (1946).
Brooklyn College, B.A., 1944.
Columbia University, M.A., 1945.

Bertsch, Carl V.
Emeritus Professor
University of Michigan, B.S., 1928.
University of Michigan, M.S., 1931.
University of Michigan, Ph.D., 1937.

Buteau, Leon
Professor, Physics (1959).
Newark College of Engineering, B.S.M.E., 1958.
Stanford University, M.S., 1959.
University of Florida, Ph.D., 1963.

Camp, James E.
Professor Emeritus (1963).
Louisiana State University, B.A., 1949.
University of Michigan, Ph.D., 1965.
Columbia University, M.A., 1952.

Carluccio, Joseph
Associate Professor Emeritus, Electrical & Computer Engineering (1957).
Newark College of Engineering, B.S., 1946.
Newark College of Engineering, M.S., 1952.

Carr, William
Professor, Electrical & Computer Engineering (1986).
Carnegie Institute of Technology, B.S., 1959.
Carnegie Institute of Technology, M.S., 1959.
Carnegie Institute of Technology, Ph.D., 1962.
Southern Methodist University, M.S., 1966.

Chakrabarti, Alok
Distinguished Professor, School of Management (1989).
Foundation Chair, Management of Technology
Jadavpur University, B.Ch.E., 1963.
Indian Institute of Technology, M.B.A., 1966.
Northwestern University, Ph.D., 1972.

Cohen, Edwin
Professor Emeritus, Electrical & Computer Engineering (2002).

Deutschman, Aaron
Professor Emeritus, Mechanical and Industrial Engineering

DiMatteo, John
Associate Professor Emeritus, Mechanical and Industrial Engineering (1966).
Cooper Union, B.S., 1931.
Stevens Institute of Technology, M.S., 1950.

Droughton, John
Professor Emeritus, Mechanical and Industrial Engineering (2004).

Duursema, Charles H.
Associate Professor Emeritus
Newark College of Engineering, B.S., 1933.
Montclair State College, M.S., 1936.

Elwell Jr., David
Associate Professor, College of Architecture and Design (1975).
Yale University, B.S., 1957.
Cambridge University, B.A., 1963.
Princeton University, M.F.A., 1965.

Engler, Peter
Associate Professor Emeritus, Biomedical Engineering (1984).
McGill University, B.Eng., 1957.
Cornell University, M.S.E.E., 1961.
State University of New York at Buffalo, Ph.D., 1974.

Fenster, Saul
President and Professor Emeritus, Mechanical and Industrial Engineering (1978).
City College of New York, B.M.E., 1953.
Columbia University, M.S., 1955.
University of Michigan, Ph.D., 1959.

Frank, Joseph
Associate Professor Emeritus, Electrical & Computer Engineering (1968).
City College of New York, B.E.E., 1952.
Columbia University, M.S.E.E., 1960.
Polytechnic Institute of New York, Ph.D., 1975.

Gage, Howard
Associate Professor Emeritus, Industrial and Manufacturing Engineering (1972).
City College of New York, B.M.E., 1960.
New York University, M.M.E., 1965.
New York University, Ph.D., 1972.

Getzin, Donald
Associate Professor, Chemistry and Environmental Science (1965).

Goldberg, Vladislav
Distinguished Professor Emeritus, Mathematical Sciences (1982).
Moscow State University, M.S., 1958.
Moscow State University, Ph.D., 1961.

Granik, Gerald
Professor Emeritus, Mathematical Sciences (1952).
Newark College of Engineering, B.S., 1950.
Newark College of Engineering, M.S., 1954.
Stevens Institute of Technology, M.S., 1958.
Stevens Institute of Technology, Sc.D., 1965.

Greenfeld, Joshua
Professor, Civil and Environmental Engineering
Ohio State University, PhD
Ohio State University, MSc
Tel Aviv University, BA

Greenfield, Sanford
Professor Emeritus, College of Architecture and Design (1981).
Massachusetts Institute of Technology, B.Arch., 1952.
Massachusetts Institute of Technology, M.Arch., 1954.
Harvard University, Ed.M., 1975.

Grow, James
Professor, Chemistry and Environmental Science (1977).
Oregon State University, PhD, 1974.
University of Wisconsin, MS, 1972.
University of Illinois at Urbana-Champaign, BS, 1968.

Helfgott, Roy
Distinguished Professor Emeritus, School of Management (1968).
City College of New York, B.S., 1948.
Columbia University, M.A., 1949.
New School for Social Research, Ph.D., 1957.

Herman, Harry
Professor Emeritus, Mechanical and Industrial Engineering (1964).
Cooper Union, B.M.E., 1948.
Columbia University, M.S., 1956.
Polytechnic Institute of Brooklyn, Ph.D., 1964.

Hiltz, Starr Roxanne
Distinguished Professor, Information Systems (1985).
Vassar College, A.B., 1963.
Columbia University, M.A., 1964.
Columbia University, Ph.D., 1969.

Hodge, Elizabeth
Professor Emeritus, Humanities (2007).

Hrycak, Peter
Professor Emeritus, Mechanical and Industrial Engineering (1993).
University of Minnesota, PhD, 1960.
University of Minnesota, MS, 1955.
University of Minnesota, BS, 1954.

Hsieh, Jui S.
Professor Emeritus, Mechanical and Industrial Engineering (1960).
Wuhan University, B.E., 1943.
University of Kentucky, M.S., 1950.
Ohio State University, Ph.D., 1955.

Huang, Ching-Rong
Professor Emeritus, Chemical Biological and Pharmaceutical Engineering (1966).
National Taiwan University, B.S., 1954.
Massachusetts Institute of Technology, M.S., 1958.
University of Michigan, M.S., 1965.
University of Michigan, Ph.D., 1966.

Jaffe, William J.
Distinguished Professor Emeritus (1946).
Columbia University, M.S., 1941.
New York University, B.S., 1930.
New York University, Engr.Sc.D., 1953.
Columbia University, M.A., 1931.

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Montclair State College, M.A., 1951.
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Newark College of Engineering, B.S., 1962.
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City College of New York, B.A., 1956.
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Professor Emeritus, Electrical & Computer Engineering (2002).

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City College of New York, B.C.E., 1938.
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University of Oslo, B.A.Eng., 1943.
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Newark College of Engineering, B.S., 1946.
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Rosemont College, B.S., 1960.
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Stevens Institute of Technology, M.S., 1952.
New York University, M.Aero.E., 1959.

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Newark College of Engineering, B.S.C.E., 1958.
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University of Michigan, B.S., 1949.
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Wayne State University, B.F.A., 1967.
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City College of New York, B.B.A., 1951.
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Rutgers University, M.S., 1996.
Rutgers University, Ph.D., 1998.

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University of Colombia, B.B.A., 1982.
Cranfield University, M.B.A., 1984.
Cranfield University, M. Phil., 1986.
Drexel University, Ph.D., 1994.

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Stevens Institute of Technology, B.S.E.E., 1959.
Newark College of Engineering, M.S.E.E., 1964.
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Stevens Institute of Technology, Ph.D., 1973.

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New Jersey Institute of Technology, B.S.E.E., 1982.
University of Michigan, M.S.E.E., 1983.
Purdue University, Ph.D., 1988.

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Rutgers University, B.S., 1992.
Johns Hopkins University, M.S.E., 1994.
University of Pennsylvania, Ph.D., 1999.

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Director, Pharmaceutical Engineering Program (2002).
University of Rome, Laurea in Ingeneria Chimica, 1977.
University of Virginia, Ph.D., 1984.

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Purdue University, B.S., 1984.
Illinois Institute of Technology, M.S., 1992.
Illinois Institute of Technology, Ph.D., 1995.

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Teheran University, B.S., 1965.
Illinois State University, M.S., 1968.
University of Wisconsin, Ph.D., 1984.

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Interim Chairperson, Computer Science (2006).
University of Connecticut, B.S.E.E., 1968.
University of Connecticut, M.S., 1973.
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Brown University, Ph.D., 1969.

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New Jersey Institute of Technology, B.S., 1980.
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Massachusetts Institute of Technology, Ph.D., 1990.

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Northeastern University, B.S., 1967.
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New York University, B.Ch.E., 1957.
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Seattle University, B.S., 1962.
University of Pittsburgh, M.S., 1965.
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Northwestern University, Ph.D., 1987.

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Clemson University, Ph.D., 1987.

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Director of Statistics Program, Mathematical Sciences (2003).
Calcutta University, B.S., 1958.
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Polytechnic Institute of Brooklyn, B.S., 1965.
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City College of New York, B.S., 1971.
Columbia University, M.B.A., 1975.
Polytechnic Institute of New York, M.S., 1976.
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Bernard M. Baruch College, B.A., 1976.
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Trinity College, Cambridge University, B.A., 1979.
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Columbia University, B.S., 1989.
Brown University, M.S., 1991.
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Marietta College, B.S., 1964.
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Moscow State University, Ph.D., 2000.

Katz, David
Research Associate, Electrical & Computer Engineering (2004).
Hebrew University of Jerusalem, B.Sc., 1997.
Hebrew University of Jerusalem, M.Sc., 1999.
Hebrew University of Jerusalem, Ph.D., 2004.

Korikov, Alexander
Fellow, Chemical Engineering (2001).
Moscow State University, M.S., 1997.
Russian Academy of Science, Ph.D., 2001.

Lanzerotti, Louis
Distinguished Research Professor, Physics (2002).
University of Illinois, B.S., 1960.
Harvard University, A.M., 1963.
Harvard University, Ph.D., 1965.

Lee, Jeongwoo
Associate Research Professor (2000).
Seoul National University, B.S., 1985.
Seoul National University, M.S., 1987.
California Institute of Technology, Ph.D., 1994.

Lee, Sang Gu
Visiting Professor

Levkov, Serhiy
Research Professor, Electrical & Computer Engineering (1995).
Ukrainian Academy, Diploma, 1976.
Kyiv Polytechnic Institute, Ph.D., 1992.

Marquette, William
Site Director/Chief Observer, Physics

Moore, Carrie
Research Assistant, Architecture

Moyal, Pascal
Fellow, Mathematical Sciences (2004).
Universite de Versailles - St. Quentin, B.Sc.
Universite Paris VI, M.S., 2000.
Universite Paris VI, M.S., 2001.
Ecole Nationale Suprieure, Ph.D., 2004.

Nie, Xiliang
Research Associate (2004).
Wuhan University, B.S., 1983.
Wuhan University, M.S., 1991.
Wuhan University, Ph.D., 1994.

Nita, Gelu
Assistant Research Professor (2003).
University of Bucharest, B.S., 1987.
New Jersey Institute of Technology, Ph.D., 2004.

Olsen, Richard
Director, Healthcarre and Aging, Architecture

Pang, Edward
Research Architect, Architecture (2004).
University of British Columbia, B.A., 1989.
University of Oregon, M.Arch., 1995.

Rapp, William V.
Henry J. Leir Chair in International Trade and Business Research Professor, Management (2000).
Amherst College, B.A., 1961.
Yale University, M.A., 1962.
Stanford University, M.A., 1970.
Yale University, Ph.D., 1966.

Ren, Deqing
Research Scientist, Physics (2004).

Rodriguez, M. Pilar Montanes
Assistant Research Professor, Physics (2004).

Romano, Paul
Research Architect, Architecture (2004).
Pratt Institute, B.Arch., 1992.

Salinas Weber, Carlos
Visiting Assistant Professor, Architecture (2003).
University of San Juan (Argentina), M.A., 1993.
University of Illinois at Chicago, M.A., 2000.

Schoenitz, Mirko
Assistant Research Professor, Mechanical Engineering (2003).
RWTH Aachen, Diploma, 1995.
Princeton University, M.A., 1997.
Princeton University, Ph.D., 2001.

Simmens, Herbert
Urban Fellow, Architecture (2004).
University of Pennsylvania, B.A., 1969.
Princeton University, M.P.A.U.P., 1971.

Simone, Lisa
Research Professor, Biomedical Engineering

Tritschler, Alexandra
Research Associate, Physics

Ugural, Ansel
Research Professor, Mechanical Engineering (2001).
Ankara Technical College, Diploma, 1956.
University of Wisconsin, M.S., 1962.

Yamauchi, Yohei
Research Scientist, Physics

Yang, Guo
Research Associate (2004).
Nanjing University, B.S., 1995.
Nanjing University, M.S., 1998.
New Jersey Institute of Technology, Ph.D., 2004.

Young, Ming-wan
Research Professor, Chemical Engineering

Yetim, Fahri
Research Scholar, Information Systems (2004).

Applied Physics

Administered By: Physics Departments of NJIT and Rutgers-Newark

Administration

Chairperson (NJIT)	N M. Ravindra
Chairperson (Rutgers-Newark)	Grace Spruch
Coordinators of Joint Graduate Programs	Haimin Wang
Undergraduate Program Advisors	Keun H. Ahn, Andrew J. Gerrard, Andrei Sirenko, Gordon A. Thomas, Tao Zhou
Administrative Coordinator	Renee Crawley
Administrative Assistant	Leslie M. Williams
Customer Service Representative	Cindy Montalvo-Harden

NJIT Faculty

Distinguished Professors	Philip R. Goode, Roland A. Levy, Haimin Wang, John F. Federici, Dale E. Gary, Ian Gatley, Trevor A. Tyson
Professors	Andrei Sirenko, Andrew J. Gerrard, Ken K. Chin, N M. Ravindra, Gordon A. Thomas, Andrei Sirenko, Andrew J. Gerrard
Associate Professors	Nissim M. Towfik, Onofrio L. Russo, Camelia Prodan, Tao Zhou
Assistant Professors	Wenda Cao, Keun H. Ahn
Distinguished Research Professors	Louis J. Lanzerotti
Research Professors/Special Lecturers	Reginald Farrow, Anthony T. Fiory, Oktay H. Gokce, Richard H. Janow, Jeongwoo Lee, Libarid A. Maljian, Gelu M. Nita, Halina Opyrchal, Jan Opyrchal, Slawomir Piatek, Vitaly A. Shneidman, George E. Georgiou, Andres Jerez

Rutgers- Newark Faculty

Professors Rank II	Daniel Murnick
Professor	Zhen Wu
Associate Professor	Martin Schaden
Associate Professor Lecturer	John Rollino
Administrative Assistant	Elizabeth Wheeler

Applied physics is the study of the basic laws of nature and their application to modern technologies.

The B.S. in Applied Physics program is designed to give students a broad background in physics while at the same time relating this background to applications used in technology-based industries including optical science and photonics, biophysics, astronomy/astrophysics, semiconductors, solar cells, and microelectronics (using NJIT's clean room facility). The curriculum is structured around three different concentrations (Optical Science and Engineering, Astronomy and Astrophysics, Biophysics). However, there is flexibility in the curriculum to allow students to pursue a broad exposure to several major areas of physics. For students that are potentially interested in attending Medical School, the Biophysics concentration is suggested.

For students who are interested in physics, as well as, computer science, a Dual Major in Applied Physics and Computer Science (B.S. program) is offered. Students who have a strong interest in Math may also consider the Dual Major in Applied Physics and Mathematics. As an Applied Physics major, students may also participate in an Accelerated Pre-Medical/Pre-Dental/Pre/Law program through NJIT's Honors College. Students who are interested in a teaching career have the option of earning a Teaching Certificate in conjunction with their undergraduate degree.

The B.S. in Applied Physics is a joint degree program offered by NJIT and Rutgers-Newark.

B. S. in Applied Physics - Astronomy Option (127 Credits)

FIRST YEAR:

1st Semester:

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.

HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
Math 111	Calculus I (4-1-4)
CS 113	Introduction to Computer Science (3-0-3) ***or***
CS 115	Intro. to CS I in C++ (3-0-3)
Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
Chem 125	General Chemistry I (3-0-3)
Fresh Sem	(Freshman Seminar) (1-0-0)

2nd Semester:

Phys 114	Introduction to Data Reduction with Applications (3-0-3)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
Math 112	Calculus II (4-1-4)
Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
Chem 126	General Chemistry II (3-0-3)
Chem 124	General Chemistry Laboratory (0-2-1)
Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR:

1st. Semester:

Math 211	Calculus III A (3-0-3)
Math 225	Survey of Probability and Statistics (1-0-1)
Phys 234	Physics III (3-0-3)
Phys 231A	Physics III Laboratory (0-2-1)
Elective	(Social Science:GUR) (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Elective	(Physical Education:GUR) (0-1-1)

2nd Semester:

Math 222	Differential Equations (4-0-4)
Math 328	Mathematical Methods for Scientists and Engineers (3-0-3)

		Phys 335	Introductory Thermodynamics (3-0-3)
		Elective	(Social Science:GUR) (3-0-3)
		Elective	(Cultural History:GUR) (3-0-3)

THIRD YEAR:
Astronomy & Astrophysics Option
1st Semester:

		Phys 418	Fundamentals of Optical Imaging (2-2-3)
		Phys 432	Electromagnetism I (3-0-3)
		Phys 320	Astronomy and Astrophysics I (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		Phys 430	Classical Mechanics I (3-0-3)

2nd Semester:

		Phys 433	Electromagnetism II (3-0-3)
		Phys 321	Astronomy and Astrophysics II (3-0-3)
		Elective	(Math) (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)
		Elective	(Lit/Hist/Phil/STS/SS/THTR:GUR) (3-0-3)
		Elective	(Math/Phys/CS)

FOURTH YEAR:
Astronomy & Astrophysics Option
1st Semester:

		Phys 420	Special Relativity (3-0-3)
		Phys 442	Introduction to Quantum Mechanics (3-0-3)
		Elective	(Math/Phys/CS)
		Elective	(Technical)
		Elective	(Management:GUR) (3-0-3)

2nd Semester:

		Phys 322	Observational Astronomy (3-0-3)
		Phys 421	General Relativity (3-0-3)
		Phys 450	Advanced Physics Laboratory (1-4-3)
		Elective	(Technical) (3-0-3)
		Elective	(Technical) (3-0-3)

B.S. in Applied Physics - Optical Science and Engineering Concentration (127 credits)

FIRST YEAR:
1st Semester:

		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Math 111	Calculus I (4-1-4)
{		CS 113	Introduction to Computer Science (3-0-3) ***or***
		CS 115	Intro. to CS I in C++ (3-0-3)
		Chem 125	General Chemistry I (3-0-3)
		Fresh Sem	(Freshman Seminar) (1-0-0)

2nd Semester:

		Phys 114	Introduction to Data Reduction with Applications (3-0-3)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)

Math 112	Calculus II (4-1-4)
Chem 126	General Chemistry II (3-0-3)
Chem 124	General Chemistry Laboratory (0-2-1)
Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR:
1st Semester:

Math 211	Calculus III A (3-0-3)
Math 225	Survey of Probability and Statistics (1-0-1)
Phys 234	Physics III (3-0-3)
Phys 231A	Physics III Laboratory (0-2-1)
Elective	(Social Science:GUR) (3-0-3)
Elective	(Eng/Comm. or Cultural History:GUR) (3-0-3)
Elective	(Physical Education:GUR) (0-1-1)

2nd Semester:

Math 222	Differential Equations (4-0-4)
Math 328	Mathematical Methods for Scientists and Engineers (3-0-3)
Phys 335	Introductory Thermodynamics (3-0-3)
Elective	(Social Science:GUR) (3-0-3)
Elective	(Cultural History:GUR) (3-0-3)

THIRD YEAR:
Optical Science Option
1st Semester:

OPSE 301	Introduction to Optical Science and Engineering (3-0-3)
Phys 418	Fundamentals of Optical Imaging (2-2-3)
Phys 430	Classical Mechanics I (3-0-3)
Phys 432	Electromagnetism I (3-0-3)
Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)

2nd Semester:

Phys 433	Electromagnetism II (3-0-3)
Phys 446	Solid State Physics (3-0-3)
OPSE 402	High Power Laser and Photonics Applications (3-0-3)
Elective	(Free) (3-0-3)
Elective	(Eng/Hist/Lit/Phil/STS/SS/THTR:GUR) (3-0-3)
Elective	(Phys/OPSE) (3-0-3)

FOURTH YEAR:
Optical Science Option
1st Semester:

Phys 442	Introduction to Quantum Mechanics (3-0-3)
Elective	(Technical) (3-0-3)
Elective	(Management) (3-0-3)
Elective	(Technical) (3-0-3)
Elective	(Phys/OPSE/EE) (3-0-3)

2nd Semester:

OPSE 310	Virtual Instrumentation (3-0-3)
Phys 450	Advanced Physics Laboratory (1-4-3)
Elective	(Phys/EE) (3-0-3)
Elective	(Technical) (3-0-3)
Elective	(Capstone Seminar) (3-0-3)

B. S. Double Major in Applied Physics and Applied Mathematics (130 credits)

FIRST YEAR:

1st Semester:

HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
Math 111	Calculus I (4-1-4)
CS 113	Introduction to Computer Science (3-0-3) ***or***
CS 115	Intro. to CS I in C++ (3-0-3)
Chem 125	General Chemistry I (3-0-3)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

Phys 114	Introduction to Data Reduction with Applications (3-0-3)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
Math 112	Calculus II (4-1-4)
Chem 126	General Chemistry II (3-0-3)
Chem 124	General Chemistry Laboratory (0-2-1)
Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR:

1st Semester:

Math 213	Calculus III B (4-0-4)
Math 244	Introduction to Probability Theory (3-0-3)
Phys 234	Physics III (3-0-3)
Phys 231A	Physics III Laboratory (0-2-1)
Elective	(Social Science:GUR) (3-0-3)
Elective	(Eng/Comm or Cultural History:GUR) (3-0-3)

2nd Semester:

Math 222	Differential Equations (4-0-4)
Math 328	Mathematical Methods for Scientists and Engineers (3-0-3)
Phys 335	Introductory Thermodynamics (3-0-3)
HSS21X	(Cultural History:GUR) (3-0-3)
Elective	(Social Science:GUR) (3-0-3)
Elective	(Physical Education:GUR) (0-1-1)

THIRD YEAR:

1st Semester:

Math 337	Linear Algebra (3-0-3)
Phys 430	Classical Mechanics I (3-0-3)
Phys 432	Electromagnetism I (3-0-3)
Math 227	Mathematical Modeling (4-0-4) ***or***
Elective	(Math300+ elective) (GUR:3-0-3)
Math 332	Introduction to Functions of a Complex Variable (3-0-3)
Elective	(Eng/Lit/Hist/Phil/STS:GUR) (3-0-3)

2nd Semester:

Math 340	Applied Numerical Methods (3-1-3)
Math 331	Introduction to Partial Differential Equations (3-0-3)
Phys/OPSE	(Physics/OPSE Elective) (3-0-3)
Phys/OPSE	(Physics/OPSE Elective) (3-0-3)
Phys 433	Electromagnetism II (3-0-3)

FOURTH YEAR:

1st Semester:

		Math 480	Introductory Mathematical Analysis (3-0-3)
		Phys 442	Introduction to Quantum Mechanics (3-0-3)
		Math 473	Intermediate Differential Equations (3-0-3)
		Elective	(Eng/Hist/Lit/Phil/STS/SS/THTR:GUR) (3-0-3)
		Math 450H	Methods of Applied Mathematics I (Capstone I) (3-0-3)

2nd Semester:

		Elective	(Management:GUR) (3-0-3)
		HSS40X	(Capstone Seminar:GUR) (3-0-3)
		Phys 450	Advanced Physics Laboratory (1-4-3)
		Math 451H	Methods of Applied Mathematics II (Capstone II) (3-0-3)
		Phys/OPSE	(Physics/OPSE Elective) (3-0-3)

BS/MD Accelerated Program in Applied Physics (115 credits)

FIRST YEAR:

1st Semester: (18 credits)

		R120:101	General Biology I (3-3-4)
		Chem 125	General Chemistry I (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 111	Calculus I (4-1-4)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (19 credits)

		Chem 124	General Chemistry Laboratory (0-2-1)
		Chem 126	General Chemistry II (3-0-3)
		Math 112	Calculus II (4-1-4)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		R120:102	General Biology II (3-3-4)
		Elective	(Social Science) (GUR) (3-0-3)

Summer I: (6 credits)

{		CS 113	Introduction to Computer Science (3-0-3) ***or***
		CS 115	Intro. to CS I in C++ (3-0-3)
		Math 211	Calculus III A (3-0-3)

SECOND YEAR:

1st Semester: (18 credits)

		Elective	(Cultural History:GUR) (3-0-3)
		R120:301	Foundations of Biology: Cell and Molecular Biology (3-0-3)
		Phys 234	Physics III (3-0-3)
		Phys 231A	Physics III Laboratory (0-2-1)
		Chem 243	Organic Chemistry I (3-0-3)
		Elective	(Eng., Comm. or Cult. History:GUR) (3-0-3)

		Elective	(Physical Education:GUR) (0-1-1)

2nd Semester: (17 credits)

		Math 328	Mathematical Methods for Scientists and Engineers (3-0-3)
		Math 222	Differential Equations (4-0-4)
		Elective	(Social Science:GUR) (3-0-3)
		Chem 244	Organic Chemistry II (3-0-3)
		Math 225	Survey of Probability and Statistics (1-0-1)
		Phys 335	Introductory Thermodynamics (3-0-3)

Summer II: (6 credits)

		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		Elective	(Management:GUR) (3-0-3)

THIRD YEAR

1st Semester: (16 credits)

		Elective	(Physical Education:GUR) (0-1-1)
		Phys 430	Classical Mechanics I (3-0-3)
		Phys 432	Electromagnetism I (3-0-3)
		OPSE 301	Introduction to Optical Science and Engineering (3-0-3)
		Phys 350	Biophysics I (3-0-3)
		Phys 442	Introduction to Quantum Mechanics (3-0-3)

2nd semester: (15 credits)

		Elective	(Eng/Hist/Lit/Phil/STS/SS/THTR:GUR) (3-0-3)
		Phys 451	Biophysics II (3-0-3)
		OPSE 410	Biophotonics (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)
		Phys 433	Electromagnetism II (3-0-3)

BS Dual Major in Computer Science and Applied Physics (135 credits)

FIRST YEAR:

1st Semester: (17 credits)

		CS 113	Introduction to Computer Science (3-0-3)
		CS 113A	Lab (0-1.5-0)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Math 111	Calculus I (4-1-4)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Chem 125	General Chemistry I (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (18 credits)

		CS 114	Introduction to Computer Science II (3-0-3)
		CS 114A	Lab (0-1.5-0)
		Phys 114	Introduction to Data Reduction with Applications (3-0-3)

		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		Math 112	Calculus II (4-1-4)
		Chem 126	General Chemistry II (3-0-3)
		Chem 124	General Chemistry Laboratory (0-2-1)

SECOND YEAR:

1st Semester: (17 credits)

		CS 280	Programming Language Concepts (3-0-3)
		Math 211	Calculus III A (3-0-3)
		Phys 234	Physics III (3-0-3)
		Phys 231A	Physics III Laboratory (0-2-1)
		SS	(Social Science:GUR) (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Elective	(Physical Education) (0-1-1)

2nd Semester: (19 credits)

		CS 288	Intensive Programming in Linux (3-0-3)
		Math 222	Differential Equations (4-0-4)
{		Math 335	Vector Analysis (3-0-3) ***or***
		Math 328	Mathematical Methods for Scientists and Engineers (3-0-3)
		Phys 335	Introductory Thermodynamics (3-0-3)
		SS	(Social Science:GUR) (3-0-3)
		HSS	(Cultural History:GUR) (3-0-3)

THIRD YEAR:

1st Semester: (18 credits)

		CS 252	Computer Organization and Architecture (3-0-3)
		IS 350	Computers, Society and Ethics (3-0-3)
		CS 241	Foundations of Computer Science I (3-0-3)
		Math 333	Probability and Statistics (3-0-3)
		Phys 430	Classical Mechanics I (3-0-3)
		Phys 432	Electromagnetism I (3-0-3)

2nd Semester: (16 credits)

		CS 435	Advanced Data Structures and Algorithm Design (3-0-3)
		CS 332	Principles of Operating Systems (3-0-3)
		Elective	(Physics/OPSE 300/400 Elective) (3-0-3)
		OPSE 310	Virtual Instrumentation (3-0-3)
		Elective	(Management:GUR) (3-0-3)
		Elective	(Physical Education) (0-1-1)

FOURTH YEAR:

1st Semester: (15 credits)

		CS 341	Foundations of Computer Science II (3-0-3)
		CS 490	Guided Design in Software Engineering (3-0-3)
		CS 431	Database System Design and Management (3-0-3)
		Phys 442	Introduction to Quantum Mechanics (3-0-3)

		Phys 485	Computer Modeling of Applied Physics Problems (3-0-3)

2nd Semester: (15 credits)

{		CS 491	Senior Project (3-0-3) ***or***
		Phys 490	Independent Study (3-0-3)
		Elective	(Eng/Hist/Lit/Phil/STS/SS/Thtr:GUR) (3-0-3)
		Elective	(Physics 300/400 Elective) (3-0-3)
		Elective	(CS Elective) (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)

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.

Refer to the General University Requirement section of this catalog for further information on GUR electives

Co-op

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 and Phys 411 are taken for degree Credit with permission.

Architecture

Administered By: College of Architecture and Design

Administration

Dean	Urs P. Gauchat
Associate Dean for Academic Affairs	John M. Cays
Associate Dean for Administrative Affairs	Margaret Fitzpatrick
Director for School of Architecture	Darius T. Sollohub
Director, Graduate Architecture Programs	Keith A. Krumwiede
Manager of Graduate Programs	Frederick A. Little

Faculty

Distinguished Professor	Zeynep Celik, G M. Mostoller
Professors	Karen A. Franck, Urs P. Gauchat, Glenn Goldman, David L. Hawk* , Peter C. Papademetriou, Antonio P. De Sousa Santos
Associate Professors	Gabrielle Esperdy, Sandy Moore, Anthony W. Schuman, Darius T. Sollohub, Donald R. Wall, Michael S. Zdepski, Richard J. Garber, Georgeen Theodore, John R. Russo, Keith A. Krumwiede
Assistant Professors	Andrzej Zarzycki, Matther Burgermaster, Martina Decker, Jesse W. Lecavalier
Research Professors	Ervin Bales

Advisors

Lead Undergraduate Advisor	Frederick A. Little
Undergraduate Advisor	Amada Belton

* Joint appointee with the School of Management.

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. A program may be granted a 6-year, 3-year, or 2-year term of accreditation, depending on the extent of its conformance with established educational standards.

Master's degree programs may consist of a professional undergraduate degree and a professional graduate degree that, when earned sequentially, constitute an accredited professional education. However, the professional degree is not, by itself, recognized as an accredited degree.

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 courses in history, building science 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 technological university with its extensive capacity in computer graphics while emphasizing design directed toward the traditional human-centered values of architecture.

The total time needed to earn a Bachelor of Architecture (the first professional degree) at NJIT is five years.

The curriculum as described below is for students entering NJIT as freshmen in the fall of 2000 or after that date. Students entering before that date may have a different program and should consult the school to learn which curriculum applies.

Credit distribution for the Bachelor of Architecture (B.Arch)

Credit distribution for the Bachelor of Architecture (B.Arch.) :

Required architecture credits	97
Architecture electives	12
Free electives	9
General University Requirements	46
	*164

The New Jersey School of Architecture also offers a nonprofessional, four-year undergraduate program leading to the Bachelor of Science (B.S.) in Architecture. The B.S. does not lead to licensure as an architect; instead it presents students with a wide array of other options leading to career opportunities within the building industry. Students can be admitted to the B.S. in Architecture program as a freshman or transfer from the B.Arch. program after two years. The B.S. in Architecture program requires 135 credits and is structured as follows:

The first two years of the B.S. in Architecture program are identical to the course of study for the five-year professional program.

In the third year, all B.S. students take Arch 363 followed by a computer elective. Thus every student has at least one full year of computer-based learning. The B.S. in Architecture is designed to lead into a series of accelerated graduate degree programs in fields such as construction management (B.S. in Architecture/M.S. in Civil Engineering), infrastructure planning (B.S. in Architecture/Master in Infrastructure Planning), management (B.S. in Architecture/M.S. in Management; B.S. in Architecture/M.B.A. in Management of Technology), or a professional graduate degree in Architecture (B.S. in Architecture/Master of Architecture) leading to licensure. Graduate-level course descriptions for those listed in the dual degree programs description are located in the NJIT Graduate Catalog.

Course choices are worked out on an individual basis after consultation with the academic advisor to reflect a student's individual interests and career objectives. The B.S. in Architecture provides a wide array of curriculum paths; it is designed to provide a superb general education for all building professionals.

Bachelor of Architecture (164 credits)

FIRST YEAR:
1st Semester: (14 Credits)

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.

		Arch 155	Modes of Design Communication I (2-3-3)
		Arch 163	Introduction to Design I (1-12-5)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
{		Math 107	University Mathematics BI (3-0-3) ***or***
		Math 113	Finite Mathematics and Calculus I (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (15 Credits)

		Arch 156	Modes of Design Communication II (2-4-3)
		Arch 164	Introduction to Design II (1-12-5)
	#	HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Math 120	Basic Concepts in Statistics (1-0-1)
{		Math 113	Finite Mathematics and Calculus I (3-0-3) ***or***
		Math 115	Elements of Geometry (3-0-3)

SECOND YEAR:
1st Semester: (18 Credits)

		Arch 223	Construction I (3-0-3)
	****	Arch 251	History of Architecture I (3-0-3)
		Arch 263	Architecture Studio I (1-12-5)
		Phys 102	General Physics (3-0-3)
		Phys 102A	General Physics Laboratory (0-2-1)
		Elective	(Cultural History:GUR) (3-0-3)

2nd Semester: (18 Credits)

		Arch 227	Environmental Control Systems I (3-0-3)
		Arch 229	Structures I (3-0-3)
		Arch 252	History of Architecture II (3-0-3)
		Arch 264	Architecture Studio II (1-12-5)
		Phys 103	General Physics (3-0-3)
		Phys 103A	General Physics Laboratory (0-2-1)

THIRD YEAR:
1st Semester: (17 Credits)

		Arch 327	Environmental Control Systems II (3-0-3)
		Arch 329	Structures II (3-0-3)
		Arch 363	Architecture Studio III (1-12-5)
		Arch 381	History of Architecture III (3-0-3)
		CS 104	Computer Programming and Graphics Problems (3-0-3)

2nd Semester: (17 Credits)

		Arch 323	Construction II (3-0-3)
		Arch 364	Architecture Studio IV (1-12-5)
	****	Arch 382	History of Architecture IV (3-0-3)
		Arch 472	Architectural Programming and Project Development (3-0-3)
		Elective	(Basic SS:GUR) (3-0-3)

FOURTH YEAR:

1st Semester: (15 Credits)

	Arch 423	Construction III (3-0-3)
	Arch 429	Structures III (3-0-3)
	Arch 463	Option Studio 1 (1-12-5)
	PE XXX	(Physical Education: GUR) (0-1-1)
	Arch XXX	(Architecture Elective) (3-0-3)

2nd Semester: (15 Credits)

	Arch 464	Option Studio II (1-12-5)
	Elective	(Humanities Elective: Lit/Hist/Phil/STS GUR) (3-0-3)
	PE XXX	(Physical Education: GUR) (0-1-1)
	Elective	(Basic SS:GUR) (3-0-3)

FIFTH YEAR:
1st Semester: (17 Credits)

***	Arch 563	Comprehensive Studio I (1-12-5)
	Arch 558	Professional Architectural Practice (3-0-3)
	Arch XXX	(Architecture) (3-0-3)
	Arch XXX	(Architecture) (3-0-3)
	Elective	(Open Humanities:GUR) (3-0-3)

2nd Semester: (18 Credits)

	Arch 526	Building Systems VIII (0-3-3)
	Arch 564	Comprehensive Studio II (1-12-5)
	Arch 565	Comprehensive Studio Lab (0-3-1)
	Arch XXX	(Architecture) (3-0-3)
	Free Elective	(Free Elective) (3-0-3)
	Mgmt 390	Principles of Management (3-0-3)
	HSS	(Humanities Capstone:GUR) (3-0-3)

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: the Bachelor of Architecture (B.Arch) requires 164 credits; Bachelor of Science in Architecture (B.S. Arch) requires 135 credits. Students are required to maintain a 2.0 cumulative studio average to advance to the next studio level each succeeding year.

Electives

Basic Social Sciences GUR: Six (6) credits in basic (100 and 200 level) Social Sciences (Econ 265, Econ 266, EPS 202, STS 258 or any of the following Rutgers-Newark courses: R070:203 or 204, R790:201 or 202, R830:101 or 102, R920:201 or 202, R202:201. Students may take R220:101 or 102 instead of Econ 265 or 266.)

Cultural History GUR: The Cultural History courses are the Pre-Modern World (HUM 211), The Making of the Modern World (HUM 212), and the Twentieth-Century World (Hist 213). Students may also take approved introductory courses at Rutgers-Newark.

Lit/Hist/Phil/STS GUR: One 300+ level course in Lit, Hist or Philosophy or STS approved 300-level Rutgers course with prefix 350 (English Literature), 352 (American Literature), 510 (History), 512 (American History) or 730 (Philosophy).

Natural Science GUR: At least seven (7) credits in natural sciences, including a laboratory experience. Courses may be selected from Biology Courses (R120:101, R120:102, R120:109, R120:110, R120:205, R120:206, R120:207, R120:208, R120:237, R120:241, R120:242) Chemistry Courses (Chem 122, Chem 123, Chem 124, Chem 125, Chem 126), Physics Courses (Phys 102, Phys 102A, Phys 103, Phys 103A, Phys 106, Phys 106A, Phys 111, Phys 111A, Phys 121, Phys 121A, Phys 202, Phys 202A, Phys 203, Phys 203A), Geology Courses (R460:101, R460:103, R460:104, R460:206, R460:207).

Open Elective in Hum/SS: One 300+ level course in English, social science, theater, literature, history, philosophy, or STS or any 300-level Rutgers-Newark courses in humanities, social sciences, fine arts, or performing arts. (Prefixes 070, 080, 081, 202, 220, 350, 352, 370, 420, 510, 560, 570, 700, 701, 790, 810, 861, 920, 940, 965, 988).

See the General University Requirements section of this catalog for more information on electives.

***** Arch 565 must be taken concurrently with upper level studio Arch 563 or Arch 564.

Degree Requirements for Dual B.Arch. 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.

In addition to existing architecture courses, the M.S. in Management comprises 36 credits as follows. Note: This program was under revision at press time. Students should contact Elly Matzko, student advisor, for the current curriculum.

12 credits to fulfill both B.Arch. and M.S. in Management requirements:

Arch 650	Economy of Building (3 credits)
Arch 651	Real Estate Analysis for Architects (3 credits)
Arch 652	Architectural Project Management (3 credits)
HRM 601	Organizational Behavior (3 credits)

15 credits as follows:

Fin 516	Principles of Financial Management (3 credits)
Fin 600	Corporate Finance I (3 credits)
Fin 618	Public and Private Financing of Urban Areas (3 credits)
MIS 620	E-Commerce Technologies (3 credits)
Mgmt 680	Entrepreneurial Strategy (3 credits) ***or***
Mgmt 692	Strategic Management (3 credits)

9 credits of electives from:

Acct 615	Management Accounting (3 credits)
Fin 624	Corporate Finance II (3 credits)
Mgmt 640	New Venture Management (3 credits)
Mgmt 645	New Venture Finance (3 credits)
MIS 645	Information Systems Principles (3 credits)
Mrkt 630	Models of Consumer Behavior (3 credits)
Mrkt 638	Sales Management for Technical Professionals (3 credits)

Degree Requirements for Dual B.Arch. and Master of Business Administration 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 as follows. Note: This program was under revision at press time. Students should contact Elly Matzko, student advisor, for the current curriculum.

9 required credits taken in the New Jersey School of Architecture constitute an area of concentration in architectural management and count toward both the B.Arch. and M.B.A

Arch 650	Economy of Building (3 credits)
Arch 651	Real Estate Analysis for Architects (3 credits)
Arch 652	Architectural Project Management (3 credits)

21 credits in core courses - technology module:

Fin 516	Principles of Financial Management (3 credits)
Mgmt 620	Management of Technology (3 credits)
Mgmt 625	Distribution Logistics (3 credits)
Mgmt 630	Decision Analysis (3 credits)
Mgmt 635	Data Mining and Analysis (3 credits) ***or***
Math 661	Applied Statistics (3 credits)
MIS 620	E-Commerce Technologies (3 credits)
MIS 645	Information Systems Principles (3 credits)

18 credits in core courses - essential business processes:

Acct 615	Management Accounting (3 credits)
Fin 600	Corporate Finance I (3 credits)
Fin 618	Public and Private Financing of Urban Areas (3 credits)
HRM 601	Organizational Behavior (3 credits)
Mrkt 620	Competing in Global Markets (3 credits)
Mgmt 680	Entrepreneurial Strategy (3 credits) ***or***
Mgmt 692	Strategic Management (3 credits)

Degree Requirements for Dual B.Arch. and Master in Infrastructure Planning

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.

In addition to the completion of the architecture program requirements, the *M.I.P. comprises 36 credits as follows:*

MIP 601	Interdisciplinary Infrastructure Studio I (6 credits)
MIP 602	Interdisciplinary Infrastructure Studio II (6 credits)
MIP 612	Introduction to Environmental Policy Studies (3 credits)
MIP 615	Introduction to Transportation Studies (3 credits)
MIP 618	Public and Private Financing of Urban Areas (3 credits)
MIP 631	History and Theory of Infrastructure (3 credits)
MIP 652	Geographic Information Systems (3 credits)
MIP 655	Land Use Planning (3 credits)
MIP 674	Infrastructure and Architecture (3 credits)
MIP 675	Elements of Infrastructure Planning (3 credits)

Students in the B.Arch. program may take any four of the required 3-credit courses to count toward both their B.Arch. and M.I.P. Students who have completed a comprehensive options studio and have a superior academic record may take MIP 601 in place of the last options studio in the B.Arch. program. This counts for 6 of the 12 credits counted toward both degrees.

Degree Requirements for Dual B.Arch. and Master of Science 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.

In addition to completion of the architecture program requirements, the *M.S. in Civil Engineering* comprises 30 credits as follows:

10 credits in bridge courses: 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.

CE 200	Surveying (3-0-3)
CE 200	Surveying (3-0-3)
CE 200A	Surveying Laboratory (0-3-1)
CE 501	Introduction to Soil Behavior (3 credits)
Math 105	Elementary Probability and Statistics (3-0-3)

12 required credits that count toward both degrees:

Arch 650	Economy of Building (3 credits)
Arch 651	Real Estate Analysis for Architects (3 credits)
Arch 647	Special Topics in Computer Applications (3 credits) ***or***
Arch 675	Elements of Infrastructure Planning (3 credits)
MIS 645	Information Systems Principles (3 credits)

6 credits in civil and environmental engineering electives from:

CE 615	Infrastructure and Facilities Remediation (3 credits)

		CE 631	Advanced Reinforced Concrete Design (3 credits)
		CE 642	Foundation Engineering (3 credits)
		CE 702	Special Topics in Civil Engineering (3 credits)
		CE 710	Systems in Building Construction (3 credits)
		CE 711	Methods Improvement in Construction (3 credits)
		EnE 662	Site Remediation (3 credits)

Bachelor of Science in Architecture (135 credit minimum)

FIRST YEAR:

1st Semester:

		Arch 155	Modes of Design Communication I (2-3-3)
		Arch 163	Introduction to Design I (1-12-5)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
{		Math 107	University Mathematics BI (3-0-3) ***or***
		Math 113	Finite Mathematics and Calculus I (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

		Arch 156	Modes of Design Communication II (2-4-3)
		Arch 164	Introduction to Design II (1-12-5)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Math 120	Basic Concepts in Statistics (1-0-1)
{		Math 113	Finite Mathematics and Calculus I (3-0-3) ***or***
		Math 115	Elements of Geometry (3-0-3)

SECOND YEAR:

1st Semester:

		Arch 223	Construction I (3-0-3)
		Arch 251	History of Architecture I (3-0-3)
		Arch 263	Architecture Studio I (1-12-5)
		Phys 102	General Physics (3-0-3)
		Phys 102A	General Physics Laboratory (0-2-1)
		Elective	(Cultural History: GUR) (3-0-3)

2nd Semester:

		Arch 227	Environmental Control Systems I (3-0-3)
		Arch 229	Structures I (3-0-3)
		Arch 252	History of Architecture II (3-0-3)
		Arch 264	Architecture Studio II (1-12-5)
		Phys 103	General Physics (3-0-3)
		Phys 103A	General Physics Laboratory (0-2-1)

THIRD YEAR:

1st Semester:

		Arch 363	Architecture Studio III (1-12-5)
		Arch 381	History of Architecture III (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)
		Elective	(Cultural History: GUR) (3-0-3)
		Elective	(Physical Education: GUR) (0-1-1)
		Elective	(Architecture) (3-0-3)

2nd Semester:

		Elective	(Lit/Hist/Phil/STS: GUR) (3-0-3)
	##	Econ 201	Economics (3-0-3)
		Elective	(Architecture) (3-0-3)
		Elective	(Architecture) (3-0-3)
		Elective	(Computing) (3-0-3)
		Elective	(Architecture Elective) (3-0-3)

FOURTH YEAR:
1st Semester:

		HSS 409	Humanities Senior Seminar - Social Science (3-0-3)
		Elective	(Open: GUR) (3-0-3)
		Elective	(Physical Education: GUR) (0-1-1)
		Elective	(Architecture) (3-0-3)
		Elective	(Architecture) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)

2nd Semester:

		Elective	(Architecture) (3-0-3)
		Elective	(Architecture) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)

Electives
Architecture: Any architecture course.
Computing: Select in consultation with curriculum advisor.
Free: Select in consultation with curriculum advisor.

Basic Social Sciences GUR: Three credits of the basic social sciences requirement must be taken in economics; acceptable courses are Econ 265, or Econ 266. The remaining 3 credits may be satisfied by HSS 202,STS257, or STS 258 . Students also may take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students also may satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark.

Physical Education GUR: Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course. Students are urged to complete the requirement as soon as possible.

See the General University Requirements section of this catalog for more information on electives.

Degree Requirements for Dual B.S. in Architecture and M.S. in Management, B.S. in Architecture and M.B.A. in Management of Technology, and B.S. in Architecture and M.S. in Civil Engineering

The requirements for these programs are the same as for the B.Arch. dual degree programs. The exception is that only 6 credits of graduate-level coursework may be counted toward both degrees.

Degree Requirements for Dual B.S. in Architecture and M.I.P.
The M.I.P requirements for this program are the same as for the dual B.Arch./M.I.P. The difference is that only 6 credits of

coursework may be counted toward both degrees. B.Arch. students take two of the following four courses to count toward both degrees:

6 credits from:

		MIP 631	History and Theory of Infrastructure (3 credits)
		MIP 652	Geographic Information Systems (3 credits)
		MIP 674	Infrastructure and Architecture (3 credits)
		MIP 675	Elements of Infrastructure Planning (3 credits)

� Arch 251 satisfies 3 credits of the Cultural History GUR for B.Arch. majors; Arch 382 satisfies the Open Elective in Humanities and Social Science GUR for B.Arch. majors.

* The minimum Credit requirement for graduation is the successful completion of 164 credits of prescribed courses within the curriculum; and the maintenance of a 2.0 (C) average. Students are also required to maintain a minimum 2.0 studio cumulative average to advance to each succeeding year of studio. Students must take one upper level studio designated as "comprehensive".

** This option is subject to prior approval.

*** To be taken concurrently with comprehensive studio.

BioChemistry

Administered By: Department Chemistry and Environmental Science

Administration

Chair	Edgardo T. Farinas
Associate Chair	Edgardo T. Farinas
Director of Freshman Chemistry	Frank B. Ellis

Faculty

Distinguished Professor	Joseph W. Bozzelli, Carol A. Venanzi, Somenath Mitra
Professors	Tamara Gund, Lev N. Krasnoperov, Nancy L. Jackson
Associate Professors	Leonard Dauerman, Maurie Cohen, Edgardo T. Farinas, Zeyuan Qiu
Assistant Professors	Liping Wei, Haidong Huang
Research Professors	Zafar Iqbal
University Lecturers	Alexander D. Butherus, Bavani Balasubramanian, Kathleen M. Gilbert, Michael P. Bonchonsky, Roumiana S. Petrova, William Skawinski
Director of freshman Chemistry	Frank B. Ellis
Professor Emeritus	Barbara B. Kebbekus, Donald Getzin

Advisors

Undergraduate Advisor	Roumiana S. Petrova

The Bachelor of Science (BS) in BioChemistry prepares students for careers in industry and for entry to graduate school or professional schools in areas of chemistry, medicine, dentistry or law. The program includes solid emphasis on laboratory skills, scientific principles and mathematics in practical, industrially-oriented areas of chemistry. Students can specialize or explore a particular area of chemistry or prepare for an advanced degree by selecting from a wide range of technical electives. It is recommended that each student carry out an undergraduate research project with a faculty mentor. The faculty have expertise in areas such as energy, fuels, pharmaceuticals, petrochemicals, materials, environmental chemistry and pollution control. Research areas include analytical and environmental chemistry at industrial and microchip scales, synthesis of organic and inorganic materials in green solvents, computer-aided drug design, laser diagnostics of elementary processes, kinetics, thermochemistry and thermodynamics.

Credit requirement for graduation is 129 credits.

Biochemistry (129 Credits)

FIRST YEAR:

1st Semester: (17 credits)

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.

Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
Chem 125	General Chemistry I (3-0-3)
CS 113	Introduction to Computer Science (3-0-3) ***or***
BNFO 135	Programming for Bioinformatics (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Math 111	Calculus I (4-1-4)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (16 credits)

Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
Chem 126	General Chemistry II (3-0-3)
Chem 124	General Chemistry Laboratory (0-2-1)
Math 112	Calculus II (4-1-4)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
PE	(Physical Education) (0-1-1)

SECOND YEAR:

1st Semester: (18 credits)

Chem 221	Analytical Chemical Methods (0-4-2)
Chem 222	Analytical Chemistry (3-0-3)
Chem 243	Organic Chemistry I (3-0-3)
Math 211	Calculus III A (3-0-3)
R120:101	General Biology I (3-3-4)
Elective	(Cultural History GUR) (3-0-3)

2nd Semester: (15 credits)

Chem 231	Physical Chemistry I (3-0-3)
Chem 244	Organic Chemistry II (3-0-3)
Chem 244A	Organic Chemistry II Laboratory (0-4-2)
R120:102	General Biology II (3-3-4)
Elective	(Technical) (3-0-3)

THIRD YEAR:

1st Semester: (17 credits)

Chem 473	Biochemistry (3-0-3)
Chem 235	Physical Chemistry II (3-0-3)

		Elective	(Technical) (3-0-3)
		R120:301	Foundations of Biology: Cell and Molecular Biology (3-0-3)
		R120:302	Foundations of Biology-Lab (0-3-1)
		Elective	(Lit/Hist/Phil/STS) (3-0-3)
		PE	(Physical Education GUR) (0-1-1)

2nd Semester: (17 credits)

		Elective	(Technical Elective) (3-0-3)
		Chem 475	Biochemistry Lab I (0-4-2)
		Econ 201	Economics (3-0-3)
		R120:356	Molecular Biology (3)
		Elective	(Free Elective) (3-0-3)

FOURTH YEAR:

1st Semester: (15 credits)

		Chem 235A	Physical Chemistry II Laboratory (0-4-2)
		Math 225	Survey of Probability and Statistics (1-0-1)
		EPS 202	Society, Technology, and the Environment (3-0-3)
		R120:352	Genetics (3)
		Elective	(Technical) (3-0-3)
		Elective	(Open GUR) (3-0-3)

2nd semester: (14 credits)

		Chem 480	Instrumental Analysis (0-4-2)
		Elective	(Capstone Seminar GUR) (3-0-3)
		Elective	(Management GUR) (3-0-3)
		EvSc 385	Environmental Microbiology (3-0-3)
		Elective	(Technical) (3-0-3)

Specific General University Requirements

Courses that satisfy the General University Requirements are so certified by the University Curriculum Review Committee at the time they are first approved to be offered.

Computing Sciences:

At least two (2) credits in an introductory course in the computing sciences (CS 101, CS 103, CS 104, CS 111, CS 113, CS 115, or IS 118).

English/Communication and Cultural History:

At least nine (9) credits, including at least three (3) credits in English/Communication (one of HUM 100, HUM 100S, or HUM 101 and HUM 102) and at least three (3) credits in cultural history, all at the 100 or 200-level (HIST 213, HUM 211, HUM 212, or any Rutgers-Newark 200-level history course with prefix 510 or 512).

Humanities and Social Sciences Electives (Upper-level)

At least nine (9) credits in upper-level Humanities and Social Sciences, including

1. Three (3) credits in a 300-level course in literature (LIT); history (HIST); philosophy (PHIL); or science, technology and society (STS). Any Rutgers-Newark 300- or 400-level course with prefix 350 (English Literature), 352 (American Literature), 510 (History), 512 (American History) or 730 (Philosophy).

2. Three (3) credits in a 300-level course in english (ENG); history (HIST), literature (LIT); philosophy (PHIL); science, technology and society (STS); social science (SS) or theater (THR). Any 300-level Rutgers-Newark course in humanities, social sciences, fine arts or performing arts (prefixes 070, 080, 081, 202, 220, 350, 352, 370, 420, 510, 512, 560, 570, 700, 701, 790, 810, 830, 861, 920, 940, 965, 988).

3. Three (3) credits in a 400-level senior seminar in the humanities and social sciences (HSS 401; HSS 402, HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 491).

No more than three (3) of the nine required credits in this category may be fulfilled with a course that is specially required by a student's degree program or college.

Management

At least three (3) credits in management (HRM 301, MGMT 390, ENTR 410 or IE 492). Students in the aerospace option take AS 333 and those in the dual degree program between architecture and management take HRM 301.

Mathematics

At least six (6) credits, including one course covering the principles of calculus (MATH 111, MATH 113 or MATH 138) and at least one (1) credit in probability and statistics (MATH 105, MATH 114, MATH 225, MATH 244, MATH? 279, MATH 305, MATH 333, IE 331, ECE 321, or MNET 315).

Natural Sciences:

At least seven (7) credits in natural sciences, including a laboratory experience.

Biology Courses: R120:101, R120:102, R120:109, R120:110, R120:205,R120:206, R120:207, R120:208, R120:237, R120:241, R120:242

Chemistry Courses: CHEM 122, CHEM 123, CHEM 124, CHEM 124, CHEM 125, CHEM 126

Physics Courses: PHYS 102, PHYS 102A, PHYS 103, PHYS 103A, PHYS 106, PHYS 106A, PHYS 111, PHYS 111A, PHYS 121, PHYS 121A, PHYS 202, PHYS 202A, PHYS 203, PHYS 203A.

Geology Courses: R460:101, R460:103, R460:104, R460:206, R460:207

Physical Education

At least two (2) credits in physical education. Students who register as full time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course.

Social Sciences (lover-level):

At least six (6) credits in basic (100- and 200-level) social sciences (ECON 265, ECON 266, EPS 202, STS 257, or STS 258, or any of the following Rutgers_Newark courses R070:203, R070:204, R202:201, R790:201, R790:202, R830:101, R830:102, R920:201, R920:202. Students may take R220:101 or R220:102 intead of ECON 265 or ECON 266).

Bioinformatics

Administered By: Department of Computer Science

Adminstration

Chairperson:	Michael A. Baltrush
Associate Chairperson:	James M. Calvin
Director of Bioinformatics:	Usman W. Roshan

Faculty

Distinguished Professors:	Joseph Y. Leung
Professors:	Narain Gehani, James Geller, James McHugh, Ali Mili, Yehoshua Perl, Frank Y. Shih, athomas, verkhovs, Jason T. Wang
Associate Professors:	Michael A. Baltrush, James M. Calvin, Alexandros Gerbessiotis, Daochuan Hung, Marvin K. Nakayama, David Nassimi, Chengjun Liu, John W. Ryon, Vincent Oria, Edward Sarian, Andrew Sohn, Dimitrios Theodoratos
Assistant Professors:	Cristian M. Borcea, Barry Cohen, Usman W. Roshan, Guiling Wang, Zhi Wei
Special Lecturers:	George Blank, Osama Eljabiri, Jonathan J. Kapleau, Dionissios Karvelas, Morty D. Kwestel, Theodore L. Nicholson, Kurban K. Niroomand, Wallace Rutkowski

Advisors:

Bioinformatics Advisors:	Amanda D. Ackerman, Casey L. Hennessey, George W. Olsen
Graduate Advisors:	Amanda D. Ackerman, Casey L. Hennessey

Bioinformatics is a new and exciting field that stands at the intersection of biology, computer science and information technology - among the most revolutionary scientific disciplines of the twenty first century.

Computation is doing for biology today what the microscope did four centuries ago - allowing scientists to peer deeper into the fundamental processes of life and to extract, record, retrieve, analyze, visualize and ultimately to utilize for medical and other practical purposes tremendous quantities of information. The human genome, for example, has three billion "letters" in it, organized into some 30,000 genes.

The Bachelor of Science in Bioinformatics degree provides the student with an understanding of bioinformatics, computer science and biology fundamentals, along with supporting science and mathematics. This degree is ideal for students interested in pursuing a career in the biotechnology, pharmaceutical, biomedical or related industries, or for those interested in pursuing advanced degrees in bioinformatics or medicine.

The Computer Science Department, which administers the Bachelor of Science in Bioinformatics degree, requires all students enrolled in its majors to prepare a Program of Study Form, an approved copy of which must be on file with the department. The form should be prepared as early as possible in the student's career, and changes should be made only in consultation with the department advisor. Bioinformatics majors should enroll in CS 113 and CS 114 in the freshman year, along with General Biology I and II.

The curriculum as described below is for students entering NJIT as freshman in the fall of 2005 or after that date.

B. S. in Bioinformatics (129 credit minimum)

FIRST YEAR:
1st Semester

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.

		R120:101	General Biology I (3-3-4)
		Chem 125	General Chemistry I (3-0-3)
		Math 111	Calculus I (4-1-4)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		BNFO 135	Programming for Bioinformatics (3-0-3)
		CS 107	Computing as a Career (1-0-1)

2nd Semester

		R120:102	General Biology II (3-3-4)
		Chem 124	General Chemistry Laboratory (0-2-1)
		Chem 126	General Chemistry II (3-0-3)
		Math 112	Calculus II (4-1-4)
		BNFO 136	Programming for Bioinformatics II (3-0-3)

SECOND YEAR:
1st Semester

		R120:201	(Foundations of Biology) (3)
		R120:202	(Foundations of Biology laboratory) (1)
		R120:352	Genetics (3)
		CS 241	Foundations of Computer Science I (3-0-3)
		Math 333	Probability and Statistics (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)

2nd Semester

		R120:356	Molecular Biology (3)
		Chem 243	Organic Chemistry I (3-0-3)
		Social Science	(GUR) (3)
		BNFO 240	Principles of Bioinformatics II (3-0-3)
		Econ 201	Economics (3-0-3)
		CS 207	Computing and Effective Communication (1-0-1)

THIRD YEAR:
1st Semester

		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
	*	BNFO 340	Data Analysis for Bioinformatics (3-0-3)
{		HUM 211	The Pre-Modern World (3-0-3)
		HUM 212	The Modern World (3-0-3)
		Hist 213	The Twentieth-Century World (3-0-3)
		CS 431	Database System Design and Management (3-0-3)

		Elective	(Free) (3-0-3)

2nd Semester

		Math 337	Linear Algebra (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)
		Elective SP	(Specialty Elective) (3-0-3)
		CS 435	Advanced Data Structures and Algorithm Design (3-0-3)
		IS 350	Computers, Society and Ethics (3-0-3)
		PE	(Physical Education) (1)

FOURTH YEAR:
1st semester

	*	BNFO 482	Databases and Data Mining in Bioinformatics (3-0-3)
{		Eng 340	Oral Presentations (3-0-3)
		Eng 352	Technical Writing (3-0-3)
		Elective SP	(Specialty Elective) (3-0-3)
		Elective SP	(Specialty Elective) (3-0-3)
		Elective	(Free) (3-0-3)
		PE	(Physical Education) (1)

2nd Semester

		BNFO 491	Computer Science Project (3-0-3)
		HSS Cap	(Capstone Seminar:GUR) (3-0-3)
		Elective GUR	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		Elective SP	(Specialty Elective) (3-0-3)
		Elective	(Free) (3-0-3)
		CS 407	Professional Development in Computing (1-0-1)

Electives:

Basic Social Sciences GUR: Three credits of the basic social sciences requirement must be taken in economics; acceptable courses are Econ 265, or Econ 266. The remaining 3 credits may be satisfied by HSS 202, STS 257, or STS 258. Students also may take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

Cultural History GUR: Take two courses (6 credits) from among Hum 211, Hum 212, Hist 213 , or an approved 200-level history course at Rutgers-Newark.

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology and society (STS); social science (SS); or theater (Thtr). Students also may satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends that computer science majors take Eng 352.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology and society (STS); or an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H.

Physical Education GUR: Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course. Students are urged to complete the requirement as soon as possible.

Management GUR: Students take IE 492 or Mgmt 390.

Mathematics: One approved 300- or 400-level course in mathematics or Math 222.

CS: Four 300/400-level electives as offered by the College of Computing Sciences.

Interdisciplinary Studies: A sequence of three 300/400-level courses from mathematics, science or engineering. A list of approved course sequences is available from the advisor. Courses that are not acceptable for a major in a given department are not to be used for interdisciplinary studies.

General: A minimum of four courses (12 credits minimum). Courses should be chosen to meet prerequisite requirements of other courses. Two of the four electives must be in mathematics, science , computer science, or engineering. Two of these electives must be upper division courses. All students must have at least one science/scientific methods course in either their interdisciplinary studies courses or general electives. See below.

Science with Lab: Students take Physics III, Biology I, Chemistry I, or another science approved by the advisor each with its associated lab. This course and associated lab fulfills one semester of the three-semester laboratory science requirement for the major.

Refer to the General University Requirements section of this catalog for further information on electives.

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* New/Renamed Course

Catalog and curricula information approved by the relevant academic department.

Biology

Administered By: Department of Biological Sciences

Administration

Chair	Jorge P. Golowasch
Academic Coordinator	Karen Roach

NJIT Faculty

Distinguished Professor	Gene M. Jonakait
Professor	Farzan Nadim
Associate Professor	Jorge P. Golowasch, Gareth J. Russell
Assistant Professor	Andrew Hill, Daniel E. Bunker
Lecturers	Darshan J. Desai, Maria L. Stanko, Christopher M. Trimby, Ellen M. Wisner
Laboratory Coordinator	Maria L. Stanko
Research Associate	Kimberly N. Russell

Rutgers-Newark Faculty

Chair.	Edward M. Bonder
Professors	Ann Cali(Prof. Emaritus), Harvey Feder(Associate Provost), Gerald Frenkel, David Kafkewitz, Edward Kirby(Dean: FASN), Judith Weis, Wilma Friedman
Associate Professors	Edward M. Bonder, John Crow, Lion Gardiner, Andrew Kasper, John Maiello, Douglas Morrison, Haesum Kim, Claus Holzapfel
Assistant Professors	Nihal Altan-Bonnet, Nan Gao, Tracy Tran, Alexis Rodriguez, Patrice Maurel, Karina V. R. Shafer

Advisors

Undergraduate Advisor	Jorge P. Golowasch
Undergraduate Advisor	Gene M. Jonakait
Undergraduate Advisor	Gareth J. Russell
Undergraduate Advisor	Karen Roach
Undergraduate Advisor	Andrew Hill
MS Advisor	Kimberly N. Russell
PhD Advisor	Susan Seipel (Rutgers)
University Pre-Health Advisor	Darshan J. Desai

The Department of Biological Sciences offers Bachelor of Science (BS) and Bachelor of Arts (BA) degrees. The coursework in the first year for the B.S. and B.A. degrees are identical, allowing students to make a choice between majors as late as the second year. The B.S. curriculum involves more rigorous training in mathematics, and computer Science. Students in both programs are required to complete a minimum of 38 credits in Biology.

Accelerated 7-year Biology BA/MD/DMD/DDS/OD/DPT programs are also available. Contact the Albert Dorman Honors College for a sample program and information.

The curricula described below are for students entering or who entered NJIT as freshmen in the fall of 2011 or later. Students entering before that date may have a different program and should consult the Academic Coordinator to determine which curriculum applies.

BS in Biology (128 credit minimum)

FIRST YEAR:

1st semester:

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.

		Biol 200	Concepts in Biology (4-0-4)
{		Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
		Chem 125	General Chemistry I (3-0-3)
		Math 111	Calculus I (4-1-4)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		BNFO 135	Programming for Bioinformatics (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd semester:

		R120:201	(Foundation of Biology) (3-0-3)
		R120:202	(Foundations of Biology Lab) (3-0-3)
		Chem 124	General Chemistry Laboratory (0-2-1)
{		Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
		Chem 126	General Chemistry II (3-0-3)
		Math 112	Calculus II (4-1-4)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Phys Ed	(Physical Education:GUR) (0-1-1)

SECOND YEAR:

1st semester:

		Biol 205	Foundations of Biology: Ecology and Evolution Lecture (3-0-3)
		Biol 206	Foundations of Biology: Ecology and Evolution Lab (0-3-1)
		Chem 243	Organic Chemistry I (3-0-3)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Math 211	Calculus III A (3-0-3)
		BNFO 136	Programming for Bioinformatics II (3-0-3)

2nd semester:

		Chem 244	Organic Chemistry II (3-0-3)
		Chem 244A	Organic Chemistry II Laboratory (0-4-2)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		Cognate	(Math) (3 or 4)
		Elective	(Social Sciences:GUR) (3-0-3)

		Phys Ed	(Physical Education:GUR) (0-1-1)

THIRD YEAR:

1st semester:

	***	Biol Elective	(Functional Laboratory Elective) (3-0-3)
		Biol Elective	(Cluster Elective) (3-0-3)
		Math 333	Probability and Statistics (3-0-3)
		Elective	(English and Cultural History:GUR) (3-0-3)
		Elective	(Social Science:GUR) (3-0-3)

2nd semester:

	***	Biol Elective	(Laboratory Elective) (3-0-3)
		Biol Elective	(Cluster Elective) (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)
		Elective	(HSS Upper Level:GUR) (3-0-3)
		Elective	(Technical) (3-0-3)

FOURTH YEAR:

1st semester:

		Biol Elective	(Laboratory) (3-0-3)
		Biol Elective	(Cluster Elective) (3-0-3)
		GUR Elective	(HSS Upper level6) (3-0-3)
		Elective	(Technical) (3-0-3)
		Elective	(Free) (3-0-3)

2nd semester:

		Biol Elective	(Biology Elective) (3-0-3)
		Biol Elective	(Biology Elective) (3-0-3)
		Elective	(HSS Senior Seminar:GUR) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)

Total Minimum Credits: 128

Biology Credits: 35 (Including General Biology I, II, and Foundations of Biology)

BA in Biology (124 credit minimum)

FIRST YEAR:

1st semester:

		Biol 200	Concepts in Biology (4-0-4)
{		Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
		Chem 125	General Chemistry I (3-0-3)
		Math 138	General Calculus I (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		BNFO 135	Programming for Bioinformatics (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd semester:

		R120:201	(Foundation of Biology) (3-0-3)
		R120:202	(Foundations of Biology Lab) (3-0-3)
		Chem 124	General Chemistry Laboratory (0-2-1)
		Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***

Chem 126	General Chemistry II (3-0-3)
Math 238	General Calculus II (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Phys Ed	(Physical Education:GUR) (0-1-1)

SECOND YEAR:
1st semester

Biol 205	Foundations of Biology: Ecology and Evolution Lecture (3-0-3)
Biol 206	Foundations of Biology: Ecology and Evolution Lab (0-3-1)
Chem 243	Organic Chemistry I (3-0-3)
Phys 102	General Physics (3-0-3)
Phys 102A	General Physics Laboratory (0-2-1)
GUR Elective	(English and Cultura History) (3-0-3)
GUR Elective	(Physical Education) (0-1-1)

2nd semester:

Biol Elective	(Cluster) (3-0-3)
Chem 244	Organic Chemistry II (3-0-3)
Chem 244A	Organic Chemistry II Laboratory (0-4-2)
Phys 103	General Physics (3-0-3)
Phys 103A	General Physics Laboratory (0-2-1)
GUR Elective	(Social Science) (3-0-3)

THIRD YEAR:
1st semester:

Biol Elective	(Functional Laboratory Elective) (3-0-3)
Biol Elective	(Cluster) (3-0-3)
Mgmt 390	Principles of Management (3-0-3)
Elective	(Technical) (3-0-3)
GUR Elective	(HSS Upper Level) (3-0-3)

2nd semester:

Biol Elective	(Laboratory Elective) (3-0-3)
Biol Elective	(Biology Elective) (3-0-3)
Elective	(Technical Elective) (3-0-3)
GUR Elective	(HSS Upper Level) (3-0-3)
GUR Elective	(Social Science) (3-0-3)

FOURTH YEAR:
1st semester:

Biol Elective	(Laboratory Elective) (3-0-3)
Biol Elective	(Biology Elective) (3-0-3)
Elective	(HSS Upper Level:GUR) (3-0-3)
Elective	(Free) (3-0-3)
Elective	(Free) (3-0-3)

2nd semester:

Elective	(Biology) (3-0-3)
Elective	(Technical) (3-0-3)
Elective	(Free) (3-0-3)

		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)

Total Minimum Credits: 124

Biology Credits: 35 (Including General Biology I, II, and Foundations of Biology)

General University Requirements and Electives

All students are required to satisfy the General University Requirements (GUR). All GUR 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 University Requirements section of this catalog for further information on electives.

Computer Science GUR: BNFO 135

Management GUR (3 credits): Students take IE 492 or Mgmt 390.

Physical Education GUR: Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course. Students are urged to complete the requirement as soon as possible.

Social Science Lower Level GUR (6 credits): Take two courses from ECON 265, 266, EPS 202, STS 257, 258 or approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

English/Communication/Cultural History GUR (6 credits): Biology majors are required to take HUM 101 and 102. The remaining three credits can be satisfied by HUM 211, 212 or Hist 213 or any 200 level history course at Rutgers-Newark.

Lit/Hist/Phil/STS GUR (3 credits): Students must take one 300-level course from any of the following fields: literature, history, philosophy, science, technology, and society (STS), or an approved 300-level course at Rutgers-Newark.

Open Elective in Humanities and Social Science GUR (3 credits): Students must take one 300-level course from any of the following fields: English (Eng), history (Hist), literature (Lit), philosophy (Phil), science, technology, and society (STS), social science (SS), or theater (Thtr). Students also may satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newar

Senior Seminar in Humanities and Social Science GUR (3 credits): All students, except those enrolled in the honors college, take one of the following: HSS 401, HSS 402, HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H.

Biology_Chemistry Double Major (136 Credits)

FIRST YEAR:

1st semester:

		Chem 125	General Chemistry I (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 111	Calculus I (4-1-4)
		BNFO 135	Programming for Bioinformatics (3-0-3)
		Biol 200	Concepts in Biology (4-0-4)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd semester

		Chem 124	General Chemistry Laboratory (0-2-1)
		Chem 126	General Chemistry II (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Math 112	Calculus II (4-1-4)
		PE	(Physical Education) (0-1-1)
		R120:201/202	(Foundations of Cell/Molec) (4)

SECOND YEAR:

st

1 semester:

Chem 221	Analytical Chemical Methods (0-4-2)
Chem 222	Analytical Chemistry (3-0-3)
Chem 243	Organic Chemistry I (3-0-3)
Math 211	Calculus III A (3-0-3)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
Elective	(Cultural History GUR) (3)

2nd semester:

Chem 244	Organic Chemistry II (3-0-3)
Chem 244A	Organic Chemistry II Laboratory (0-4-2)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
Biol 205	Foundations of Biology: Ecology and Evolution Lecture (3-0-3)
Biol 206	Foundations of Biology: Ecology and Evolution Lab (0-3-1)
EPS 202	Society, Technology, and the Environment (3-0-3)
PE	(Physical Education) (0-1-1)

THIRD YEAR:

1st semester:

Chem 231	Physical Chemistry I (3-0-3)
Chem 473	Biochemistry (3-0-3)
Elective	(Math Cognate) (3 or 4 credits)
Elective	(Biology Laboratory) (4)
Elective	(Biology) (3)

2nd semester:

Chem 235	Physical Chemistry II (3-0-3)
Mgmt 390	Principles of Management (3-0-3)
Elective	(Biology) (3)
Chem 474	Biochemistry II (3-0-3)
Econ 201	Economics (3-0-3)
Elective	(Lit/Hist/Phil/STS-GUR) (3)

FOURTH YEAR:

1st semester:

Chem 235A	Physical Chemistry II Laboratory (0-4-2)
Elective	(Biology) (3)
Chem 480	Instrumental Analysis (0-4-2)
Elective	(Biology Laboratory) (4)
Math 333	Probability and Statistics (3-0-3)
Chem 475	Biochemistry Lab I (0-4-2)

2nd semester:

Chem 336	Physical Chemistry III (3-0-3)
Elective	(Physical Chemistry III) (3)
Chem 412	Inorganic Chemistry (3-0-3)
Elective	(Biology) (3)
HSS 4**	(HSS Capstone) (3)
Elective	(Open GUR) (3)

Joint Six-Year B.A Biology / Physician Assistant (112 credit minimum)

FIRST YEAR:
1st semester:

Biol 200	Concepts in Biology (4-0-4)
{	Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
	Chem 125	General Chemistry I (3-0-3)
	Math 111	Calculus I (4-1-4)
	HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
	BNFO 135	Programming for Bioinformatics (3-0-3)
	Frsh Sem	Freshman Seminar (1-0-0)

2nd semester:

	R120:201	(Foundation of Biology) (3-0-3)
	R120:202	(Foundations of Biology Lab) (3-0-3)
	Chem 124	General Chemistry Laboratory (0-2-1)
{	Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
	Chem 126	General Chemistry II (3-0-3)
	HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
	R830:101	Principles of Psychology I (3)
	Elective	(Social Science Elective) (3-0-3)

Summer I

Biol 310	Research and Independent Study (3-0-3)
Elective	(GUR Elective) (3-0-3)

SECOND YEAR:
1st semester

Biol 205	Foundations of Biology: Ecology and Evolution Lecture (3-0-3)
Biol 206	Foundations of Biology: Ecology and Evolution Lab (0-3-1)
Elective	(Biology Elective) (3-0-3)
Chem 243	Organic Chemistry I (3-0-3)
Math 105	Elementary Probability and Statistics (3-0-3)
r120:141	(Anatomy & Physiology I) (3-0-3)
Elective	(GUR Elective) (3-0-3)

2nd semester:

Biol 340	Mammalian Physiology (3-3-4)
Chem 244	Organic Chemistry II (3-0-3)
Chem 244A	Organic Chemistry II Laboratory (0-4-2)
r120:142	(Anatomy & Physiology II) (3-0-3)
Elective	(Biology Ecology/ Evolution Cluster) (3-0-3)
PE	(Physical Education) (3-0-3)

Summer II

Elective	(Management GUR Elective) (3-0-3)

THIRD YEAR:
1st semester:

R120:285	Comparative Anatomy of Vertebrates (3-3-4)
R120:335	General Microbiology (4)
R120:360	Elementary Biochemistry (3)

		Phys 102	General Physics (3-0-3)
		Phys 102A	General Physics Laboratory (0-2-1)
		Elective	(HSS Upper Level) (3-0-3)

2nd semester:

		R120:352	Genetics (3)
		Elective	(Biology Elective) (3-0-3)
		Phys 103	General Physics (3-0-3)
		Phys 103A	General Physics Laboratory (0-2-1)
		Elective	(HSS Upper level) (3-0-3)
		Elective	(HSS Senior Seminar) (3-0-3)

Biology Electives Must be Chosen as Outlined Below:

One course must be taken from A, B, and C.

A. CONCEPT CLUSTER ECOLOGY AND EVOLUTION

All courses three Cr.

		Biol 222	Evolution (3-0-3)
		R120:280	(Ecology) (3)
		R120:382	
		R120:370	Plant Ecology (3)

B. CONCEPT CLUSTER FUNCTIONAL ORGANISM (4 Cred)

		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 (3-3-4) ***or***
		Biol 340	Mammalian Physiology (3-3-4)
{		R120:342	Developmental Biology (4) ***and***
		R120:343	Developmental Bio Lab (1)

C. CONCEPT CLUSTER MOLECULAR AND CELLULAR

All courses three Cr.

		R120:352	Genetics (3)
		R120:355	Cell Biology (3)
		R120:356	Molecular Biology (3)
{		R120:360	Elementary Biochemistry (3) ***or***
		Chem 473	Biochemistry (3-0-3)

LABORATORY EXPERIENCE COURSES

Laboratory Courses (4 cr.)

		R120:227	(Biol. Invertebrates) (4)
		R120:285	(Comp Vert. Anatomy) (4)
		R120:311	Taxonomy of Vascular Plants (4)
		R120:313	(Mycology) (4)
{		R120:325	Animal Parasites (3) ***and***
		R120:326	Laboratory Exercises in Parasitology (1)
		R120:358	
		R120:430	Plant Growth and Development (4)
		R120:481	Marine Biology (4)

	(Any course from funtional concept cluster)

Laboratory Courses (3 cr.)

R120:328	Ecology of Birds (3-0-3)
R120:371	Field Studies in Plant Ecology (3)
R120:381	Field Studies in Animal Ecology (2)
R120:380	Field Ecology (3)
Biol 475	Ecological Field Methods and Analysis (3-0-3)

Laboratory Courses (2 cr.)

R120:486	Tropical Field Biology (2)

BIOLOGY ELECTIVES
All courses three Cr. unless Specified

Biol 225	Insects and Human Society (3-0-3)
R120:346	Neurobiology (3) ***or***
Biol 346	Neurobiology (3-0-3)
R120:350	(Immunology) (3)
R120:365	Human Ecology (3-0-3)
Biol 368	The Ecology and Evolution of Disease (3-0-3)
Math 371	Physiology and Medicine (3-0-3)
Math 372	Population Biology (3-0-3)
Math 373	Introduction to Mathematical Biology (3-0-3)
Biol 375	Conservation Biology (3-0-3)
Biol 383	Neural Basis of Behavior (3-0-3)
R120:403	Biological Ultrastructure (3)
R120:404	Light and Electron Microscopy (4)
Biol 405	Cell Physiology and Imaging (1-3-4)
R120:422	Biological Invasions (3)
Math 430	Analytical and Computational Neuroscience (3-1-3)
Biol 440	Cell Biology of Disease: Cells gone Bad! (3-0-3)
R120:445	Endocrinology (3)
Biol 447	Cellular and Systems Neuroscience (3-0-3)
Biol 448	Neuropathophysiology: Nervous System Gone Bad! (3-0-3)
R120:451	Laboratory in Cellular and Molecular Biology I: Cellular Biophysics (4)
R120:452	Laboratory in Cellular and Molecular Biology II: Molecular Biotechniques (4)
R120:455	Molecular Cell Biology (3)
R120:471	Ecological Physiology (3)
R120:487	Systems Ecology (3)
Problems in Biol	(BIOL 491-492) (6 crs max)

** Choice of: Math 222 Differential Equations, Math 227 Mathematical Modeling, Math 337 Linear Algebra or Math 340 Applied Numerical Methods

*** Technical Electives: Any course in Chemistry, Mathematics, or Environmental Science; Any course in Environmental Science, Computer Science or Engineering

Accelerated Six-Year B. A. Biology/Doctor of Physical Therapy (112 Minimum credits)

FIRST YEAR:

1st Semester: (18 credits)

		Biol 200	Concepts in Biology (4-0-4)
		Chem 125	General Chemistry I (3-0-3)
		Math 111	Calculus I (4-1-4)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		BNFO 135	Programming for Bioinformatics (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (18 credits)

		R120:201	(Foundations of Cell and Molecular Biology) (3-0-3)
		R120:202	(Foundations of Cell and Molecular Biology Lab)
		Chem 124	General Chemistry Laboratory (0-2-1)
		Chem 126	General Chemistry II (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		R830:101	Principles of Psychology I (3)
		Elective	(Social Science:GUR) (3-0-3)

Summer I: (5 credits)

		Biol 310	Research and Independent Study (3-0-3)
		Biol 410	Work Experience II (3-0-3)

SECOND YEAR:

1st Semester: (17 credits)

		Biol 205	Foundations of Biology: Ecology and Evolution Lecture (3-0-3)
		Biol 206	Foundations of Biology: Ecology and Evolution Lab (0-3-1)
		Biology Elective	(Cluster Elective) (3-0-)
		Chem 243	Organic Chemistry I (3-0-3)
		Math 105	Elementary Probability and Statistics (3-0-3)
		Elective	(English and Cultural History:GUR) (3-0-3)
		Elective	(Physical Education:GUR) (0-1-1)

2nd Semester: (16 credits)

		Biol 340	Mammalian Physiology (3-3-4)
		Biol Elective	(Cluster) (3-0-3)
		Chem 244	Organic Chemistry II (3-0-3)
		Chem 244A	Organic Chemistry II Laboratory (0-4-2)
		Elective	(Free)
		Elective	(Physical Education:GUR) (0-1-1)

Summer II: (6 credits)

		GUR Elective	(HSS Upper Level) (3-0-3)
		GUR Elective	(Management) (3-0-3)

THIRD YEAR:

1st Semester: (16 credits)

		R120:285	(Comparative Vertebrates Anatomy) (3-3-4)
		Elective	(Biology) (3-0-3)
		Phys 102	General Physics (3-0-3)
		Phys 102A	General Physics Laboratory (0-2-1)
		GUR Elective	(HSS Upper Level) (3-0-3)

Elective	(Free Elective) (3-0-3)

2nd Semester: (15 credits)

R120:352	Genetics (3)
Biol Elective	(Laboratory) (3-0-3)
Elective	(Biology) (3-0-3)
Elective	(Biology) (3-0-3)
Phys 103	General Physics (3-0-3)
Phys 103A	General Physics Laboratory (0-2-1)
Elective	(HSS Senior Seminar:GUR) (3-0-3)

Biology Credits: 35 (General Biology I, II, Foundations of Biology, Mammalian Physiology, Comparative Vertebrate Anatomy are required).

Special Curriculum Note for Accelerated Doctor of Physical Therapy Program:

Students in the DPT program must take the following courses:

- Rutgers-Newark 21: 120:340 Mammalian Physiology (4 credits)
- Rutgers-Newark 21: 120:320 Comparative Anatomy of Vertebrates (4 credits)
- Rutgers-Newark 21 & 62: 830:101 Principles of Psychology (3 credits)

These courses can be fit into elective slots in the existing curricula. Consult advisor.

Accelerated Seven-Year B. A. Biology/MD, DMD, DDS, OD (111 Minimum credits)

FIRST YEAR:

1st Semester: (18 credits)

Biol 200	Concepts in Biology (4-0-4)
Chem 125	General Chemistry I (3-0-3)
Math 111	Calculus I (4-1-4)
Phys 102	General Physics (3-0-3)
Phys 102A	General Physics Laboratory (0-2-1)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (18 credits)

Biol 205	Foundations of Biology: Ecology and Evolution Lecture (3-0-3) ***or***
Biol 206	Foundations of Biology: Ecology and Evolution Lab (0-3-1)
Chem 124	General Chemistry Laboratory (0-2-1)
Chem 126	General Chemistry II (3-0-3)
Phys 103	General Physics (3-0-3)
Phys 103A	General Physics Laboratory (0-2-1)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Elective	(Social Science:GUR) (3-0-3)

Summer I: (5 credits)

CS 101	Computer Programming and Problem Solving (3-0-3)
Elective	(English and Cultural History:GUR) (3-0-3)

SECOND YEAR:

1st Semester: (17 credits)

R120:301	Foundations of Biology: Cell and Molecular Biology (3-0-3)

	R120:302	Foundations of Biology-Lab (0-3-1)
	Chem 243	Organic Chemistry I (3-0-3)
	Math 105	Elementary Probability and Statistics (3-0-3)
	Elective	(Social Science:GUR) (3-0-3)
	Elective	(HSS Upper Level:GUR)
	Elective	(Physical Education:GUR)

2nd Semester: (16 credits)

	Elective	(Biology with Lab) (3-3-4)
	Chem 244	Organic Chemistry II (3-0-3)
	Chem 244A	Organic Chemistry II Laboratory (0-4-2)
	Elective	(HSS Upper Level:GUR) (3-0-3)
	Elective	(Free)
	Elective	(Physical Education:GUR) (0-1-1)

Summer II: (6 credits)

	Biol 491	Research and Independent Study (0-3-3)
	Biol 492	Research and Independent Study (3-0-3)

THIRD YEAR:

1st Semester: (16 credits)

	Elective	(Biology with Lab) (3-3-4)
	Elective	(Biology) (3-0-3)
******	Elective	(Technical Elective) (3-0-3)
	Elective	(Management:GUR) (3-0-3)
	Elective	(Free) (3-0-3)

2nd Semester: (15 credits)

	Elective	(Biology) (3-0-3)
	Elective	(Biology) (3-0-3)
	Elective	(HSS Senior Seminar:GUR) (3-0-3)
******	Elective	(Technical Elective) (3-0-3)
	Elective	(Free) (3-0-3)

Biology Credits: 35 (including General Biology I, II, and Foundations of Biology)

***** Pending approval.

****** Technical Electives: A 300-level or higher course in Chemistry, Mathematics, or Environmental Science; a three credit course in any of the Computer Science or Engineering disciplines; or any Physics course 234 or higher or six additional credits of biology. Courses required for the major cannot be used to satisfy the technical elective requirement.

******* Technical Electives: A 300-level or higher course in Chemistry, Mathematics, or Environmental Science; a three credit course in any of the Computer Science or Engineering disciplines; or any physics course 234 or higher.

BIOLOGY ELECTIVES MUST BE CHOSEN AS OUTLINED BELOW:

A. ECOLOGY AND EVOLUTION

(All courses three credits)

	R120:322	
	R120:370	Plant Ecology (3)

R120:380	Field Ecology (3)
R120:382	

B. THE FUNCTIONAL ORGANISM

(All courses four 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 (3-3-4)
R120:342	Developmental Biology (4) ***and***
R120:343	Developmental Bio Lab (1)

C. MOLECULAR AND CELLULAR MECHANISMS:

(All courses three credits)

R120:352	Genetics (3)
R120:355	Cell Biology (3)
R120:356	Molecular Biology (3)
R120:360	Elementary Biochemistry (3) ***or***
Chem 473	Biochemistry (3-0-3)

D. MAJORS ARE REQUIRED TO TAKE AT LEAST TWO ADDITIONAL LABORATORY OR FIELD COURSES CHOSEN FROM SECTION B ABOVE OR FROM THE LIST BELOW:

Laboratory Courses

(4 credits)

R120:311	Taxonomy of Vascular Plants (4)
R120:320	
R120:325	Animal Parasites (3) ***and***
R120:326	Laboratory Exercises in Parasitology (1)
R120:327	
R120:358	
R120:413	
R120:430	Plant Growth and Development (4)
R120:481	Marine Biology (4)

Laboratory courses

(3 credits)

R120:328	Ecology of Birds (3-0-3)
R120:371	Field Studies in Plant Ecology (3)
R120:381	Field Studies in Animal Ecology (2)
R120:470	

Laboratory courses

(2 credits)

		R120:486	Tropical Field Biology (2)

E. THE COURSES LISTED BELOW MAY BE USED TO COMPLETE 35 CREDITS OF BIOLOGY COURSE WORK.

(All courses three credits unless specified)

		R120:346	Neurobiology (3)
		R120:365	Human Ecology (3-0-3)
		Biol 368	The Ecology and Evolution of Disease (3-0-3)
		Math 371	Physiology and Medicine (3-0-3)
		Math 373	Introduction to Mathematical Biology (3-0-3)
		Biol 383	Neural Basis of Behavior (3-0-3)
		R120:403	Biological Ultrastructure (3)
		R120:404	Light and Electron Microscopy (4)
		R120:422	Biological Invasions (3)
		Math 430	Analytical and Computational Neuroscience (3-1-3)
		R120:443	
		R120:445	Endocrinology (3)
		R120:451	Laboratory in Cellular and Molecular Biology I: Cellular Biophysics (4)
		R120:452	Laboratory in Cellular and Molecular Biology II: Molecular Biotechniques (4)
		R120:455	Molecular Cell Biology (3)
		R120:471	Ecological Physiology (3)
		R120:487	Systems Ecology (3)
	********	Biol 491	Research and Independent Study (0-3-3)
	********	Biol 492	Research and Independent Study (3-0-3)

******** Biol 491 and Biol 492 (6 credits max)

Catalog and curricula information approved by the relevant academic department.

Biomedical Engineering

Administered By: Department of Biomedical Engineering

Adminstration

Chairperson	Bharat Biswal
Undergraduate Program Director	Tara L. Alvarez
Undergraduate Program Coordinator	Alev K. Erdi
Ph.D. & MS Program Director	Treena L. Arinzeh
MS Program Coordinator	Max Roman

Faculty

Professor	Treena L. Arinzeh, Bharat Biswal, William C. Hunter
Associate Professors	Sergei Adamovich, Bryan J. Pfister, Tara L. Alvarez, Richard A. Foulds, Mesut Sahin
Assistant Professors	Cheul Cho, Eun J. Lee, Raquel Perez-Castillejos
University Lecturers	Bruno Mantilla, Naphtaly Ehrenberg, Joel Schesser
Research Professors	Hans R. Chaudhry, Xin Di, Michael Jaffe, George Collins
Distinguished Emeritus Professor	William C. Van Buskirk
Emeritus Professors	Peter Engler, David Kistol, Stanley Reisman

Advisers

Freshman, Sophomore, & Transfer Adviser	Alev K. Erdi
Bioinstrumentation Track Advisers	Tara L. Alvarez, Mesut Sahin
Biomechanics Track Advisers	Sergei Adamovich, Richard A. Foulds, William C. Hunter
Biomaterials/Tissue Engineering Track Advisers	Cheul Cho, Eun J. Lee, Raquel Perez-Castillejos
MS Adviser	Max Roman
Ph.D. Adviser	Treena L. Arinzeh

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

Department 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, and (7) serve our wider constituencies by offering our expertise to other health-related professionals, industries, and state and local communities.

Program Educational ObjectivesObjective

A) The overall educational objective of the Bachelor of Science Biomedical Engineering Program is to prepare students for productive careers related broadly to biomedical engineering. It is anticipated that BME graduates will embark upon diverse career paths:

Obj-A-1) We anticipate that a significant number of our graduates will serve the medical device / pharmaceutical / biotechnology industries.

Obj-A-2) We also anticipate that many of our graduates will utilize their foundation from biomedical engineering education in a variety of related endeavors: for example, medicine, dentistry, law, business, management, and other engineering/scientific fields.

Objective B) While working within their selected career path, we expect that our alumni will demonstrate the following traits:

Obj-B-1) 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.

Obj-B-2) BME alumni are communicators/translators: We expect BME graduates to successfully and effectively utilize their multidisciplinary background to foster communication across professional and disciplinary boundaries.

Obj-B-3) 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.

Obj-B-4) 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

By the time they graduate from the Biomedical Engineering Program, students will demonstrate that they possess the following knowledge and skill sets:

(A) an ability to apply knowledge of mathematics, science, and engineering

(B) an ability to design and conduct experiments, as well as to analyze and interpret data

(C) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(D) an ability to function on multi-disciplinary teams

(E) an ability to identify, formulate, and solve engineering problems

(F) an understanding of professional and ethical responsibility

(G) an ability to communicate effectively

(H) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(I) a recognition of the need for, and an ability to engage in life-long learning

(J) a knowledge of contemporary issues

(K) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

(L) an understanding of biology and physiology

(M) the capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve problems at the interface of engineering and biology

(N) an ability to make measurements on and interpret data from living systems

(O) an ability to address problems associated with the interaction between living and non-living materials and systems

This program is accredited by the Engineering Accreditation Commission of ABET, http://abet.org.

B.S. in Biomedical Engineering (133 credits)

The following is a model timeline to complete the requirements for the degree. Beyond the 4th semester, semester credits and BME track course credits may differ from those listed, according to the track requirements provided.

FIRST YEAR:

1st Semester: (18 Credits)

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.

	*	HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Chem 125	General Chemistry I (3-0-3)
		Math 111	Calculus I (4-1-4)
		FED 101	Fundamentals of Engineering Design (2-1-2)
		BME 101	Introduction to Biomedical Engineering (1-0-0)
		BME 105	Introduction to Human Physiology I (2-0-2)

2nd Semester: (19 credits)

*	HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
	Phys 121	Physics II (3-0-3)
	Phys 121A	Physics II Laboratory (0-2-1)
	Chem 124	General Chemistry Laboratory (0-2-1)
	Chem 126	General Chemistry II (3-0-3)
	CS 101	Computer Programming and Problem Solving (3-0-3)
	Math 112	Calculus II (4-1-4)
	BME 106	Introduction to Human Physiology II (1-0-1)

SECOND YEAR:

1st Semester: (17 credits)

	Hist2XX	(Communication/Cultural History:GUR) (3-0-3)
	BME 301	Electrical Fundamentals of Biomedical Engineering (1-3-3)
	BME 302	Mechanical Fundamentals of Biomedical Engineering (1-3-3)
	BME 303	Biological and Chemical Foundations of Biomedical Engineering (3-0-3)
	Math 211	Calculus III A (3-0-3)
**	Math 279	Statistics and Probability for Engineers (2-0-2)

2nd Semester: (17 credits)

*	Elective	(Basic Social Science:GUR) (3-0-3)
	BME 310	Biomedical Computing (3-1-3)
****	Chem 243	Organic Chemistry I (3-0-3)
	BME 304	Material fundamentals of Biomedical Engineering (3-0-3)
	Math 222	Differential Equations (4-0-4)
	PE XXX	(Physical Education:GUR) (0-1-1)

THIRD YEAR:

1st Semester: (17 credits)

*	Elective	(Basic Social Sciences:GUR) (3-0-3)
*****	BME 381	Engineering Models in Physiology I (3-2-3)
	BME Track	(Core BME track course. Replace with Chem 243 for Biomechanics track) (3-0-3)
	Math 337	Linear Algebra (3-0-3)
	BME Track	(Core BME Track Course)
	PE XXX	(Physical Education:GUR) (0-1-1)

2nd Semester: (15 credits)

*	Elective	(Open Elective in Humanities and Social. Science:GUR) (3-0-3)
*****	BME 382	Engineering Models in Physiology II (3-2-3)
	BME Track	(Core BME Track Course)
	BMETrack	(Core BME Track Course)
***		

		BME Track	(Core BME Track or Elective Course)

FOURTH YEAR:

1st Semester: (16 credits)

	*	Mgmt 390	Principles of Management (3-0-3)
		BME 495	Capstone Design I (2-3-3)
		BME Track	(Core BME Track course) (3-0-3)
		BME Track	(Core BME Track course) (3-0-3)
	***	BME Track	(Core BME Track or Elective Course) (3-0-3)
	***	BME Track	(BME Track Elective-Laboratory)

2nd Semester: (15 credits)

	*	Elective	(Capstone Seminar-Humanities & Social Science:GUR) (3-0-3)
		Elective	(Lit/Hist/Phil/STS Phil 351, Hist 379 or Hist 381 recommended:GUR) (3-0-3)
		BME 496	Capstone Design 2 (2-5-3)
	***	BME Track	(BME Track Elective)
	***	BME Track	(BME Track Elective)

Specialized BME curricula are offered in three areas:

(1) bioinstrumentation, (2) biomechanics, (3) biomaterials and tissue engineering. The lists below give the courses that are required in each track. In addition, each track is completed by a number of upper-level technical electives that are chosen in consultation with track advisors.

Bioinstrumentation:

		BME 372	Biomedical Electronics (3-0-3)
		BME 333	Biomedical Signals and Systems (3-0-3)
		BME 373	Biomedical Electronics II (3-0-3)
		BME 489	Medical Instrumentation (3-0-3)
		ECE 251	Digital Design (3-1-3)
		ECE 252	Microprocessors (3-0-3)
		BME 386	Bioinstrumentation Laboratory (1-3-3)
		Advanced Elective	(Choose by consultation with advisor. A minimum of 18 credits required of which 6 must be engineering science or design.:)

Biomaterials and Tissue Engineering:

		BME 385	Cell and Biomaterial Engineering Laborarory (1-3-3)
		BME 420	Advanced Biomaterials Science (3-0-3)
		BME 427	Biotransport (3-0-3)
		BME 430	Fundamentals of Tissue Engineering (3-0-3)
		BME 422	Biomaterials Characterization (3-0-3)
		ChE 210	Chemical Process Calculations I (3-0-2)
		ChE 230	Chemical Engineering Thermodynamics I (3-0-3)
		Chem 244	Organic Chemistry II (3-0-3)
		MtSE 301	Principles of Material Science and Engineering (3-0-3)
		Advanced	(Choose by consultation with advisor. Minimum of 5 credits which must be

		Elective	engineering science or design.)

Biomechanics:

		BME 351	Introduction to Biofluid Mechanics (3-0-3)
		BME 384	Biomechanics Laboratory (1-3-3)
		BME 451	Biomechanics I (3-0-3)
		BME 452	Mechanical Behavior & Performance of Biomaterials (3-0-3)
		BME 420	Advanced Biomaterials Science (3-0-3)
		BME 478	Introduction to CAD for Biomechanics (2-2-3)
		Mech 236	Dynamics (2-0-2)
		Mech 320	Statics and Strength of Materials (3-0-3)
		Advanced Elective	(Choose by consultation with advisor. Minimum of 8 credits of which 4 must be engineering science or design.)

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* Course or elective satisfies GUR requirements.

** Math 279 is a co-requisite with BME 302.

*** FOCUS AREA: (34 credits). BME students are required to select a focus area or "track" before their 4th semester. The curriculum for each specialized track requires 34 credits, 27 of which must be in engineering and science or design.

**** Should be deferred to Third Year and replaced by Mech 320 for Biomechanics Track.

***** Students are required to take two of the following three courses: BME 381, BME 382, BME 383

B.S. in Biomedical Engineering - Accelerated (133 credits minimum)

Accelerated Students in Biomedical Engineering Department.

This program is designed to prepare the student upon graduation to pursue advanced education in a professional school (for medicine or dentistry).

The criteria for enrollment in this accelerated program include:

- Acceptance into the Albert Dorman Honors College.
- Acceptance into an accelerated pre-professional program.

FIRST YEAR:

1st Semester: (18 credits)

		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Chem 125	General Chemistry I (3-0-3)
		Math 111	Calculus I (4-1-4)
		FED 101	Fundamentals of Engineering Design (2-1-2)
		BME 101	Introduction to Biomedical Engineering (1-0-0)
		BME 105	Introduction to Human Physiology I (2-0-2)

2nd Semester: (19 credits)

		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)

		Chem 124	General Chemistry Laboratory (0-2-1)
		Chem 126	General Chemistry II (3-0-3)
		CS 101	Computer Programming and Problem Solving (3-0-3)
		Math 112	Calculus II (4-1-4)
		BME 106	Introduction to Human Physiology II (1-0-1)

Summer *(11 credits)*

		BME 302	Mechanical Fundamentals of Biomedical Engineering (1-3-3)
		Math 279	Statistics and Probability for Engineers (2-0-2)
	********	Mech 320	Statics and Strength of Materials (3-0-3)
		Hist2XX	(Humanities/Cultural History:GUR) (3-0-3)

SECOND YEAR

1st Semester: (20 credits)

		Math 211	Calculus III A (3-0-3)
		R120:101	General Biology I (3-3-4)
		Chem 243	Organic Chemistry I (3-0-3)
		BME 301	Electrical Fundamentals of Biomedical Engineering (1-3-3)
	********	BME 420	Advanced Biomaterials Science (3-0-3)
	********	MtSE 301	Principles of Material Science and Engineering (3-0-3)

2nd Semester: (19 credits)

		BME 310	Biomedical Computing (3-1-3)
		R120:102	General Biology II (3-3-4)
		Chem 244	Organic Chemistry II (3-0-3)
		Chem 244A	Organic Chemistry II Laboratory (0-4-2)
	********	BME 422	Biomaterials Characterization (3-0-3)
		Math 222	Differential Equations (4-0-4)

Summer *(12 credits)*

		Elective	(Basic Social Science:GUR) (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)
	********	BME 491	Research and Independent Study I (3-0-3)
		Math 337	Linear Algebra (3-0-3)

THIRD YEAR

1st Semester: (18 credits)

		Elective	(Basic Social Science:GUR) (3-0-3)
	********	ChE 230	Chemical Engineering Thermodynamics I (3-0-3)
	********	BME 430	Fundamentals of Tissue Engineering (3-0-3)
		BME 381	Engineering Models in Physiology I (3-2-3)
		BME 495	Capstone Design I (2-3-3)
	********	BME 479	BioMicroElectroMechanical Systems (3-0-3)
		PE	(Physical Education:GUR) (0-1-1)

2nd Semester: (18 credits)

		Elective	(Lit/Hist/Phil/STS 3xx/4xx GUR) (3-0-3)
		Elective	(Open Hum/SS:GUR) (3-0-3)
	********	BME 427	Biotransport (3-0-3)

		BME 382	Engineering Models in Physiology II (3-2-3)
		BME 495	Capstone Design I (2-3-3)
		Elective	(Humanities Capstone:GUR) (3-0-3)
		PE	(Physical Education:GUR) (0-1-1)

B. S. in Engineering Science with Concentration in BME for Pre-Health - Accelerated (136 credits minimum)

FIRST YEAR:

1st Semester: (18 credits)

		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Phys 111W	Physics I Workshop (0-1-0)
		Chem 125	General Chemistry I (3-0-3)
		Math 111	Calculus I (4-1-4)
		FED 101	Fundamentals of Engineering Design (2-1-2)
		BME 105	Introduction to Human Physiology I (2-0-2)

2nd Semester: (18 credits)

		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		Chem 124	General Chemistry Laboratory (0-2-1)
		Chem 126	General Chemistry II (3-0-3)
		CS 101	Computer Programming and Problem Solving (3-0-3)
		Math 112	Calculus II (4-1-4)
		BME 106	Introduction to Human Physiology II (1-0-1)
		BME 101	Introduction to Biomedical Engineering (1-0-0)

Summer: (8 credits)

		Chem 243	Organic Chemistry I (3-0-3)
		Chem 244	Organic Chemistry II (3-0-3)
		Chem 244A	Organic Chemistry II Laboratory (0-4-2)

SECOND YEAR:

1st Semester: (19 credits)

		R120:101	General Biology I (3-3-4)
	*****	BME 301	Electrical Fundamentals of Biomedical Engineering (1-3-3)
	*****	BME 302	Mechanical Fundamentals of Biomedical Engineering (1-3-3)
	******	MtSE 301	Principles of Material Science and Engineering (3-0-3)
		Math 211	Calculus III A (3-0-3)
		Math 225	Survey of Probability and Statistics (1-0-1)

2nd Semester: (18 credits)

		Elective	(Basic Social Science:GUR) (3-0-3)
		R120:102	General Biology II (3-3-4)
	******	Mech 320	Statics and Strength of Materials (3-0-3)
	******	BME 420	Advanced Biomaterials Science (3-0-3)

		Math 222	Differential Equations (4-0-4)
		Elective	(Physical Education:GUR) (0-1-1)

THIRD YEAR:

1st Semester: (16 credits)

		Elective	(Basic Social Science:GUR) (3-0-3)
		Hist2XX	(Communication/Cultural History:GUR) (3-0-3)
		Elective	(BME-Approved Elective, Science or Engineering) (3-0-3)
	******	BME 430	Fundamentals of Tissue Engineering (3-0-3)
	*****	BME 381	Engineering Models in Physiology I (3-2-3)
		Elective	(Physical Education:GUR) (0-1-1)

		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3) (Phil 351, Hist 379 and Hist 381 are recommended)
		Elective	(Open HUM/SS:GUR) (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)
	*****	BME 382	Engineering Models in Physiology II (3-2-3)
	******	BME 491	Research and Independent Study I (3-0-3)
		Elective	(Humanities Capstone) (3-0-3)

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* If the elective is engineering, there will be 51 engineering credits.

** If the elective is science or other, there will be 48 engineering credits.

**** Legal Studies electives are chosen in consultation with the Legal Studies Minor Coordinator.

***** Note: BME approved courses must be Engineering courses that are included in the BME curriculum. Curriculum subject to approval by University Curiculum Review Committee in Fall 2006.

****** Suggested course to fulfill BME concentration and/or engineering credit requirement (30 engineering credits for Engineering Science degree); may be replaced by BME-approved course.

******* Course is currently administered by Rutgers University Biology Departement

******** Suggested course to fulfill B.S. in BME requirements; may be replaced by BME approved course.

BioPhysics

Administered By: Department of Physics

Administration

Chair	N M. Ravindra
Co-Directors	Camelia Prodan, Gordon A. Thomas

Faculty

Professors	Gordon A. Thomas
Associate Professors	Camelia Prodan
Research Professors	Reginald Farrow

Advisors

Undergraduate Advisor	Camelia Prodan, Gordon A. Thomas

For graduation, students must earn a minimum GPA of 2.00 overall, and 2.00 in all physics courses taken.*The Bachelor of Science (BS) in Biophysics prepares students for* careers in medicine and related fields. A large part of the MCAT and similar exams are devoted to this interdisciplinary area because it is so important. The biophysics courses use physics as a foundation and integrate biomedical science such as medical devices, cellular electronics, genetic engineering, microbiology, molecular biology and radiology.

Biophysics is a new, exciting interdisciplinary area with expanding career opportunities. The past 20 years have witnessed a revolution in biophysical sciences. Biology studies life in its variety and complexity. It describes how organisms go about getting food, communicating, sensing the environment, and reproducing. On the other hand, physics looks for mathematical laws of nature and makes detailed predictions about the forces that drive idealized systems. Spanning the distance between the complexity of life and the simplicity of physical laws is the challenge of biophysics. Looking for the patterns in life and analyzing them with math and physics is a powerful way to gain insights.

Biophysics looks for principles that describe patterns. If the principles are powerful, they make detailed predictions that can be tested.earn a minimum GPA of 2.00 overall, and 2.00 in all physics courses taken.

Bachelor of Science in BioPhysics (127 credits)

FIRST YEAR:

1st Semester:

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.

		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)

		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Math 111	Calculus I (4-1-4)
{		CS 113	Introduction to Computer Science (3-0-3) ***or***
		CS 115	Intro. to CS I in C++ (3-0-3)
{		Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
		Chem 125	General Chemistry I (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

		Phys 114	Introduction to Data Reduction with Applications (3-0-3)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		Math 112	Calculus II (4-1-4)
{		Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
		Chem 126	General Chemistry II (3-0-3)
		Chem 124	General Chemistry Laboratory (0-2-1)
		Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR:

1st Semester:

		R120:101	General Biology I (3-3-4)
		Math 225	Survey of Probability and Statistics (1-0-1)
		Phys 234	Physics III (3-0-3)
		Phys 231A	Physics III Laboratory (0-2-1)
		Chem 243	Organic Chemistry I (3-0-3)
		Math 211	Calculus III A (3-0-3)
		Elective	(Physical Education:GUR) (0-1-1)

2nd Semester:

		Math 222	Differential Equations (4-0-4)
		Math 328	Mathematical Methods for Scientists and Engineers (3-0-3)
		Phys 335	Introductory Thermodynamics (3-0-3)
		R120:301	Foundations of Biology: Cell and Molecular Biology (3-0-3)
		Elective	(Eng/Comm or Cultural History:GUR) (3-0-3)

THIRD YEAR:

1st Semester:

		R120:102	General Biology II (3-3-4)
		Phys 430	Classical Mechanics I (3-0-3)
		Phys 432	Electromagnetism I (3-0-3)
		Elective	(Social Science:GUR) (3-0-3)
		Elective	(Social Science:GUR) (3-0-3)

2nd Semester:

		OPSE 310	Virtual Instrumentation (3-0-3)
		Phys 433	Electromagnetism II (3-0-3)
		R120:360	Elementary Biochemistry (3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		Elective	(Cultural History:GUR) (3-0-3)

FOURTH YEAR:

1st Semester:

		Elective	(Eng/Hist/Lit/Phil/STS/SS/THTR:GUR) (3-0-3)
		Phys 442	Introduction to Quantum Mechanics (3-0-3)
		Phys 418	Fundamentals of Optical Imaging (2-2-3)
		Elective	(300-400 Physics Elective) (3-0-3)
		Phys 350	Biophysics I (3-0-3)

2nd Semester:

		Elective	(Management:GUR) (3-0-3)
		Phys 451	Biophysics II (3-0-3)
		Phys 450	Advanced Physics Laboratory (1-4-3)
		OPSE 410	Biophotonics (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)

Specific General University Requirements

Courses that satisfy the General University Requirements are so certified by the University Curriculum Review Committee at the time they are first approved to be offered.

Business

Administered By: School of Management

Administration

Dean	Pius J. Egbelu
Associate Dean	Lisa B. Axe
Sponsored Chairs	Katia Passerini(Hurlburt Professor)* , William V. Rapp(Henry J. Leir Chair in International Business)
Director, Executive Program	Delores E. Frazier

Advisors

Undergraduate Advisor	Michael T. Sweeney
Graduate Advisor	Lilia A. Lozarito

Faculty

Distinguished Professors	Pius J. Egbelu
Professors	Asokan Anandarajan, Jerry L. Fjermestad* , Shanthi Gopalakrishnan, Kenneth D. Lawrence, Rajiv Mehta, Hindy L. Schachter, Mark Somers, Cheickna Sylla
Associate Professors	Theologos H. Bonitsis, Katia Passerini* , Marguerite A. Schneider, Stephan P. Kudyba, Yi Chen
Assistant Professors	Michael A. Ehrlich, Wei Xu, Zhipeng Yan, Ronald Sverdlove, Ellen Thomas, James E. Cicon, Cesar Bandera
Special Lecturer	Jose C. Casal, Porchiung B. Chou, Diana Walsh, Karen P. Schoenebeck

* Joint appointee with the Department of Computer and Information Science

** Joint appointee with the School of Architecture

B. S. in Business

The B.S. in Business curriculum is designed to help students understand the many functions involved in operating a successful organization in today's global economy. The School of Management draws upon NJIT's vast resources in science and technology to present a focused program emphasizing the application and management of technology to improve decision-making and competitiveness in organizations, from the multinational conglomerate to the local small business.

The curriculum is cross-disciplinary in approach, emphasizing the intersection of information technologies, business planning, and human behavior in organizations. The program also emphasizes quantitative skills and utilization of current information-age technologies. Students are introduced to multimedia systems, E-commerce and Financial Systems. Students also gain knowledge of current telecommunications technologies and their impact on business operations. Since companies in both domestic and international markets increasingly seek technology-oriented business managers, NJIT business graduates have an advantage.

CONCENTRATIONS

The B.S. in Business offers five concentrations: management information systems, marketing, finance, international business and accounting.

The management information systems concentration focuses on the design of information systems that improve business effectiveness. Coursework includes programming languages, database design, and applications of information technologies to business problems.

The marketing concentration focuses on business-to-business marketing with a strong emphasis on the marketing of technology-based products and innovations. Courses emphasize selling and promotion, product design and market research, and marketing information systems.

The finance concentration focuses on finance and financial technologies. Courses cover topics such as securities, risk management, financial statement analysis and ERP systems.

The International Business specialization emphasizes global business and an understanding of diverse cultures and business environments. Students are strongly encouraged to study abroad at one of our partner universities.

The accounting concentration offers students who want to become accountants the required course path for getting a CPA license. Courses include managerial accounting, cost accounting, auditing, federal tax and new courses that will be added are forensic and international accounting.

The curriculum as described below is for students entering NJIT as freshmen in the Fall 2007 or after that date. Students entering before that date may have a different program and should consult the school to learn which curriculum applies.

B.S. in Business (123 Credit minimum)

FIRST YEAR:
1st Semester:

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.

Acct 115	Fundamentals of Financial Accounting (3-0-3)
CS 103	Computer Science with Business Problems (3-0-3) ***or***
IS 118	Introduction to Software Application Tools (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Math 135	Calculus for Business (3-0-3)
Mgmt 190	Introduction to Business (3-0-3)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

Acct 215	Managerial Accounting I (3-0-3)
Econ 265	Microeconomics (3-0-3)
MIS 245	Introduction to Management Information Systems (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
PE	(Physical Education GUR) (0-1-1)
Mgmt 290	Business Law I (3-0-3)

SECOND YEAR:
1st Semester:

Econ 266	Macroeconomics (3-0-3)
Math 105	Elementary Probability and Statistics (3-0-3)
Elective	(Natural Science GUR) (3-0-3)
HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***

	Hist 213	The Twentieth-Century World (3-0-3)
	PE	(Physical Education GUR) (0-1-1)
	Elective	(Free Elective 3-0-3)

2nd Semester:

	Fin 218	Financial Markets and Institutions (3-0-3)
	Elective	(Hum 251 or any 200 level and above Philosophy or Ethics course) (3-0-3)
	Mgmt 216	Business Statistics (3-0-3)
	Elective	(Eng 200 or any Eng 300 level or above) (3-0-3)
	Elective	(Natural Science Lab) (4)

THIRD YEAR:
1st Semester:

	Fin 315	Fundamentals of Corporate Finance (3-0-3)
	HRM 301	Organizational Behavior (3-0-3)
	Mgmt 316	Business Research Methods (2-1-3)
	Mrkt 330	Principles of Marketing (3-0-3)
**	Elective	(Business Specialization Course) (3-0-3)

2nd Semester:

	MIS 363	Project Management for Managers (3-0-3)
	OM 375	Management Science (3-0-3)
**	Elective	(Business Specialization course) (3-0-3)
	Elective	(300 level STS course or Phil or Lit orHist GUR) (3-0-3)
	Elective	(Free Elective) (3-0-3)

FOURTH YEAR:
1st Semester:

	Mgmt 491	International Business (3-0-3)
	Elective	(300 level HUM/SS/ENG/Thtr/Lit/Hist/Phil/Econ/Poli. Sci.) (3-0-3)
**	Elective	(Business Specialization course) (3-0-3)
**	Elective	(Business Specialization course) (3-0-3)
	Elective	(Free Elective) (3-0-3)

2nd Semester:

	Mgmt 492	Business Policy (3-0-3)
	Mgmt 480	Managing Technology and Innovation (3-0-3)
	Elective	(HSS Capstone Seminar:GUR) (3-0-3)
**	Elective	(Business Specialization Course) (3-0-3)
	Elective	(Free) (3-0-3)

BUSINESS SPECIALIZATION COURSES: Choose 5 courses in your concentration.

BUSINESS CONCENTRATION ELECTIVES

Students must receive written approval from a faculty advisor, prior to registration, for all option electives.

Accounting Specialization

Choose 5:
9 Credits from:

Acct 325	Intermediate Accounting I (3-0-3)
Acct 425	Tax Accounting I (3-0-3)
Acct 415	Auditing (3-0-3)
Acct 335	Managerial Accounting II (3-0-3)
Acct 435	Intermediate Accounting II (3-0-3)
Fin 403	Financial Statement Analysis (3-0-3)

Finance Specialization

Choose 5:

Fin 401	Securities in Financial Markets (3-0-3)
Fin 402	Financial Risk Measurement and Management (3-0-3)
Fin 403	Financial Statement Analysis (3-0-3)
Fin 416	Advanced Corporate Finance (3-0-3)
Fin 417	(Advance Portfolio Analysis) (3-0-3)
Fin 422	International Finance (3-0-3)
Fin 430	Options and Futures Markets (3-0-3)
Entr 420	Financing New Venture (3-0-3)

International Business Specialization

Choose 5:

Fin 422	International Finance (3-0-3)
Mrkt 435	International Marketing (3-0-3)
SS 318	International Economic Policy (3-0-3)
SS 351	International Relations (3-0-3)
Eng 360	Collaborative Communication: Community and Global Perspectives (3-0-3)
MGMT 3XX	(Special Topics)
HRM 310	Managing Diversity in Organizations (3-0-3)

Management Specialization

Choose 5:

Entr 410	New Venture Management (3-0-3)
Fin 402	Financial Risk Measurement and Management (3-0-3)
HRM 310	Managing Diversity in Organizations (3-0-3) ***or***
HRM 415	Organizational Design and Development (3-0-3)
Mrkt 338	Product Development and Management (3-0-3)
MRKT431	***or***
Mrkt 432	Sales Management (3-0-3)
Entr 420	Financing New Venture (3-0-3)
Fin 403	Financial Statement Analysis (3-0-3) ***or***
Fin 416	Advanced Corporate Finance (3-0-3)
Eng 360	Collaborative Communication: Community and Global Perspectives (3-0-3)

Management Information Systems Specialization

Choose 5:

CS 114	Introduction to Computer Science II (3-0-3)

		CS 332	Principles of Operating Systems (3-0-3)
		Mrkt 360	Internet Marketing (3-0-3)
		IS 390	Requirements Analysis and Systems Design (3-0-3)
		IS 431	Database Design, Management and Applications (3-0-3)
		CS 451	Network Technologies (3-0-3)
		Mgmt 350	Knowledge Management (3-0-3)
		IS 455	Information Systems Management (3-0-3)

Marketing Specialization

Choose 5:

		Entr 410	New Venture Management (3-0-3)
		Mrkt 331	Consumer and Buyer Behavior ((3-0-3))
		MRKT332	
		Mrkt 338	Product Development and Management (3-0-3)
		Mrkt 339	Professional Selling (3-0-3)
		Mrkt 360	Internet Marketing (3-0-3)
		Mrkt 430	Marketing Research (3-0-3)
		MrKt431	(Marketing Strategy) (3-0-3)
		Mrkt 432	Sales Management (3-0-3)
		Mrkt 434	Business to Business Marketing (3-0-3)
		Mrkt 435	International Marketing (3-0-3)

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* Needs approval.

** Study abroad courses can apply.

*** Study abroad courses can fulfill requirements also.

Catalog and curricula information approved by the relevant academic department.

Business and Information Systems

Administered By: Department of Information Systems , College of Computing Sciences, Guttenberg Information Technologies Center, Room 5500. For more details, please visit the IS web page at http://is.njit.edu

Administration

Interim Dean, College of Computing Sciences	James Geller
Associate Dean, College of Computing Sciences	Barry Cohen
Assistant to the Dean, College of Computing Sciences	Serena Branson
Chair, Information Systems Department	Yi-fang Wu
Assistant to the Chair, Information Systems	Michelle D. Craddock-Bouler
Director of Undergraduate HCI Program	Quentin Jones
Director of Undergraduate IS Programs	Lin Lin
Director of Master's Programs	Michael P. Bieber
Director of Emergency Management & Business Continuity	Michael J. Chumer
Director of PhD Program	Michael P. Bieber
Secretary	Patricia B. Lundberg

Faculty

Professors Emeriti	S R. Hiltz, Marilyn Tremaine, Murray Turoff
Professors	Michael P. Bieber, Fadi Deek
Associate Professors	Quentin Jones, Michael L. Recce, Julian M. Scher, Yi-fang Wu
Assistant Professors	Lian Duan, Songhua Xu
Senior University Lecturers	Richard W. Egan, Lin Lin, Keith A. Williams

Advisors

Advisor B.A./ B.S.	Amanda D. Ackerman, George W. Olsen, Casey L. Hennessey
Advisor M.S.	George W. Olsen
Advisor Ph.D.	Michael P. Bieber

Information systems (IS) are computer systems that support business operations, management, and decision making in organizations. IS are an integral part of virtually every work environment and play a critical role in running organizations. They are the heart of the internet-based economy. IS enable people to access the information they need, to collaborate, make informed decisions, and perform their jobs and personal activities effectively. IS and the Web are deeply intertwined.

The field of Information Systems bridges computing and business. IS professionals serve as the critical link between the technical and business areas of an organization. They collaborate to solve problems, and then design, analyze, implement, deploy and evaluate the computing systems that drive the modern enterprise. IS professionals are thus among the most essential individuals in an organization, building and managing the systems upon which the enterprise survives and thrives.BS in Business & Information Systems

The BS BIS degree provides the best of both worlds—a solid understanding of business concepts and the technical know-how to support the needs of an organization and its customers. Besides learning about IS topics such as databases, application development tools, web design, software use and evaluation, management information and decision support systems, students will learn such business topics as accounting, finance, financial products, business operations, and marketing.

The program concludes with a capstone project with a major local company. The U.S. Bureau of Labor Statistics points to a great need for people with strong management and technical skills well into the next decade. Jobs in this field include business systems analyst, management analyst, and e-commerce architect. BS BIS students also qualify for NJIT's Business minor.

Bachelor of Science in Business and Information Systems (129 credits)

FIRST YEAR:

1st Semester: (17 credits)

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.

	CS 100	Roadmap to Computing (3-0-3)
	Acct 117	Survey of Accounting (3-0-3)
	Science Elective	(Science) (3-0-3)
	HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
*	Math 138	General Calculus I (3-0-3)
	CS 107	Computing as a Career (1-0-1)

2nd Semester: (16 credits)

	IS 117	Introduction to Website Development (3-0-3)
	CS 113	Introduction to Computer Science (3-0-3)
	Econ 201	Economics (3-0-3)
	IS 265	Introduction to Information Systems (3-0-3)
	HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
	Science	(Science with lab) (3-1-4)
	Phys Ed	(Physical Education 0-1-1)

SECOND YEAR:

1st Semester: (16 credits)

*	Math 105	Elementary Probability and Statistics (3-0-3)
	IS 350	Computers, Society and Ethics (3-0-3) ***or***
	HSS 251	Ethical Issues in Business (3-0-3)
	IT 310	E-commerce Technology (3-0-3)
	Elective	(General Elective) (3-0-3)
	Phys Ed	(Physical Education) (0-1-1)

2nd Semester: (16 credits)

	IS 247	Designing the User Experience (3-0-3)
	IS 344	Computing Applications in Business (3-0-3)
	IS 117	Introduction to Website Development (3-0-3) ***or***
	IS 218	Building Web Applications (3-0-3)
	Elective	(Social Science GUR) (3-0-3)

{		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		General Elective	(General Elective) (3-0-3)
		CS 207	Computing and Effective Communication (1-0-1)

THIRD YEAR:

1st Semester: (18 credits)

		Mgmt 216	Business Statistics (3-0-3)
		Fin 218	Financial Markets and Institutions (3-0-3)
		IS 390	Requirements Analysis and Systems Design (3-0-3)
		IS 331	Database Design Management and Applications (3-0-3)
		General Elective	(General Elective) (3-0-3)
{		Eng 352	Technical Writing (3-0-3) ***or***
		Eng 340	Oral Presentations (3-0-3)

2nd Semester: (15 credits)

		HRM 301	Organizational Behavior (3-0-3)
		Fin 315	Fundamentals of Corporate Finance (3-0-3)
		IS 375	Evaluating the User Experience (3-0-3)
		CS 356	Introduction to Computer Networks (3-0-3)
		General Elective	(General Elective) (3-0-3)

FOURTH YEAR:

1st Semester: (16 credits)

		Mrkt 330	Principles of Marketing (3-0-3)
		Mgmt 491	International Business (3-0-3)
		Mgmt 492	Business Policy (3-0-3)
	**	IE 492	Engineering Management (3-0-3)
		IS 455	Information Systems Management (3-0-3)
		CS 407	Professional Development in Computing (1-0-1)

2nd semester: (15 credits)

{		CS 491	Senior Project (3-0-3) ***or***
		IS 491	Senior Project (3-0-3) ***or***
		IT 491	IT Capstone Project (3-0-3)
		IS 465	Advanced Information Systems (3-0-3)
		Elective	(Upper lit/phil/Hist/STS elective) (3-0-3)
		General Elective	(General Elective) (3-0-3)
		Elective	(HSS Capstone Seminar) (3-0-3)

Curriculum Overview

Following is an overview of the curriculum.? The full curriculum is in the next section.

Core Information Systems Courses

Semester	Course #	Title
2	IS 265	Introduction to Information Systems
3	IT 310	E-Commerce Technology
3	IS 247	Designing the User Experience
3	IS 350*	Computers, Ethics and Society
4	IS 344	Computing Applications in Business
5	IS 390	Requirements Analysis and Systems Design
6	IS 375	Evaluating the User Experience
7	IS 465	Advanced Information Systems
7	IE 492	Engineering Management (Project Management)
8	IS 491	Senior Capstone Project

Core Business Courses

Semester	Course #	Title
1	ACCT 117	Survey of Accounting
2	ECON 201	Economics
3	HSS 251*	Ethical Issues in Business
5	MGMT 216	Business Statistics
5	FIN 218	Financial Markets and Institutions
6	HRM 301	Human Resource Management
6	FIN 315	Fundamentals of Corporate Finance
7	MRKT 330	Principles of Marketing
7	MGMT 491	International Business
8	MGMT 492	Business Policy

** Students may take HSS 251 or IS 350*

Technical Foundation Courses

Semester	Course #	Title
1	CS 100	Roadmap to Computing
2	CS 113	Introduction to Computer Science
5	IS 331	Database Design, Management and Applications
6	CS 356	Introduction to Computer Networks

Career Building Courses

Semester	Course #	Title

1	CS 107	Computing as a Career
4	CS 207	Computing and Effective Communication
7	CS 407	Professional Development in Computing

B. S. in Science, Technology and Society/Business and Information Systems (126 Credits)

FIRST YEAR:

1st Semester: (17 credits)

IS 118	Introduction to Software Application Tools (3-0-3)
Math 138	General Calculus I (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Science	(Science with Lab) (3-2-4)
Econ 201	Economics (3-0-3)
PE	(Physical Education GUR) (0-1-1)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (16 credits)

CS 113	Introduction to Computer Science (3-0-3) ***and***
CS 113A	Lab (0-1.5-0)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Math 105	Elementary Probability and Statistics (3-0-3)
Science	(Science with Lab) (3-0-3)
STS 101	Foundations of Science, Technology and Society (3-0-3)
PE	(Physical Education GUR) (0-1-1)

SECOND YEAR:

1st Semester: (15 credits)

Mgmt 216	Business Statistics (3-0-3)
HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
IS 245	Information Technology Systems: Hardware/Software (3-0-3)
Acct 117	Survey of Accounting (3-0-3)
STS 257	Technology, Society and Culture: An American View (3-0-3)

2nd Semester: (18 credits)

IS 265	Introduction to Information Systems (3-0-3)
IS334	
IS 350	Computers, Society and Ethics (3-0-3)
STS 258	Technology, Society and Culture: A Global View (3-0-3)
EPS 202	Society, Technology, and the Environment (3-0-3)
Elective	(Free Elective) (3-0-3)

THIRD YEAR:

1st Semester: (15 credits)

		STS 304	Writing about Science, Technology and Society (3-0-3)
		Phil 355	The Philosophy of Science (3-0-3)
		STS 312	Technology and Policy in Contemporary America (3-0-3)
		IS 344	Computing Applications in Business (3-0-3)
		Fin 315	Fundamentals of Corporate Finance (3-0-3)

2nd Semester: (15 credits)

		IS 390	Requirements Analysis and Systems Design (3-0-3)
		STS 307	Fundamentals of Research in STS (3-0-3)
		STS 310	Technology and Human Values (3-0-3)
		HRM 301	Organizational Behavior (3-0-3)
		OM 375	Management Science (3-0-3)

FOURTH YEAR:

1st Semester: (15 credits)

		STS 490	Project and Seminar I (3 credits)
		IS 431	Database Design, Management and Applications (3-0-3)
		IS 455	Information Systems Management (3-0-3)
		Mgmt 491	International Business (3-0-3)
		Elective	(Free Elective) (3-0-3)

2nd Semester: (15 credits)

		HSS	(HSS Capstone Seminar) (3-0-3)
		IS 491	Senior Project (3-0-3)
		Mgmt 492	Business Policy (3-0-3)
		Mrkt 330	Principles of Marketing (3-0-3)
		STS 491	Project and Seminar II (3 credits)

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* Math 111 and Math 333 are highly recommended to replace Math 138 and Math 105, 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 (Statistics), Math 344 (Regression Analysis), Math 334 (Operations Research) and Math 443 (Statistical Methods), all of which require Math 333 as a prerequisite.

** Off-campus e-learning only students may substitute Mgmt 390 instead of IE 492.

Catalog and curricula information approved by the relevant academic department.

Chemical Engineering

Administered By: Otto H. York Department of Chemical, Biological and Pharmaceutical Engineering

Administration

Chairman	Norman Loney
Director of Pharmaceutical Engineering Program	Piero M. Armenante

Faculty

Distinguished Professors	Piero M. Armenante, Kamalesh K. Sirkar, Rajesh N. Dave
Foundation Professor	Kamalesh K. Sirkar(Membrane Separations)
Professors	Basil C. Baltzis, Robert B. Barat, Boris Khusid, Edward L. Dreyzin, Teddy Greenstein, Deran Hanesian, Howard S. Kimmel, Norman Loney, Angelo Perna, Donald H. Sebastian, Reginald P. Tomkins, Marino Xanthos
Associate Professor	Laurent Simon
Assistant Professors	Ecevit A. Bilgili, Xianqin Wang
Distinguished Research Professors	Costas G. Gogos
Research Professors	Hyun J. Jun, Ming-wan Young
Joint Appointments	Joseph W. Bozzelli(Chemistry), Somenath Mitra(Chemistry)

Advisors

Undergraduate Advisor	Lisa M. Kardos
Co-Graduate Advisors	Norman Loney, Reginald P. Tomkins
Freshman Advisor	Lisa M. Kardos

Chemical engineers use chemistry, biology, physics and math in a 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 EDUCATIONAL OBJECTIVES:

1 - 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.

2 - **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.

3 - **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, Biological and Pharmaceutical Engineering will have:

a) an ability to apply knowledge of mathematics, science and engineering

b) an ability to design and conduct experiments, as well as to analyze and interpret data of importance to the design and analysis of chemical processes.

c) an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d) an ability to function on multi-disciplinary teams

e) an ability to identify, formulate, and solve engineering problems

f) an understanding of professional and ethical responsibility

g) an ability to communicate effectively through written reports and oral presentations.

h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context

i) a recognition of the need for, and an ability to engage in life-long learning

j) an introduction to contemporary issues in chemical engineering

k) an ability to use the techniques, skills and modern engineering tools necessary for chemical engineering practice.

This program is accredited by the Engineering Accreditation Commission of ABET, http://abet.org

ADVISEMENT

All student 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 with **Mrs. Kathy Tomlinson**, to see their undergraduate advisor, **Lisa M Kardos**. Appointments can be made in the Chemical, Biological and Pharmaceutical Engineering Department, 150 Tiernan Hall or by calling (973)596-3568.

FRESHMAN ADVISEMENT

Some freshmen are assigned courses (Chem 121-122; Eng 095-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.

B.S. in Chemical Engineering (135 credits minimum)

FIRST YEAR:

1st Semester:

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.

{		Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
		Chem 125	General Chemistry I (3-0-3)
		FED 101	Fundamentals of Engineering Design (2-1-2)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
{		Math 111	Calculus I (4-1-4) ***or***
		Math 131	Calculus A (4-1-4)
		STS 201	Understanding Technological Society (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)
		Phys Ed	(Physical Education:GUR) (0-1-1)

2nd Semester:

		ChE 101	Introduction to Chemical Engineering (1-0-0)
		Chem 124	General Chemistry Laboratory (0-2-1)
		Chem 126	General Chemistry II (3-0-3)
		CS 101	Computer Programming and Problem Solving (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Math 112	Calculus II (4-1-4) ***or***
		Math 132	Calculus B (4-1-4) ***or***

Math 133	Calculus C (4-1-4)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
PE Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR:
1st Semester:

ChE 210	Chemical Process Calculations I (3-0-2)
ChE 210W	Chemical Process Calculations I (0-1-0)
ChE 230	Chemical Engineering Thermodynamics I (3-0-3)
ChE 230W	Chemical Engineering Thermodynamics I Workshop (0-1-0)
Chem 245	Organic Chemistry for Chemical Engineers (4-1-4)
Math 211	Calculus III A (3-0-3)
HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
Econ 201	Economics (3-0-3)

2nd Semester:

Chem 238	Analytical/Organic Chem Lab for Chemical Engineers (0-4-2)
ChE 240	Chemical Process Calculations II (3-0-3)
ChE 240W	Chemical Process Calculations II (0-1-0)
ChE 260	Fluid Flow (3-0-3)
Chem 236	Physical Chemistry for Chemical Engineers (4-1-4)
Math 222	Differential Equations (4-0-4)

THIRD YEAR:
1st Semester:

ChE 342	Chemical Engineering Thermodynamics II (3-0-3)
ChE 370	Heat and Mass Transfer (4-0-4)
ChE 380	Introduction to Biotechnology (3-0-3)
Eng 352	Technical Writing (3-0-3)
Chem 339	Analytical/Physical Chem Lab for Chemical Engineers (0-4-2)
Math 225	Survey of Probability and Statistics (1-0-1)

2nd Semester:

ChE 349	Kinetics and Reactor Design (3-0-3)
ChE 360	Separation Processes I (3-0-2)
ChE 365	Techniques for Process Simulation (3-0-2)
ChE 396	Chemical Engineering Laboratory I (0-5-3)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
Mech 320	Statics and Strength of Materials (3-0-3)

FOURTH YEAR:
1st Semester:

ChE 460	Separation Processes II (3-0-2)
ChE 489	Process Dynamics and Control (2-2-3)
ChE 375	Structure, Properties and Processing of Materials (3-0-3)

		ChE 496	Chemical Engineering Laboratory II (0-6-3)
		IE 492	Engineering Management (3-0-3)
		Elective	(Concentration) (3-0-3)

2nd Semester:

		ChE 472	Process and Plant Design (4-0-4)
		Elective	(Concentration) (3-0-3)
		Elective	(Concentration) (3-0-3)
	**	Elective	(HSS Capstone Seminar:GUR) (3-0-3)
	*	Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)

Students must earn a 2.0 minimum GPA and must meet appropriate departmental regulations. These include an average GPA of 2.0 in all chemical engineering courses.

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* Elective: One 300-level course in Literature, History, Philosophy or STS.

** Capstone Seminar: All students must take one 400-level capstone seminar offered by the Dept. of Humanities and Social Sciences.

*** Students must take Math 225 (Special section for ChE and Chemistry) at the same time as Chem 339.

Catalog and curricula information approved by the relevant academic department.

Chemistry

Administered By: Department Chemistry and Environmental Science

Administration

Chair	Edgardo T. Farinas
Associate Chair	Edgardo T. Farinas
Director of Freshman Chemistry	Frank B. Ellis

Faculty

Distinguished Professors	Joseph W. Bozzelli, Carol A. Venanzi, Somenath Mitra
Professors	Tamara Gund, Lev N. Krasnoperov, Nancy L. Jackson
Associate Professors	Leonard Dauerman, Maurie Cohen, Edgardo T. Farinas, Zeyuan Qiu
Assistant Professors	Liping Wei, Haidong Huang
Research Professors	Zafar Iqbal
University Lecturers	William Skawinski, Michael P. Bonchonsky, Roumiana S. Petrova, Alexander D. Butherus, Bhavani Balasubramanian, Kathleen M. Gilbert
Director of Freshman Chemistry	Frank B. Ellis
Professor Emeritus	Barbara B. Kebbekus, Donald Getzin

Advisors

Chemistry Graduate Advisor	Carol A. Venanzi
Pharma Chem Graduate Advisor	Lev N. Krasnoperov
Undergraduate Advisor	Roumiana S. Petrova

The Bachelor of Science (BS) in Chemistry prepares students for careers in industry and for entry to graduate school or professional schools in areas of chemistry, medicine, dentistry or law. The program includes solid emphasis on laboratory skills, scientific principles and mathematics in practical, industrially-oriented areas of chemistry. Students can specialize or explore a particular area of chemistry or prepare for an advanced degree by selecting from a wide range of technical electives. It is recommended that each student carry out an undergraduate research project with a faculty mentor. The faculty have expertise in areas such as energy, fuels, pharmaceuticals, petrochemicals, materials, environmental chemistry and pollution control. Research areas include analytical and environmental chemistry at industrial and microchip scales, synthesis of organic and inorganic materials in green solvents, computer-aided drug design, laser diagnostics of elementary processes, kinetics, thermochemistry and thermodynamics.

Credit requirement for graduation is 125 credits.

The curriculum as described below is for students entering NJIT as freshmen in the fall of 2000 or after that date. Students entering before that date may have a different program and should consult the department to learn which curriculum applies.

Web Address: http://chemistry.njit.edu

B.S. in Chemistry (125 credits minimum)

FIRST YEAR:

1st semester:

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.

{		Chem 125	General Chemistry I (3-0-3) ***or***
		Chem 121	Fundamentals of Chemical Principles I (3-0-3)
{		CS 113	Introduction to Computer Science (3-0-3) ***or***
		BNFO 135	Programming for Bioinformatics (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 111	Calculus I (4-1-4)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd semester:

		Chem 124	General Chemistry Laboratory (0-2-1)
{		Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
		Chem 126	General Chemistry II (3-0-3)
		Math 112	Calculus II (4-1-4)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		PE	(Physical Education:GUR) (0-1-1)

SECOND YEAR:

1nd semester:

		Chem 221	Analytical Chemical Methods (0-4-2)
		Chem 222	Analytical Chemistry (3-0-3)
		Chem 243	Organic Chemistry I (3-0-3)
		Math 211	Calculus III A (3-0-3)
		Elective	(Cultural History:GUR) (3-0-3)
		PE	(Physical education:GUR) (0-1-1)

2nd semester:

		Chem 231	Physical Chemistry I (3-0-3)
		Chem 244	Organic Chemistry II (3-0-3)
		Chem 244A	Organic Chemistry II Laboratory (0-4-2)
	�	EPS 202	Society, Technology, and the Environment (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Technical) (3-0-3)

THIRD YEAR:

1nd semester:

		Chem 235	Physical Chemistry II (3-0-3)
	�		

		Econ 201	Economics (3-0-3)
		Elective	(Lit/Hist/Phil/STS) (GUR) (3-0-3)
		Elective	(Technical) (3-0-3)
		Elective	(Technical) (3-0-3)

2nd semester:

		Chem 340	Chemistry and Engineering of Materials (3-0-3)
		Chem 336	Physical Chemistry III (3-0-3)
		Chem 235A	Physical Chemistry II Laboratory (0-4-2)
	*	Math 225	Survey of Probability and Statistics (1-0-1)
		Elective	(Open:GUR) (3-0-3)
		Elective	(Technical) (3-0-3)

FOURTH YEAR:

1st semester:

		Chem 473	Biochemistry (3-0-3)
{		Chem 412	Inorganic Chemistry (3-0-3) ***or***
		R160:413	Inorganic Chemistry (3)
		Elective	(Technical) (3-0-3)
		Elective	(Technical) (3-0-3)
		Elective	(Technical) (3-0-3)

2nd semester:

		Chem 480	Instrumental Analysis (0-4-2)
		Elective	(Management:GUR) (3-0-3)
		Elective	(Capstone Seminar) (GUR) (3-0-3)
		Elective	(Technical) (3-0-3)
		Elective	(Technical) (3-0-3)

For a listing of GUR and Electives click here

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.

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* Students must take a special section of Math 225 for chemical engineering or chemistry majors, in conjunction with Chem 235A

B.S. in Chemistry Curriculum for Accelerated Pre-Professional Students (104 credits)

FIRST YEAR

1st Semester:

		Chem 125	General Chemistry I (3-0-3)
		CS 113	Introduction to Computer Science (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 111	Calculus I (4-1-4)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

		Chem 124	General Chemistry Laboratory (0-2-1)
		Chem 126	General Chemistry II (3-0-3)
		Math 112	Calculus II (4-1-4)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		Elective	(Cultural History:GUR) (3-0-3)
		Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR
1st Semester:

		Chem 221	Analytical Chemical Methods (0-4-2)
		Chem 222	Analytical Chemistry (3-0-3)
		Chem 243	Organic Chemistry I (3-0-3)
		Math 211	Calculus III A (3-0-3)
		R160:207	Structure And Bonding (3)
		Elective	(Cultural History:GUR) (3-0-3)
		Elective	(Physical Education:GUR) (0-1-1)

2nd Semester:

		Chem 231	Physical Chemistry I (3-0-3)
		Chem 244	Organic Chemistry II (3-0-3)
		Chem 244A	Organic Chemistry II Laboratory (0-4-2)
		R120:101	General Biology I (3-3-4)
		Elective	(Open:GUR) (3-0-3)
		HSS202	

Summer

		Chem 491H	Honors Research and Independent Study I (3-0-3)
		Chem 492H	Research and Independent Study II ? Honors (3-0-3)

THIRD YEAR
1st Semester:

		Chem 235	Physical Chemistry II (3-0-3)
		Econ 201	Economics (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		Chem 480	Instrumental Analysis (0-4-2)
		Chem 473	Biochemistry (3-0-3)
		Elective	(Management:GUR) (3-0-3)

2nd Semester:

		Chem 340	Chemistry and Engineering of Materials (3-0-3)
		Chem 336	Physical Chemistry III (3-0-3)
		Chem 235A	Physical Chemistry II Laboratory (0-4-2)
	*	Math 225	Survey of Probability and Statistics (1-0-1)
{		Chem 412	Inorganic Chemistry (3-0-3) ***or***
		R160:413	Inorganic Chemistry (3)
		Elective	(Capstone Seminar HSS491 Honors:GUR) (3-0-3)
		R120:102	General Biology II (3-3-4)

Electives
†**Basic Social Science GUR:** Three Credits of the basic science requirements must be taken in economics; acceptable courses are SS 201, Econ 265 or Econ 266.The remaining 3 Credits may be satisfied by HSS 202, STS 257 or STS 258. Student also may take approved introductory courses in basic sciences at Rutgers-Newark to fulfill this requirements.

Capstone Seminar in Humanities and Social Sciences GUR: All students enrolled in the honors college take one from HSS 491H-HSS 499H.

Lit/Hist/Phil/STS GUR: Students must take one 300 level course from any of the following fields: literature, history, philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Open Elective in Humanities and Social Science GUR: Students make take one 300-level course from any of the following fields: English (Eng); History (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or Theater (Thtr). Students also ma satisfy this requirement with Architectural history IV (Arch) or by taking an approved 300-level course at Rutgers-Newark.

Cultural History GUR: Take two course (6 credits) from among HSS 211, HSS 212, HSS 213 and 200-level history course at Rutgers-Newark.

Management GUR: Students take IE 492 or Mgmt 390 or AS 333, which is acceptable only for students taking the aerospace option. Students enrolled in a dual degree program between architecture and management may take HRM 601 to fulfill this requirement.

Refer to the General University Requirement section of the NJIT web site for further information on electives.

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* Students must take a special section of Math 225 for chemcial or chemistry majors, in conjunction with Chem 235A

Civil Engineering

Administered By: Department of Civil and Environmental Engineering. Colton Hall, Room 200.

Administration

Chairperson	Taha F. Marhaba
Acting Associate Chairperson for Graduate Studies	Methi Wecharatana
Associate Chairperson for Undergraduate Studies	Walter Konon

Faculty

Distinguished Professor	Sunil Saigal
Professors	Lisa B. Axe, Sima Bagheri, Michel Boufadel, I J. Chien, Harold D. Deutschman, Robert Dresnack, Eugene B. Golub, Hsin-neng Hsieh, Ct T. Hsu, Raj P. Khera, Walter Konon, Taha F. Marhaba, Jay N. Meegoda, Priscilla Nelson, Dorairaja Raghu, John R. Schuring, Methi Wecharatana, Lazar Spasovic
Associate Professors	Thomas J. Olenik, Janice R. Daniel, Yuan Ding, Fadi A. Karaa, Rongfang Liu
Assistant Professors	Wen Zhang
Senior University Lecturer	Geraldine Milano, Stephanie R. Santos

Advisors

Freshman Advisor	Priscilla Nelson
Undergraduate Advisor	Walter Konon, Thomas J. Olenik
Graduate Advisor (PhD for Students)	Methi Wecharatana

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.

Objective 1: Engineering Practice: Recent alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

Objective 2: Professional Growth: Recent alumni will advance their skills through professional growth and development activities such as graduate study in engineering, professional registration, and continuing education; some graduates will transition into other professional fields such as business and law through further education.

Objective 3: Service: Recent alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, and humanitarian endeavors.

Program Outcomes
Our student outcomes are what students are expected to know and be able to do by the time of their graduation:

a. an ability to apply knowledge of math, science, and engineering
b. an ability to design and conduct experiments, as well as interpret data
c. an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d. an ability to function on multi-disciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of ethical and professional responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. a recognition of need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. an ability to use techniques, skills and modern engineering tools necessary for engineering practice
l. take the FE examination as the first step toward professional licensure

This program is accredited by the Engineering Accreditation Commission of ABET, http://abet.org.

B.S. in Civil Engineering (132 credits minimum)

FIRST YEAR:
1st Semester:

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.

{		Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
		Chem 125	General Chemistry I (3-0-3)

		FED 101	Fundamentals of Engineering Design (2-1-2)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 111	Calculus I (4-1-4)
		Econ 201	Economics (3-0-3)
		Elective	(Physical Education:GUR) (1-0-1)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd semester:

{		Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
		Chem 126	General Chemistry II (3-0-3)
		Chem 124	General Chemistry Laboratory (0-2-1)
		CS 101	Computer Programming and Problem Solving (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Math 112	Calculus II (4-1-4)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR:

1st semester:

		CE 200	Surveying (3-0-3)
		CE 200A	Surveying Laboratory (0-3-1)
		Math 211	Calculus III A (3-0-3)
		Math 279	Statistics and Probability for Engineers (2-0-2)
	*****	Mech 235	Statics (3-0-3)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)

2nd semester:

		CE 210	Construction Materials and Procedures (3-0-3)
		CE 260	Civil Engineering Methods (2-2-3)
		*EPS	(Basic SS Requirement) (3-0-3)
		Math 322	Differential Equations for Applications (3-0-3)
	*****	Mech 237	Strength of Materials (3-0-3)
		EnE 262	Introduction to Environmental Engineering (3-1-3)

THIRD YEAR:

1st semester:

		CE 320	Fluid Mechanics (4-0-4)
		CE 320A	Hydraulics Laboratory (0-3-1)
		CE 321	Water Resources Engineering (3-0-3)
		CE 332	Structural Analysis (3-0-3)
		Mech 236	Dynamics (2-0-2)
		**HUM/Hist	(Cultural History:3-0-3)

2nd semester:

		CE 333	Reinforced Concrete Design (3-0-3)
		CE 341	Soil Mechanics (3-0-3)
		CE 341A	Soil Mechanics Laboratory (0-3-1)

		CE 350	Transportation Engineering (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR(300 Level)) (3-0-3)
		Elective	(Technical) (3-0-3)

FOURTH YEAR:

1st *semester:*

		CE 431	Construction Materials Lab (0-3-1)
		CE 432	Steel Design (3-0-3)
		CE 443	Foundation Design (3-0-3)
		CE 494	Civil Engineering Design I (3-0-3)
		Elective	(CE Elective) (3-0-3)
	****	HSS Elective	(Communications Elective 300 Level) (3-0-3)

2nd semester:

		CE 495	Civil Engineering Design II (3-0-3)
		Elective	(Science Elective) (3-0-3)
		Elective	(Management:GUR) (3-0-3)
		Elective	(Capstone Seminar 400 Level:GUR) (3-0-3)
	***	Elective	(CE Elective) (3-0-3)

Electives

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Cultural History GUR: Take two courses (6 credits) from among Hum 211, Hum 212, Hist 213, and 200-level history courses at Rutgers-Newark.

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students also may satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark.

Basic Social Sciences GUR: Three credits of the basic social sciences requirement must be taken in economics; acceptable courses are Econ 265, or Econ 266. The remaining 3 credits may be satisfied by HSS 202, STS 257, or STS 258. Students also may take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

Capstone Seminar in Humanities and Social Science GUR: students, except those enrolled in the honors college, take one of the following: HSS403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS491-499H.

Physical Education GUR: Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course. Students are urged to complete the requirement as soon as possible.

Management GUR: Students take IE 492 or Mgmt 390 or AS 333, which is acceptable only for students taking the aerospace option. Students enrolled in a dual degree program between architecture and management take HRM 601 to fulfill this requirement.

Technical: Must be chosen from a list of courses available from the civil and environmental engineering department.

Refer to the General University Requirement section of this catalog for further information on electives.

Co-op

In Civil Engineering, CE 311 and CE 413 are taken for additive credit.

* EPS 202 or Rutgers course

** Hum 211, Hum 212 or Hist 213 . Students must select one.

*** Students must choose one of the following: CE 307, CE 351, CE 410, CE 414, CE 450, ENE 360, ENE 361

**** Eng 339, 340, 347, 352, 369, Thtr 435

***** Requires a grade of C or better in order to move to the next level of courses

Note: The Fundamentals of Engineering (FE) Exam is required for graduation.

Communication and Media

Administered By: Department of Humanities

Administration

Chairperson	Carol S. Johnson
Associate Chairperson	
Program Director	Christopher T. Funkhouser

Faculty

Professors	Norbert Elliot, Burt J. Kimmelman
Associate Professors	Christopher T. Funkhouser, Nancy L. Steffen, Carol S. Johnson
Assistant Professors	Philip A. Klobucar
Lecturers	Miriam F. Ascarelli

Program Website: Click Here

The Program in Communication and Media offers two undergraduate degrees: the bachelor of arts (B.A.) and the bachelor of science (B.S.); the former is more humanistic, the latter more technological. The program entails study of a set of core courses covering various aspects of communication, and course concentrations of choice in six disciplinary areas: Digital Expression, Journalism, Literature (with an option in Education), Media Arts, Professional and Technical Communication and Theater Arts.

Both degrees prepare students with the skills and knowledge to work in a variety of fields crucial to the twenty first century global economy. Today, communication specialists are required for a wide range of positions in business, industry, government, journalism; and in artistic, humanistic, scientific, and technological communities. Professional communicators are needed to serve as editors, researchers, and writers. The typical Communication and Media graduate can work in occupations such as multimedia design and communications; technical communication; journalism; television; film and video production; print publishing; theater; graphic design; education; quality assurance documentation; advertising; grant proposal writing; medical and/or scientific reporting or analysis; and technical reporting or analysis.

The bachelor's degrees also serve as the foundation for a graduate degree in journalism, literature, law, theater and writing. There are accelerated programs leading to medical, dental, physical therapy, optometry and law degrees, for qualified students, who also can enroll in the B.S./M.S. program in Professional and Technical Communication, in which students earn a bachelor's and master's degree in less time than if earned separately. In addition, students may earn primary or secondary school teaching certification.

Both the B.A. and B.S. have the same core curriculum including a co-op work experience consisting of two semester-long internships in appropriate fields and a senior project capstone course in which a student produces a substantial, original work consisting of either a traditional research thesis, a substantial work of creative writing (such as a novella), or a practical communication application. In addition to NJIT courses, a number of courses in related areas offered at Rutgers-Newark may be taken for degree credit.

Double Majors
Students may earn a second major in addition to the Communication and Media major. A double major with the B.A. or B.S. in Communication and Media and the B.A. in History, for instance, is usually feasible within four years of full-time study. For general rules about double majors, see Degree Options in the Academic Policies and Procedures section of the undergraduate catalog. For further information about appropriate double majors with the Communication and Media program, contact the Humanities department.

Program Website: Click Here

The curriculum as described below is for students entering NJIT as freshmen in the fall of 2009 or after this date. Students entering before that date may have a different program and should consult the department to learn which curriculum applies.

B.A./B.S. in Communication and Media (128 credit minimum)

FIRST YEAR:
1st Semester: 13 credits

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.

CS 101	Computer Programming and Problem Solving (3-0-3) ***or***
CS 104	Computer Programming and Graphics Problems (3-0-3) ***or***
CS 113	Introduction to Computer Science (3-0-3) ***or***
IS 118	Introduction to Software Application Tools (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Math 101	Foundations of Mathematics for the Liberal Arts (3-0-3)
Elective	(Natural Sciences:GUR) (3-0-3)
Elective	(Natural Sciences Lab:GUR:0-1-0)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: 16 credits

Elective	(Basic Social Science) (3-0-3,)
Math 105	Elementary Probability and Statistics (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Elective	(Cultural History:GUR) (3-0-3)
Elective	(Natural Sciences:GUR) (3-0-3)
Phys Ed	(Physical Education) (0-1-1)

SECOND YEAR:
1st Semester: 16 credits

COM 303	Video Narrative (3-0-3)
Elective	(Economics) (3-0-3)
Eng 353	Composing Documents for Print (3-0-3)
Hist 345	Communication through the Ages (3-0-3)
Elective	(Track Option 1) (3-0-3)
Phys Ed	(Physical Education) (1-0-1)

2nd Semester: 18 credits

Eng 354	Composing Documents for the Web (3-0-3)
Eng 339	Practical Journalism (3-0-3)
Elective	(Track Option 2) (3-0-3)
Elective	(Track Option 3) (3-0-3)
Elective	(Free 1) (3-0-3)
Elective	(Free 2) (3-0-3)

THIRD YEAR:
1st Semester: 15 credits

Eng 333	Cybertext (3-0-3)
Elective	(Open GUR) (3-0-3)

		Elective	(Track Option 4) (3-0-3)
		Elective	(Track Option 5) (3-0-3)
		Elective	(Free 3) (3-0-3)

2nd Semester: 18 credits

		Elective	(Free 4) (3-0-3)
		Eng 340	Oral Presentations (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)
		Elective	(Track Option 6) (3-0-3)
		Elective	(Lit/Hist/Phil/STS: GUR) (3-0-3)
		STS 349	Advanced Music Technology (3-0-3)

FOURTH YEAR:
1st Semester:18 credits

		Eng 302	Communication Theory (3-0-3)
		Eng 490	Co-op Work Experience I (3-0-3)
		Elective	(Track Option 7) (3-0-3)
		Elective	(Track Option 8) (3-0-3)
		Elective	(Free 5) (3-0-3)
		Elective	(Free 6) (3-0-3)

2nd Semester:15 credits

		Eng 491	Co-op Work Experience II (3-0-3)
		Eng 496	Senior Project-Communication and Media (3-0-3)
		Elective	(Capstone Seminar: GUR) (3-0-3)
		Elective	(Free 7) (3-0-3)
		Elective	(Free 8) (3-0-3)

Summary: 12-course core (36 cr.); 8-course focus (24 cr.); 8 free electives (24 cr.); GUR (48 cr.) For information on General University Requirements (GUR), please click here.

Electives

Basic Social Sciences GUR: Three credits of the basic social sciences requirement must be taken in economics; acceptable courses are Econ 201, Econ 265, or Econ 266 . The remaining 3 credits may be satisfied by EPS 202, STS 257, or STS 258. Students also may take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students also may satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark.

Cultural History GUR: Take one courses (3 credits) from among Hum 211, Hum 212, Hist 213, and 200-level history courses at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409 . Students enrolled in the honors college take one from HSS 491H-499H .

Natural Sciences GUR: Coursework totaling 7 credits in any of the following disciplines: biology, botany, chemistry, geology, and physics. Students may take a sequence of courses in one of these disciplines or courses in different disciplines. Laboratory credit must be included in the 7 credits.

Physical Education GUR: Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course. Students are urged to complete the requirement as soon as possible.

Foreign Language (I, II, III, IV): B.S. students concentrating in Literature can take 12 credits of a foreign language in lieu of literature courses. The language and choice of courses is determined in consultation with the advisor.

Art or Architecture: A number of courses offered by the New Jersey School of Architecture or Rutgers-Newark can be used to fulfill this requirement. See the advisor for appropriate courses.

Technology: See the advisor for appropriate courses.

Communication and Media Core Courses:

COM 303, Hist 345, Eng 302, Eng 333, Eng 339, Eng 340, Eng 353, Eng 354, Eng 490, Eng 491, Eng 496, STS 349.

Communication and Media

Concentrations

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 Humanities Department website for specific course listing. http://humanities.njit.edu/

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* HUM GUR - 211 or 212 or Hist 213

B. S. in Communication and Media/MD-Three Year Undergraduate Component of Seven Year Medical/Dental/Optometry Program (115 credits)

FIRST YEAR:

1st Semester: (14 credits)

	HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
	Math 111	Calculus I (4-1-4)
{	CS 113	Introduction to Computer Science (3-0-3) ***or***
	CS 103	Computer Science with Business Problems (3-0-3)
	Physical Science	(General Bio I with Lab)
	PE	(Physical Education:GUR) (0-1-1)
	Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (16 credits)

HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Econ 201	Economics (3-0-3)
Math 105	Elementary Probability and Statistics (3-0-3)
Physical Science	(General Bio 2)
Eng 352	Technical Writing (3-0-3)
PE	(Physical Education:GUR) (0-1-1)

Summer I: (10 credits)

IT 201	Information Design Techniques (3-0-3)
HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
IS 270	Designing the Multimedia Experience (3-0-3)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)

SECOND YEAR:

1st Semester: (15 credits)

Elective	(Track Option)
Eng 302	Communication Theory (3-0-3)
Eng 353	Composing Documents for Print (3-0-3)
Chem 125H	General Chemistry I Honors (3-0-3)
Eng 339	Practical Journalism (3-0-3)

2nd Semester: (18 credits)

Elective	(Track Option)
Eng 354	Composing Documents for the Web (3-0-3)
Elective	(Track Option)
Elective	(HSS Elective)
Chem 126H	General Chemistry II Honors (3-0-3)
Chem 124	General Chemistry Laboratory (0-2-1)
Mgmt 390H	Honors Principles of Management (3-0-3)

Summer II: (10 credits)

Eng 333	Cybertext (3-0-3)
Elective	(HSS Elective)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)

THIRD YEAR:

1st Semester: (15 credits)

EPS 202	Society, Technology, and the Environment (3-0-3)
Elective	(HSS Honors Capstone)
Eng 340	Oral Presentations (3-0-3)
Eng 496	Senior Project-Communication and Media (3-0-3)
Chem 243	Organic Chemistry I (3-0-3)

2nd Semester: (17 credits)

Hist 345	Communication through the Ages (3-0-3)
Chem 244	Organic Chemistry II (3-0-3)
Chem 244A	Organic Chemistry II Laboratory (0-4-2)
Elective	(Concentration Elective-Medical Sci./Policy)
Elective	(Concentration Elective-Medical Sci./Policy)
Elective	(Concentration Elective-Medical Sci./Policy)

Summer III:

No required courses.

The three year undergraduate component contains only 115 credits but assumes acceptance into a medical school program-the first year of medical school replaces the credits of the fourth year of the undergraduate major.

Concentration Elective (Medical Sci./Policy):

Students should select from the following course and other electives, in consultation with their advisor.

		R120:104	Human Health and Disease (3)
		R120:205	Environmental Issues (3)
		Hist 379	History of Medicine (3-0-3)
		Hist 380	History of Public Health (3-0-3)
		Hist 381	Germs Genes & Body: Sci. & Tech. in Modern Medicine (3-0-3)

B. A. in Communication and Media/JD-Three Year Undergraduate Component (105 credits)

FIRST YEAR:

1st Semester: (14 credits)

		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 111	Calculus I (4-1-4) ***or***
		Math 116	Mathematics of Design (3-0-3) ***or***
		Math 138	General Calculus I (3-0-3)
		CS 113	Introduction to Computer Science (3-0-3) ***or***
		CS 103	Computer Science with Business Problems (3-0-3)
		Lab Sci	(Lab Science)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (17 credits)

		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		Math 105	Elementary Probability and Statistics (3-0-3)
		Lab Sci	(Lab Science)
		Eng 352	Technical Writing (3-0-3)
		PE	(Physical Education:GUR) (0-1-1)

Summer I: (6 credits)

		Econ 201	Economics (3-0-3)
		IT 201	Information Design Techniques (3-0-3)

SECOND YEAR:

1st Semester: (15 credits)

		Elective	(Track Option)
		Elective	(Law/Polic)
		Eng 353	Composing Documents for Print (3-0-3)
		Elective	(HUM Elective)
		Eng 339	Practical Journalism (3-0-3)

2nd Semester: (17 credits)

		Eng 340	Oral Presentations (3-0-3)

		Eng 354	Composing Documents for the Web (3-0-3)
		Elective	(HUM Elective)
		Hist 345	Communication through the Ages (3-0-3)
		EPS 202	Society, Technology, and the Environment (3-0-3)
		Mgmt 390H	Honors Principles of Management (3-0-3)

Summer II: (6 credits)

		COM 303	Video Narrative (3-0-3)

THIRD YEAR:

1st Semester: (15 credits)

		Eng 336	Advanced Composition (3-0-3)
	*	Elective	(Track Option)
		Eng 369	Creative Writing (3-0-3)
		Elective	(Concentration Elective - Law Policy)
		Elective	(Concentration Elective - Law Policy)

2nd Semester: (15 credits)

		Eng 496	Senior Project-Communication and Media (3-0-3)
	*	Elective	(Track Option)
	*	Elective	(Track Option)
{		LIT 350	Fiction (3-0-3) ***or***
		LIT 355	Poetry (3-0-3) ***or***
		LIT 360	Drama (3-0-3) ***or***
		LIT 365	Non-Fiction (3-0-3)
		HSS Cap	(HSS Honors Capstone)
		Elective	(Concentration Elective - Law Policy)

Summer III:

No required courses.

The three year undergraduate component contains only 105 credits but assumes acceptance into a law school program-the first year of law school replaces the credits of the fourth year of the undergraduate major.

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* Course to be approved by program director;numerous courses at NJIT and Rutgers-Newark apply.

B. S. in Communication and Media/JD-Three Year Undergraduate Component (107 credits)

FIRST YEAR:

1st Semester: (17 credits)

		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
{		Math 116	Mathematics of Design (3-0-3) ***or***
		Math 138	General Calculus I (3-0-3)
{		CS 113	Introduction to Computer Science (3-0-3) ***or***
		CS 103	Computer Science with Business Problems (3-0-3)

		Phys Sci	(Physical Science Lab)
		PE	(Physical Education:GUR) (0-1-1)
		Frsh Sem	Freshman Seminar (1-0-0)
		IS 270	Designing the Multimedia Experience (3-0-3)
		IT 201	Information Design Techniques (3-0-3)

2nd Semester: (16 credits)

		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
{		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		Math 105	Elementary Probability and Statistics (3-0-3)
		Eng 352	Technical Writing (3-0-3)
		PE	(Physical Education:GUR) (0-1-1)
		EPS 202	Society, Technology, and the Environment (3-0-3)

Summer I: (6 credits)

		Econ 201	Economics (3-0-3)
		Phys Sci	(Physical Science)

SECOND YEAR:

1st Semester: (15 credits)

		Eng 333	Cybertext (3-0-3)
		Eng 302	Communication Theory (3-0-3)
		Eng 353	Composing Documents for Print (3-0-3)
		Elective	(HSS Elective)
		Eng 339	Practical Journalism (3-0-3)

2nd Semester: (17 credits)

		Mgmt 390	Principles of Management (3-0-3)
		Eng 340	Oral Presentations (3-0-3)
		Eng 354	Composing Documents for the Web (3-0-3)
		Hist 345	Communication through the Ages (3-0-3)
		COM 303	Video Narrative (3-0-3)

Summer II: (6 credits)

		Elective	(HSS elective)
		Elective	(Concentration Elective-Law Policy)

THIRD YEAR:

1st Semester: (15 credits)

		Elective	(Track Option)
		Elective	(Track Option)
		Elective	(PTC Electiv)
		Elective	(Concentration Elective- Law Policy)
		Elective	(Concentration Elective- Law Policy)

2nd Semester: (15 credits)

		Eng 496	Senior Project-Communication and Media (3-0-3)
		HSS Cap	(HSS Honors Capstone)
		Elective	(Track Option)

		Elective	(Track Option)
		Elective	(Concentration Elective-Law /Policy)
		LIT 350	Fiction (3-0-3) ***or***
		LIT 355	Poetry (3-0-3) ***or***
		LIT 360	Drama (3-0-3) ***or***
		LIT 365	Non-Fiction (3-0-3)

Summer III:

No courses required.

The Three year undergraduate component contains only 107 credits but assumes acceptance into a law school program-the first year of law school replaces the credits of the fourth year of the undergraduate major.

Catalog and curricula information approved by the relevant academic department.

Computational Sciences

Administered By: Department of Mathematical Sciences

Administration

Chair	Jonathan H. Luke
Associate Chair, Administration	John K. Bechtold
Associate Chair, Undergraduate Studies	Zoi-heleni Michalopoulou
Director, Graduate Studies	Michael R. Booty
Director, Statistics Program	Aridaman K. Jain
Departmental Coordinator	Eileen M. Michie

Faculty

Distinguished Professors	Gregory A. Kriegsmann, Robert M. Miura*
Professors	Daljit S. Ahluwalia, Roman I. Andrushkiw, John K. Bechtold, Manish Bhattacharjee, Denis L. Blackmore, Michael R. Booty, Amitabha K. Bose, Wooyoung Choi, Fadi Deek** , Lou Kondic, Jonathan H. Luke, Zoi-heleni Michalopoulou**** , Petronije Milojevic, Farzan Nadim*** , Manuel Perez, Michael S. Siegel
Associate Professors	Bruce G. Bukiet, Hamilton A. Chase, Linda J. Cummings, Sunil K. Dhar, Rose Dios, Jorge P. Golowasch*** , Roy H. Goodman, David J. Horntrop, Shidong Jiang, Jay M. Kappraff, Martin Katzen, Murray I. Lieb, Victor V. Matveev, Richard O. Moore, Cyrill B. Muratov, Horacio G. Rotstein, Peter G. Petropoulos, Roy A. Plastock, Gareth J. Russell*** , Sundarraman Subramanian, Yuan-nan Young
Assistant Professors	Shahriar Afkhami zakerzadeh, Yassine Boubendir, Daniel E. Bunker*** , Peter Gordon, Wenge Guo, Ronald Sverdlove*****
Senior University Lecturers	Aridaman K. Jain, Karen D. Rappaport, Jeyakumaran Ratnaswamy
Lecturers	John Hunter, Rudy Kelly, Diana P. Klimek, Soroosh Mohebbi Forushani, Jonathan J. Porus, Joseph Zaleski
Post Doctoral Fellows	Gabriel D. Chaves, Christopher C. Fazioli, Arnaud B. Goullet, Jacek Wrobel

* Joint appointment with Department of Biomedical Engineering

** Joint appointment with the Department of Information Systems

*** Joint appointment with the Federated Department of Biological Sciences

**** Joint appointment with the Department of Electrical and Computer Engineering

***** Joint appointment with School of Mangement

Please note that as of Fall 2013 this program is no longer admitting any new students. Students considering the former B.S. in Computational Sciences may wish to consider one of the current options of the B.S. in Mathematical Sciences possibly with a double major in Computer Science, Physics, Chemistry or Biology. A Computational Mathematics option for the B.S. in Mathematical Sciences is under development and expected to be *approved before fall 2014.*

The Bachelor of Science in Computational Sciences program is administered by the NJIT Department of Mathematical Sciences, Cullimore Hall, Room 606.

The Bachelor of Science in Computational Sciences gives students well developed programming skills, understanding of the mathematics needed to design and analyze numerical algorithms, knowledge of and experience using high-performance numerical methods and computing hardware, familiarity with important areas of application, and the ability to classify and analyze frequently encountered mathematical models. Students are thus prepared to make contributions in a wide variety of environments through the numerical solution of difficult problems.

In the first two years of the program, students follow a course of study typical of students in science and engineering. This background is essential to establishing the ability to work with people from a wide variety of technical disciplines. The third year builds an understanding of the modules and problems commonly appearing in applications and develops the numerical techniques needed to solve them. In the fourth year, students continue to develop their repertoire of computing skills and must use these skills to complete a substantial project in computational science.

Options in Computational Biology, Computational Chemistry, Computational Mathematics, and Computational Physics allow students to pursue computational sciences in the context of different fields.

B. S. in Computational Sciences (127 credits)

FIRST YEAR

1st Semester: (16.5 credits)

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.

		Math 111	Calculus I (4-1-4)
		CS 115	Intro. to CS I in C++ (3-0-3)
		CS 115A	Computer Science I Lab/C++ (0-1.5-0)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)
		Phys Ed	(Physical Education) (0-1-1)

2nd Semester: (16.5 credits)

		Math 112	Calculus II (4-1-4)
		CS 116	Intro. to Computer Science II/C++ (3-0-3)
		CS 116A	Computer Science II Lab/C++ (0-1.5-0)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		EPS 202	Society, Technology, and the Environment (3-0-3)
		Phys Ed	(Physical Education) (0-1-1)

SECOND YEAR

1st Semester: (17 credits)

		Math 213	Calculus III B (4-0-4)
		Math 337	Linear Algebra (3-0-3)
		Elective	(Cultural History:GUR) (3-0-3)

		Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
		Chem 125	General Chemistry I (3-0-3)
		R120:101	General Biology I (3-3-4)

2nd Semester: (17 credits)

		Math 222	Differential Equations (4-0-4)
		Math 340	Applied Numerical Methods (3-1-3)
		Math 333	Probability and Statistics (3-0-3)
		R120:102	General Biology II (3-3-4)
		Elective	(Social Science:GUR) (3-0-3)

THIRD YEAR

1st Semester: (16 credits)

		Math 391	Numerical Linear Algebra (3-0-3)
		Math 331	Introduction to Partial Differential Equations (3-0-3)
		Elective	(Approved Elective) (3-0-3)
		R120:301	Foundations of Biology: Cell and Molecular Biology (3-0-3)
		R120:302	Foundations of Biology-Lab (0-3-1)
		Elective	(Cultural History:GUR) (3-0-3)

2nd Semester: (15 credits)

		Math 440	Advanced Applied Numerical Methods (3-0-3)
		Math 373	Introduction to Mathematical Biology (3-0-3)
		BNFO 240	Principles of Bioinformatics II (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		Elective	(Mangement:GUR) (3-0-3)

FOURTH YEAR

1st Semester: (15 credits)

		MATH470	
		Math 453	High-Performance Numerical Computing (3-0-3)
		Math 430	Analytical and Computational Neuroscience (3-1-3)
		Elective	(Humanities and Social Science Upper Level Elective:GUR) (3-0-3)
		Elective	(Approved Elective) (3-0-3)

2nd Semester: (15 credits)

		MATH471	
		Elective	(Approved Elective) (3-0-3)
		Elective	(Approved Elective) (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)
		Elective	(Free Elective) (3-0-3)

B.S. in Computational Sciences (Computational Chemistry Option) (126 credits)

FIRST YEAR

1st Semester: (16.5 credits)

		Math 111	Calculus I (4-1-4)
		CS 115	Intro. to CS I in C++ (3-0-3)

CS 115A	Computer Science I Lab/C++ (0-1.5-0)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Frsh Sem	Freshman Seminar (1-0-0)
Phys Ed	(Physical Education) (0-1-1)

2nd Semester: (15.5 credits)

Math 112	Calculus II (4-1-4)
CS 116	Intro. to Computer Science II/C++ (3-0-3)
CS 116A	Computer Science II Lab/C++ (0-1.5-0)
Chem 125	General Chemistry I (3-0-3)
EPS 202	Society, Technology, and the Environment (3-0-3)
Phys Ed	(Physical Education) (0-1-1)

SECOND YEAR

1st Semester: (18 credits)

Math 213	Calculus III B (4-0-4)
Math 337	Linear Algebra (3-0-3)
Elective	(Cultural History:GUR) (3-0-3)
Chem 126	General Chemistry II (3-0-3)
Chem 124	General Chemistry Laboratory (0-2-1)
R120:101	General Biology I (3-3-4)

2nd Semester: (16 credits)

Math 222	Differential Equations (4-0-4)
Math 340	Applied Numerical Methods (3-1-3)
Math 333	Probability and Statistics (3-0-3)
Chem 243	Organic Chemistry I (3-0-3)
Elective	(Social Science:GUR) (3-0-3)

THIRD YEAR

1st Semester: (15 credits)

Math 391	Numerical Linear Algebra (3-0-3)
Math 331	Introduction to Partial Differential Equations (3-0-3)
Elective	(Cultural History:GUR) (3-0-3)
Chem 244	Organic Chemistry II (3-0-3)
Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)

2nd Semester: (15 credits)

Math 440	Advanced Applied Numerical Methods (3-0-3)
Chem 473	Biochemistry (3-0-3)
Chem 336	Physical Chemistry III (3-0-3)
Elective	(Humanities and Social Science Upper Level Elective:GUR) (3-0-3)
Elective	(Management:GUR) (3-0-3)

FOURTH YEAR

1st Semester (15 credits)

MATH470	

		Math 453	High-Performance Numerical Computing (3-0-3)
		Chem 490	Special Topics in Chemistry (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)
		Elective	(Approved Elective) (3-0-3)

2nd Semester: (15 credits)

		MATH471	
		Elective	(Approved Elective) (3-0-3)
		Elective	(Approved Elective) (3-0-3)
		Elective	(Free Elective) (3-0-3)
		Elective	(Free Elective) (3-0-3)

B.S. in Computational Sciences (Computational Mathematics Option) (126 credits)

FIRST YEAR

1st Semester (16.5 credits)

		Math 111	Calculus I (4-1-4)
		CS 115	Intro. to CS I in C++ (3-0-3)
		CS 115A	Computer Science I Lab/C++ (0-1.5-0)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)
		Phys Ed	(Physical Education) (0-1-1)

2nd Semester: (16.5 credits)

		Math 112	Calculus II (4-1-4)
		CS 116	Intro. to Computer Science II/C++ (3-0-3)
		CS 116A	Computer Science II Lab/C++ (0-1.5-0)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		EPS 202	Society, Technology, and the Environment (3-0-3)
		Phys Ed	(Physical Education:GUR) (0-1-1)

SECOND YEAR

1st Semester: (17 credits)

		Math 213	Calculus III B (4-0-4)
		Math 226	Discrete Analysis (3-0-3)
		Math 337	Linear Algebra (3-0-3)
		Elective	(Cultural History:GUR) (3-0-3)
		Elective	(Social Science:GUR) (3-0-3)

2nd Semester: (16 credits)

		Math 222	Differential Equations (4-0-4)
		Math 340	Applied Numerical Methods (3-1-3)
		Math 333	Probability and Statistics (3-0-3)
		Chem 125	General Chemistry I (3-0-3)
		Elective	(Cultural History:GUR) (3-0-3)

THIRD YEAR

1st Semester: (15 credits)

		Math 391	Numerical Linear Algebra (3-0-3)
		Math 331	Introduction to Partial Differential Equations (3-0-3)
		Math 334	Operations Research (3-0-3)
		Elective	(Humanities and Social Science Upper Level Elective:GUR) (3-0-3)
		Elective	(Approved Elective) (3-0-3)

2nd Semester: (15 credits)

		Math 440	Advanced Applied Numerical Methods (3-0-3)
		Math 321	Introduction to the Finite Element Method (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		Elective	(Management:GUR) (3-0-3)
		Elective	(Approved Elective) (3-0-3)

FOURTH YEAR

1st Semester: (15 credits)

		MATH470	
		Math 453	High-Performance Numerical Computing (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)
		Elective	(Approved Elective) (3-0-3))
		Elective	(Free Elective) (3-0-3)

2nd Semester: (15 credits)

		MATH471	
		MATH488	
		Elective	(Approved Elective) (3-0-3)
		Elective	(Approved Elective) (3-0-3)
		Elective	(Free Elective) (3-0-3)

B.S. in Computational Sciences (Computational Physics Option) (127 credits)

FIRST YEAR

1st Semester (16.5 credits)

		Math 111	Calculus I (4-1-4)
		CS 115	Intro. to CS I in C++ (3-0-3)
		CS 115A	Computer Science I Lab/C++ (0-1.5-0)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)
		Phys Ed	(Physical Education) (0-1-1)

2nd Semester: (16.5 credits)

		Math 112	Calculus II (4-1-4)
		CS 116	Intro. to Computer Science II/C++ (3-0-3)
		CS 116A	Computer Science II Lab/C++ (0-1.5-0)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)

		Phys 114	Introduction to Data Reduction with Applications (3-0-3)
		Phys Ed	(Physical Education) (0-1-1)

SECOND YEAR

1st Semester: (17 credits)

		Math 213	Calculus III B (4-0-4)
		EPS 202	Society, Technology, and the Environment (3-0-3)
		Elective	(Cultural History:GUR) (3-0-3)
{		Chem 125	General Chemistry I (3-0-3) ***or***
		R120:101	General Biology I (3-3-4)
		Phys 234	Physics III (3-0-3)
		Phys 231A	Physics III Laboratory (0-2-1)

2nd Semester: (17 credits)

		Math 222	Differential Equations (4-0-4)
		Math 340	Applied Numerical Methods (3-1-3)
		Math 225	Survey of Probability and Statistics (1-0-1)
		Math 337	Linear Algebra (3-0-3)
		Elective	(Social Science:GUR) (3-0-3)
		Phys 335	Introductory Thermodynamics (3-0-3)

THIRD YEAR

1st Semester: (15 credits)

		Math 391	Numerical Linear Algebra (3-0-3)
		Phys 431	Classical Mechanics II (3-0-3)
		Phys 430	Classical Mechanics I (3-0-3)
		Math 331	Introduction to Partial Differential Equations (3-0-3)
		Elective	(Cultural History:GUR) (3-0-3)

2nd Semester: (15 credits)

		Math 440	Advanced Applied Numerical Methods (3-0-3)
		Phys 485	Computer Modeling of Applied Physics Problems (3-0-3)
		Elective	(Approved Physics Elective) (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		Elective	(Humanities and Social Science Upper Level Elective:GUR) (3-0-3)

FOURTH YEAR

1st Semester: (15 credits)

		MATH470	
		Math 453	High-Performance Numerical Computing (3-0-3)
		Phys 442	Introduction to Quantum Mechanics (3-0-3)
		Elective	(Management:GUR) (3-0-3)
		Elective	(Free Elective) (3-0-3)

2nd Semester: (15 credits)

		MATH471	
		Phys 450	Advanced Physics Laboratory (1-4-3)
		Elective	(Approved Computational Elective) (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)

		PHYS486	

General University Requirements:

All students are required to satisfy the General University Requirements (GUR). All GUR courses and additional mathematics, technical, and free electives are to be selected in consultation with a faculty advisor. Refer to the General University Requirements section of this catalog for further information on electives.

Engineering Technology GUR (6 credits): Two courses selected from among the following: any lower division or upper division courses in engineering (including EG, FED, and Mech courses); any upper division courses in architecture, computer science, or engineering technology, or MIS 345.

Management GUR: Students take IE 492 or Mgmt 390.

Physical Education GUR: Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course. Students are urged to complete the requirement as soon as possible.

Basic Social Sciences GUR: Three credits of the basic social sciences requirement must be taken in economics; acceptable courses are Econ 201, Econ 265, or Econ 266. The remaining 3 credits may be satisfied by HSS 202, STS 257, or STS 258. Students also may take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

Cultural History GUR: Take two courses (6 credits) from among HSS 211, HSS 212, HSS 213, and 200-level history courses at Rutgers-Newark.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: Literature; History; Philosophy; or Science, Technology and Society (STS); or an approved 300-level course at Rutgers-Newark.

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); History (Hist); Literature (Lit); Philosophy (Phil); Science, Technology and Society (STS); Social Science (SS); or Theater (Thtr). Students also may satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H.

Approved Electives:

Students in the **Computational Biology** option are required to take four three-credit electives selected with the help and approval of their academic advisors. These courses must be in areas related to computational sciences including but not necessarily limited to the natural sciences, computer science and mathematics. Students are encouraged to use these courses to develop in areas of expertise within their option.

Students in the **Computational Chemistry Option** are required to take three three-credit electives selected with the help and approval of their academic advisors. These courses must be in areas related to computational sciences including but necessarily limited to the natural sciences, computer science and mathematics. Students are encouraged to use these courses to develop an area of expertise within their option.

Students in the **Computational Mathematics Option** are required to take five three-credit electives selected with the help and approval of their academic advisors. These courses must be in areas related to computational sciences including but not necessarily limited to the natural sciences, computer science and mathematics. Students are encouraged to use these courses to develop an area of expertise within their option.

Students in the **Computational Physics Option** are required to take one three-credit physics elective and on computational science elective selected with the help and approval of their academic advisors. Students are encouraged to use these courses to explore an area outside of their direct computational physics program.

Catalog and curricula information approved by the relevant academic department.

Computer Engineering

Administered By: Department of Electrical and Computer Engineering

Administration

Chair	Leonid Tsybeskov
Associate Chair (Undergraduate)	Marek Sosnowski
Associate Chair (Graduate)	Durgamadhab Misra

Faculty

Distinguished Professors	Yeheskel Bar-Ness, Atam P. Dhawan, Bernard Friedland, Jacob Savir
Professors	Ali N. Akansu, Nirwan Ansari, John D. Carpinelli, Haim Grebel, Richard A. Haddad, Alexander M. Haimovich, Durgamadhab Misra, Edip Niver, Yun-qing Shi, Kenneth S. Sohn, Marek Sosnowski, Leonid Tsybeskov, Gerald Whitman, Mengchu Zhou, Sotirios G. Ziavras
Associate Professors	Ali Abdi, Hongya Ge, Sui-hoi E. Hou, Walid Hubbi, Roberto Rojas-Cessa, Osvaldo Simeone
Assistant Professors	Abdallah Khreishah
Senior University Lecturers	Stewart Personick
University Lecturers	Mohammed Feknous, Serhiy P. Levkov, Timothy W. Steele

Advisors

Undergraduate Advisor	Shivon S. Boodhoo
Undergraduate Advisor Upper Division and Transfers	Marek Sosnowski
MS Computer Engineering Advisor	Mengchu Zhou
PHD Computer Engineering Advisor	Durgamadhab Misra
MS Electrical Engineering Advisor	Durgamadhab Misra
PHD Electrical Engineering Advisor	Durgamadhab Misra
MS Telecommunications Advisor	Roberto Rojas-Cessa
MS Internet Engineering Advisor	Roberto Rojas-Cessa
MS Power and Enegery Systems Advisor	Mengchu Zhou

The new interdisciplinary profession of computer engineering has evolved over the last two 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, and laboratory work to support the above including a project. 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 Statement of the Electrical Engineering (EE) Program is to provide EE students a rigorous learning experience and to prepare them for professional careers.

Program Educational Objectives

In order to meet the Mission of both the institution and the ECE Department, the Department and its Industry Advisory Board have been approved the following Program Educational Objectives:

1. Graduates will succeed in electrical engineering areas or other diverse fields that require analytical and/or professional skills.

2. Graduates will pursue professional development, including continuing or advanced education., relevant to their career plans.

3. Graduates will contribute to their fields or professions and society.

Electrical Engineering Program Student Outcomes

This program is accredited by the Engineering Accreditation Commission of ABET (http://abet.org) and satisfies ABET a-K Program Students Outcome:

(a) An ability to apply knowledge of mathematics, science, and engineering;

(b) An ability to design and conduct experiments, as well as to analyze and interpret data;

(c) An ability to design a system, component or process to meet desired needs within realistic constrains such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability;

(d) An ability to function on multidisciplinary teams;

(e) An ability to identify, formulate, and solve engineering problems;

(f) An understanding of professional and ethical responsibility;

(g) An ability to communicate effectively;

(h) The broad education necessary to understand the impact of engineering solutions in a global economic, environmental, and social context;

(i) A recognition of the need for, and an ability to engage in, life-long learning;

(j) A knowledge of contemporary issues;

(k) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice;

B.S. in Computer Engineering (132 credit minimum)

FIRST YEAR:

1st Semester:

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.*

Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
Chem 125	General Chemistry I (3-0-3)
FED 101	Fundamentals of Engineering Design (2-1-2)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Math 111	Calculus I (4-1-4)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

CS 115	Intro. to CS I in C++ (3-0-3)
Math 112	Calculus II (4-1-4)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
ECE 101	Introduction to Electrical and Computer Engineering (1-0-0)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR:
1st Semester:

CS 116	Intro. to Computer Science II/C++ (3-0-3)
ECE 231	Circuits and Systems I (3-1-3)
ECE 251	Digital Design (3-1-3)
Math 222	Differential Equations (4-0-4)
Elective	(Cultural History, HUM 211, HUM 212 or Hist 213:GUR) (3-0-3)
Elective	(Physical Education) (GUR) (0-1-1)

2nd Semester:

ECE 232	Circuits and Systems II (3-1-3)
ECE 252	Microprocessors (3-0-3)
ECE 271	Electronic Circuits I (3-1-3)
ECE 291	Electrical Engineering Laboratory I (0-3-1)
Math 213	Calculus III B (4-0-4)
Econ 201	Economics (3-0-3)

THIRD YEAR:
1st Semester:

CS 280	Programming Language Concepts (3-0-3)
ECE 368	Signal Transmission (2-0-2)
ECE 395	Microprocessor Laboratory (0-4-2)
Math 326	Discrete Analysis for Computer Engineers (3-0-3)
Math 333	Probability and Statistics (3-0-3)
EPS 202	Society, Technology, and the Environment (3-0-3)

2nd Semester:

CS 332	Principles of Operating Systems (3-0-3)
Math 340	Applied Numerical Methods (3-1-3) ***or***
Math 337	Linear Algebra (3-0-3)

		ECE 353	Computer Organization and Architecture (3-0-3)
		ECE 394	Digital Systems Lab (0-3-1)
		Phil 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering (3-0-3)
{		Mgmt 390	Principles of Management (3-0-3) ***or***
		IE 492	Engineering Management (3-0-3)

FOURTH YEAR:
1st Semester:

	**	IS 390	Requirements Analysis and Systems Design (3-0-3)
		ECE 354	Digital Test (2-0-2)
		ECE 414	Electrical and Computer Engineering Project I (1-0-1)
		ECE 495	Computer Engineering Design Lab (1-4-3)
	*	Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		Elective	(COETrack Elective I) (3-0-3)
		Elective	(COETrack Elective II) (3-0-3)

2nd Semester:

{		ECE 416	Electrical and Computer Engineering Project II (3-0-3) ***or***
		ECE 417	Independent Study (3-0-3)
		Elective	(COE Track Elective III) (3-0-3)
		Elective	(COE Track laboratory) (0-3-2)
		Elective	(Capstone Seminar:GUR) (3-0-3)
		Elective	(ECE Technical Elective) (3-0-3)
		Elective	(ECE Technical Elective) (0-4-2)

Electives

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: English (Eng); History (Hist); Literature (Lit); Philosophy (Phil); Science, Technology and Society (STS); Social Science (SS); or Theater (Thtr). Students may also satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends Computer Engineering majors take STS 350 to fulfill this requirement.

Cultural History GUR: Take one course (3 credits) from among HUM 211, HUM 212, Hist 213, and 200-level history courses at Rutgers-Newark.

**Basic Social Sciences GUR:* Three credits of the basic social sciences requirement must be taken in economics; acceptable courses are Econ 201, Econ 265, or Econ 266. The remaining 3 credits may be satisfied by HSS 202, STS 257 or STS 258. Students may also take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H.

Physical Education GUR: Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course. Students are urged to complete the requirement as soon as possible.

Management: Students take IE 492 or Mgmt 390 or AS 333, which is acceptable only for students taking the aerospace option. Students enrolled in a dual degree program between architecture and management take HRM 601 to fulfill this requirement.

Technical: Chosen from a list of courses available from the faculty of the program.

Refer to the General University Requirement section of this catalog for further information on electives.

Technical 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. See advisor for more information.

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 is taken for zero credits, and ECE 410 is taken for 3 degree credits, upon acceptance by the faculty co-op advisor of an approved proposal.

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* Student must take Phil 334

** Computer engineering majors enrolled in the computer science minor can take CS 490

Catalog and curricula information approved by the relevant academic department.

Computer Science

Administered By: Department of Computer Science, Guttenberg Information Technologies Center, Room 4400. For more details see the CS Web page at http://cs.njit.edu

Administration

Chairperson	James Geller
Associate Chairperson	Cristian M. Borcea
PhD Director	David Nassimi

Faculty

Distinguished Professor	Joseph Y. Leung
Professors	James M. Calvin, Narain Gehani, James Geller, James McHugh, Ali Mili, Marvin K. Nakayama, Yehoshua Perl, Frank Y. Shih, Boris S. Verkhovsky, Jason T. Wang
Associate Professors	Michael A. Baltrush, Cristian M. Borcea, Barry Cohen, Alexandros Gerbessiotis, Daochuan Hung, Chengjun Liu, Usman W. Roshan, Andrew Sohn, Dimitrios Theodoratos, Guiling Wang
Assistant Professors	Reza Curtmola, Zhi Wei
Senior Lecturers	George Blank, Osama Eljabiri, Jonathan J. Kapleau, Dionissios Karvelas, Morty D. Kwestel, Theodore L. Nicholson, Wallace Rutkowski
University Lecturers	George Blank, Jonathan J. Kapleau, Junilda Spirollari

Advisors

Undergraduate Advisor	Amanda D. Ackerman, Casey L. Hennessey, George W. Olsen
MSCS Advisor	Amanda D. Ackerman, Casey L. Hennessey
First Year PhD Advisor	David Nassimi

Computer Science (CS) is a discipline that involves the design and development of computing systems applications and their effective deployment and use. It ranges from theoretical studies of algorithms to practical problems of system implementation involving both software and hardware. The breadth of computer science is all encompassing. It is an interdisciplinary field with roots in mathematics and engineering and applications in many diverse areas. Programming is but one aspect of computer science. Computer scientists work to solve multifaceted problems. Some may be solving problems with engineers or managers in design and implementation projects, while others may be involved in research and development of systems for science and medicine. Computer Science provides excellent training in problem solving and logical thinking, which are important skills for employment and research.

The Bachelor of Science (B.S.) in Computer Science provides the student with the most comprehensive treatment of computers, with considerable breadth and depth in computer science topics, the sciences, mathematics, and supporting interdisciplinary studies. Most students interested in computer science take this major. For the student who wishes to have a strong foundation in computer science, but with more opportunity for elective choices with slightly fewer technical requirements, the department offers the Bachelor of Arts (B.A.) in Computer Science.

Curricula have been developed according to the recommendations of the ACM/IEEE Computer Science Joint Committee Task Force and in close cooperation with the department's industrial advisory board. Courses are constantly being monitored and modified for relevance. New courses are introduced as warranted by new developments.

Each of the majors offered by the CS Department has been carefully structured to meet a specific goal each year: first year, foundations; second year, understanding computing systems; third year, theoretical foundations and applications; fourth year, integration and focus. The Computer Science Department requires all students enrolled in the majors to prepare a Program of Study Form, an approved copy of which must be on file with the department. The form should be prepared as early as possible in the student's career, and changes should be made only in consultation with the department advisor. Computer science majors should enroll in CS 113, and CS 114 in the freshman year. Some students may be required to enroll in CS 110 and CS 111 instead of CS 113, depending upon the results of their CS Placement Exam.

The curriculum as described below 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.

The BS/BA programs in Computer Science are accredited by the Computing Accreditation Commission of ABET, http://abet.org.

B.S. in Computer Science (130 credit minimum)

FIRST YEAR:

1st Semester:

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.

		CS 100	Roadmap to Computing (3-0-3)
		Math 111	Calculus I (4-1-4)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		CS 107	Computing as a Career (1-0-1)

2nd Semester:

		CS 113	Introduction to Computer Science (3-0-3)
		Math 112	Calculus II (4-1-4)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
{		Econ 201	Economics (3-0-3) ***or***
		Elective	(Social Science Elective) (3-0-3)

SECOND YEAR:

1st Semester:

		CS 114	Introduction to Computer Science II (3-0-3)
		CS 252	Computer Organization and Architecture (3-0-3)
		Math 333	Probability and Statistics (3-0-3)
		Elective	(Science + Lab) (3-1-4)
{		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		PE	(Physical Education) (0-1-1)

2nd Semester:

CS 280	Programming Language Concepts (3-0-3)
CS 332	Principles of Operating Systems (3-0-3)
CS 241	Foundations of Computer Science I (3-0-3)
Eng 352	Technical Writing (3-0-3) ***or***
Eng 340	Oral Presentations (3-0-3)
Elective	(Lower General:GUR) (3-0-3)
PE	(Physical Education) (0-1-1)
CS 207	Computing and Effective Communication (1-0-1)

THIRD YEAR:

1st Semester:

CS 341	Foundations of Computer Science II (3-0-3)
IS 350	Computers, Society and Ethics (3-0-3)
Math Elective	(Math Elective) (3-0-3)
Elective	(Social Science) (3-0-3)
CS 288	Intensive Programming in Linux (3-0-3)

2nd Semester:

CS 435	Advanced Data Structures and Algorithm Design (3-0-3)
CS 431	Database System Design and Management (3-0-3)
Elective	(Math) (3-0-3)
Elective	(Interdisciplinary) (3-0-3)
Elective	(Phil/Hist/Lit/Sts)
Mgmt 390	Principles of Management (3-0-3) ***or***
IE 492	Engineering Management (3-0-3)

FOURTH YEAR:

1st Semester:

CS 490	Guided Design in Software Engineering (3-0-3)
Elective	(CS/IS) (3-0-3)
Elective	(CS/IS) (3-0-3)
Elective	(Interdisciplinary) (3-0-3)
Elective	(General Elective) (3-0-3)

2nd Semester:

CS 491	Senior Project (3-0-3)
Elective	(CS/IS) (3-0-3)
Elective	(Capstone Seminar: GUR) (3-0-3)
Elective	(interdisciplinary) (3-0-3)
Elective	(Upper General Elective) (3-0-3)
CS 407	Professional Development in Computing (1-0-1)

Electives

Basic Social Sciences GUR: Three credits of the basic social sciences. The remaining 3 credits may be satisfied by HSS 202. Students may also take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

Cultural History GUR: Take one course (3 credits) from HUM 211, HUM 212 or Hist 213 or courses at Rutgers-Newark. Only applies if taking HUM 101 and HUM 102.

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology and society (STS); social science (SS); or theater

(Thtr). Students may also satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends that computer science majors take Eng 352 or Eng 340 or Eng 360.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology and society (STS); or an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H.

Physical Education GUR: Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course. Students are urged to complete the requirement as soon as possible.

Management GUR: Students take IE 492 or Mgmt 390.

Mathematics: Two approved courses in mathematics or CS 337.

CS: 4 300/400-level CS electives as offered by the College of Computing Sciences.

Interdisciplinary Studies: A sequence of three courses from mathematics, science, engineering or management. A list of approved course sequences is available from the advisor. Courses that are not acceptable for a major in a given department are not to be used for interdisciplinary studies.

General: A minimum of four courses (12 credits minimum). Courses should be chosen to meet prerequisite requirements of other courses. Two of the four elective courses must be in mathematics, science, computer science, selected information systems or information technology courses. Two of these electives must be upper division courses.

Science with Lab: Students can take Physics III, Biology I, Chemistry I, Astronomy or another science approved by the advisor each with its associated laboratory session. This course and associated lab fulfills one semester of the three semester laboratory science requirement for the major.

Co-op:

A GPA of 2.7 is required to enroll in co-op. In the Computer Science program, 3 credits of co-op may be used as one of the four general electives (not a Computer Science elective) with the approval of the academic advisor. Additional co-op courses are additive credit.

Refer to the General University Requirements section of this catalog for further information on electives.

B.A. in Computer Science (126 credit minimum)

FIRST YEAR:

1st Semester:

CS 100	Roadmap to Computing (3-0-3)
Math 111	Calculus I (4-1-4)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Elective	(Science Elective with Lab) (3-1-4)
CS 107	Computing as a Career (1-0-1)

2nd Semester:

CS 113	Introduction to Computer Science (3-0-3)
Math 112	Calculus II (4-1-4)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Elective	(Science Elective with Lab) (3-1-4)
Econ 201	Economics (3-0-3) ***or***
Elective	(Social Science) (3-0-3)

SECOND YEAR:

1st Semester:

CS 114	Introduction to Computer Science II (3-0-3)
CS 252	Computer Organization and Architecture (3-0-3)
Math 333	Probability and Statistics (3-0-3)
Elective	(Science w/a Lab) (4)
HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
PE	(Physical Education) (0-1-1)

2nd Semester:

CS 280	Programming Language Concepts (3-0-3)
CS 332	Principles of Operating Systems (3-0-3)
CS 241	Foundations of Computer Science I (3-0-3)
Eng 352	Technical Writing (3-0-3) ***or***
Eng 340	Oral Presentations (3-0-3)
Elective	(General) (3-0-3)
PE	(Physical Education) (0-1-1)
CS 207	Computing and Effective Communication (1-0-1)

THIRD YEAR:

1st Semester:

IS 350	Computers, Society and Ethics (3-0-3)
Math Elective	(Math Elective) (3-0-3)
Elective	(Social Science) (3-0-3)
CS 288	Intensive Programming in Linux (3-0-3)
Elective	(General) (3-0-3)

2nd Semester:

CS 435	Advanced Data Structures and Algorithm Design (3-0-3)
CS 431	Database System Design and Management (3-0-3)
Elective	(Interdisciplinary) (3-0-3)
Elective	(Lit/Hist/STS, GUR) (3-0-3)
Mgmt 390	Principles of Management (3-0-3) ***or***
IE 492	Engineering Management (3-0-3)

FOURTH YEAR:

1st Semester:

CS 490	Guided Design in Software Engineering (3-0-3)
Elective	(CS/IS Elective) (3-0-3)
Elective	(CS/IS Elective) (3-0-3)
Elective	(Interdisciplinary) (3-0-3)
Elective	(Upper General) (3-0-3)

2nd Semester:

CS 491	Senior Project (3-0-3)
Elective	(CS/IS Elective) (3-0-3)
Elective	(Capstone Seminar: GUR) (3-0-3)
Elective	(Interdisciplinary) (3-0-3)

		Elective	(Upper General) (3-0-3)
		CS 407	Professional Development in Computing (1-0-1)

Electives

Basic Social Science Electives GUR: Three credits of the basic social sciences. The remaining 3 credits may be satisfied by HSS 202. Students may also take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

Cultural History GUR: Take HUM 211, or HUM 212 or Hist 213; or an approved 200-level history course at Rutgers-Newark.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology and society (STS) or an approved 300-level course at Rutgers-Newark.

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology and society (STS); social Science (SS) or theater (Thtr). Students may also satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends that computer science majors take Eng 352 or Eng 340 or Eng 360.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H.

Physical Education GUR: Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course.

Management GUR: Students take IE 492 or Mgmt 390.

Sciences: A two-semester related sequence (8 credits minimum) of laboratory science elective courses e.g., physics chemistry, biology, geology. These courses satisfy the Natural Sciences GUR. An additional 4 credits of science are required.

CS: Four 300/400-level electives as offered by the College of Computing Sciences.

Interdisciplinary Studies: A sequence of three 300/400-level courses. A list of approved course sequences is available from the advisor. Courses that are not acceptable for a major in a given department are not to be used for interdisciplinary studies.

General: A minimum of six courses (18 credits minimum). 4 credits should be chosen to meet prerequisite requirements of other courses. Four of the six electives must be upper division courses. All students must have at least two science/scientific methods courses in either their interdisciplinary studies courses or general electives. See below.

Science/Scientific Methods Requirement: An additional 4 credits of science to fulfill the science requirements. Students may take Biology, Chemistry, or Astronomy with a related laboratory session. Other science courses outside of those listed may be approved by the department.

Co-op

A GPA of 2.7 is required to enroll in co-op. In the Computer Science program, 3 credits of co-op may be used as one of the four general electives (not a Computer Science elective) with the approval of the academic advisor. Additional co-op courses are additive credit.

*** Dual Major in Math must take Physics 234 with Lab.

**** Interdisciplinaary, three 300/400 level courses within the same subject, math, science, engineering or managaement.

***** Will need to complete two scientific method electives or one science with a lab elective.

Accelerated BioInformatics Program for Honors Premed Students (107)

FIRST YEAR:

1st Semester: (17 credits)

		R120:101	General Biology I (3-3-4)

Chem 125	General Chemistry I (3-0-3)
Math 111	Calculus I (4-1-4)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
CS 113	Introduction to Computer Science (3-0-3)
Frsh Sem	Freshman Seminar (1-0-0)
Bnfo Sem	(BioInformatics Seminar) (0-0-0)

2nd Semester: (17 credits):

R120:102	General Biology II (3-3-4)
Chem 124	General Chemistry Laboratory (0-2-1)
Chem 126	General Chemistry II (3-0-3)
Math 112	Calculus II (4-1-4)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
PE	(Physical Education) (0-1-1)
Bnfo Sem	(BioInformatics Seminar) (0-0-0)

Summer Semester: (6 credits)

Elective	(Social Science:GUR) (3-0-3)
Elective	(Free Elective) ((3-0-3))

SECOND YEAR:

1st Semester: (17 credits)

R120:301	Foundations of Biology: Cell and Molecular Biology (3-0-3)
R120:352	Genetics (3)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
BNFO 235	Programming for Bioinformatics (3-0-3)
Math 105	Elementary Probability and Statistics (3-0-3)

2nd Semester: (16 credits)

Chem 243	Organic Chemistry I (3-0-3)
BNFO239	
Elective	(Social Science:GUR) (3-0-3)
Econ 201	Economics (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
PE	(Physical Education) (0-1-1)

THIRD YEAR:

1st Semester: (16 credits)

BNFO 482	Databases and Data Mining in Bioinformatics (3-0-3)
BNFO 240	Principles of Bioinformatics II (3-0-3)
Chem 244	Organic Chemistry II (3-0-3)
Chem 244A	Organic Chemistry II Laboratory (0-4-2)
HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
Eng 352	Technical Writing (3-0-3) ***or***
Eng 340	Oral Presentations (3-0-3)

2nd Semester: (18 credits)

		HSS491	
		Elective	(English and Cultural History:GUR) (3-0-3)
		BNFO492	
		Elective	(Free Elective) (3-0-3)
		Elective	(Free Elective) (3-0-3)

BS Dual Major in Computer Science and Applied Physics (135 credits)

FIRST YEAR:

1st Semester: (17 credits)

		CS 100	Roadmap to Computing (3-0-3)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Math 111	Calculus I (4-1-4)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Chem 125	General Chemistry I (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (18 credits)

		CS 113	Introduction to Computer Science (3-0-3)
		Phys 114	Introduction to Data Reduction with Applications (3-0-3)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		Math 112	Calculus II (4-1-4)
		Chem 126	General Chemistry II (3-0-3)
		Chem 124	General Chemistry Laboratory (0-2-1)

SECOND YEAR:

1st Semester: (17 credits)

		CS 114	Introduction to Computer Science II (3-0-3)
		Math 211	Calculus III A (3-0-3)
		Phys 234	Physics III (3-0-3)
		Phys 231A	Physics III Laboratory (0-2-1)
		SS	(Social Science:GUR) (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Elective	(Physical Education) (0-1-1)

2nd Semester: (19 credits)

		CS 280	Programming Language Concepts (3-0-3)
		Math 222	Differential Equations (4-0-4)
{		Math 335	Vector Analysis (3-0-3) ***or***
		Math 328	Mathematical Methods for Scientists and Engineers (3-0-3)
		Phys 335	Introductory Thermodynamics (3-0-3)
		SS	(Social Science:GUR) (3-0-3)
		HSS	(Cultural History:GUR) (3-0-3)

THIRD YEAR:

1st Semester: (18 credits)

		CS 252	Computer Organization and Architecture (3-0-3)

		CS 288	Intensive Programming in Linux (3-0-3)
		CS 241	Foundations of Computer Science I (3-0-3)
		Math 333	Probability and Statistics (3-0-3)
		Phys 430	Classical Mechanics I (3-0-3)
		Phys 432	Electromagnetism I (3-0-3)

2nd Semester: (16 credits)

		CS 435	Advanced Data Structures and Algorithm Design (3-0-3)
		CS 332	Principles of Operating Systems (3-0-3)
		Elective	(Physics/OPSE 300/400 Elective) (3-0-3)
		OPSE 310	Virtual Instrumentation (3-0-3)
		Elective	(Management:GUR) (3-0-3)
		Elective	(Physical Education) (0-1-1)

FOURTH YEAR:

1st Semester: (15 credits)

		CS 341	Foundations of Computer Science II (3-0-3)
		CS 490	Guided Design in Software Engineering (3-0-3)
		CS 431	Database System Design and Management (3-0-3)
		Phys 442	Introduction to Quantum Mechanics (3-0-3)
		Phys 485	Computer Modeling of Applied Physics Problems (3-0-3)

2nd Semester: (15 credits)

{		CS 491	Senior Project (3-0-3) ***or***
		Phys 490	Independent Study (3-0-3)
		Elective	(Eng/Hist/Lit/Phil/STS/SS/Thtr:GUR) (3-0-3)
		Elective	(Physics 300/400 Elective) (3-0-3)
		IS 350	Computers, Society and Ethics (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)

Double Major in Computer Science and Mathematical Sciences (135 credit minimum)

FIRST YEAR

1st Semester:

		CS 100	Roadmap to Computing (3-0-3)
		Math 111	Calculus I (4-1-4)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)
		Elective	(Physical Education:GUR) (0-1-1)

2nd Semester:

		CS 113	Introduction to Computer Science (3-0-3)
		Math 112	Calculus II (4-1-4)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		EPS 202	Society, Technology, and the Environment (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR

1st Semester:

Math 227	Mathematical Modeling (4-0-4)
CS 114	Introduction to Computer Science II (3-0-3)
Math 211	Calculus III A (3-0-3)
Phys 234	Physics III (3-0-3)
Phys 231A	Physics III Laboratory (0-2-1)

2nd Semester:

CS 280	Programming Language Concepts (3-0-3)
CS 332	Principles of Operating Systems (3-0-3)
Math 222	Differential Equations (4-0-4)
CS 252	Computer Organization and Architecture (3-0-3)
Elective	(Cultural History GUR) (3-0-3)
Elective	(Social Science) (3-0-)

THIRD YEAR

1st Semester:

CS 241	Foundations of Computer Science I (3-0-3)
CS 288	Intensive Programming in Linux (3-0-3)
Math 333	Probability and Statistics (3-0-3)
Math 337	Linear Algebra (3-0-3)
Math 340	Applied Numerical Methods (3-1-3)
Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)

2nd Semester:

CS 435	Advanced Data Structures and Algorithm Design (3-0-3)
CS 341	Foundations of Computer Science II (3-0-3)
Elective	(Open:GUR) (3-0-3)
Elective	(Math 300+) (3-0-3)
Math 331	Introduction to Partial Differential Equations (3-0-3)
Math 332	Introduction to Functions of a Complex Variable (3-0-3)

FOURTH YEAR

1st Semester:

CS 431	Database System Design and Management (3-0-3)
CS 490	Guided Design in Software Engineering (3-0-3)
Elective	(Management:GUR) (3-0-3)
Elective	(CS) (3-0-3)
Math 450H	Methods of Applied Mathematics I (Capstone I) (3-0-3)
Math 480	Introductory Mathematical Analysis (3-0-3)

2nd Semester:

CS 491	Senior Project (3-0-3)
Elective	(CS) (3-0-3)
Math 451H	Methods of Applied Mathematics II (Capstone II) (3-0-3)
Elective	(Math 300+) (3-0-3)
Elective	(Capstone Seminar:GUR) (3-0-3)

BS Dual Major in Computer Science and Applied Physics (135 credits)

FIRST YEAR:

1st Semester: (17 credits)

CS 113	Introduction to Computer Science (3-0-3)
CS 113A	Lab (0-1.5-0)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
Math 111	Calculus I (4-1-4)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Chem 125	General Chemistry I (3-0-3)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (18 credits)

CS 114	Introduction to Computer Science II (3-0-3)
CS 114A	Lab (0-1.5-0)
Phys 114	Introduction to Data Reduction with Applications (3-0-3)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
Math 112	Calculus II (4-1-4)
Chem 126	General Chemistry II (3-0-3)
Chem 124	General Chemistry Laboratory (0-2-1)

SECOND YEAR:

1st Semester: (17 credits)

CS 280	Programming Language Concepts (3-0-3)
Math 211	Calculus III A (3-0-3)
Phys 234	Physics III (3-0-3)
Phys 231A	Physics III Laboratory (0-2-1)
SS	(Social Science:GUR) (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Elective	(Physical Education) (0-1-1)

2nd Semester: (19 credits)

CS 288	Intensive Programming in Linux (3-0-3)
Math 222	Differential Equations (4-0-4)
Math 335	Vector Analysis (3-0-3) ***or***
Math 328	Mathematical Methods for Scientists and Engineers (3-0-3)
Phys 335	Introductory Thermodynamics (3-0-3)
SS	(Social Science:GUR) (3-0-3)
HSS	(Cultural History:GUR) (3-0-3)

THIRD YEAR:

1st Semester: (18 credits)

CS 252	Computer Organization and Architecture (3-0-3)
IS 350	Computers, Society and Ethics (3-0-3)
CS 241	Foundations of Computer Science I (3-0-3)
Math 333	Probability and Statistics (3-0-3)
Phys 430	Classical Mechanics I (3-0-3)

		Phys 432	Electromagnetism I (3-0-3)

2nd Semester: (16 credits)

		CS 435	Advanced Data Structures and Algorithm Design (3-0-3)
		CS 332	Principles of Operating Systems (3-0-3)
		Elective	(Physics/OPSE 300/400 Elective) (3-0-3)
		OPSE 310	Virtual Instrumentation (3-0-3)
		Elective	(Management:GUR) (3-0-3)
		Elective	(Physical Education) (0-1-1)

FOURTH YEAR:

1st Semester: (15 credits)

		CS 341	Foundations of Computer Science II (3-0-3)
		CS 490	Guided Design in Software Engineering (3-0-3)
		CS 431	Database System Design and Management (3-0-3)
		Phys 442	Introduction to Quantum Mechanics (3-0-3)
		Phys 485	Computer Modeling of Applied Physics Problems (3-0-3)

2nd Semester: (15 credits)

{		CS 491	Senior Project (3-0-3) ***or***
		Phys 490	Independent Study (3-0-3)
		Elective	(Eng/Hist/Lit/Phil/STS/SS/Thtr:GUR) (3-0-3)
		Elective	(Physics 300/400 Elective) (3-0-3)
		Elective	(CS Elective) (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)

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.

Refer to the General University Requirement section of this catalog for further information on GUR electives

Co-op

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 and Phys 411 are taken for degree Credit with permission.

Computing and Business

Administered By: College of Computing Sciences

Administration

Chairperson	Michael A. Baltrush
Associate Chairperson	James M. Calvin
PhD Director	David Nassimi

Faculty

Distinguished Professor	Joseph Y. Leung
Professors	Narain Gehani, James Geller, James McHugh, Ali Mili, Yehoshua Perl, Frank Y. Shih, Boris S. Verkhovsky, Jason T. Wang
Associate Professors	Michael A. Baltrush, James M. Calvin, Alexandros Gerbessiotis, Daochuan Hung, Marvin K. Nakayama, Chengjun Liu, John W. Ryon, Andrew Sohn, Dimitrios Theodoratos
Assistant Professors	Cristian M. Borcea, Barry Cohen, Usman W. Roshan, Guiling Wang
Special Lecturers	George Blank, Osama Eljabiri, Jonathan J. Kapleau, Dionissios Karvelas, Morty D. Kwestel, Theodore L. Nicholson, Wallace Rutkowski

Advisors

Undergraduate Advisor	Amanda D. Ackerman, Casey L. Hennessey, George W. Olsen
MSCS Advisor	Amanda D. Ackerman, Casey L. Hennessey
1st Year PhD Advisor	David Nassimi

Technology and science are dramatically changing our economy and our society. This is creating new business opportunities and needs, with an increasing push for computing employees to be more involved in business aspects of a company. Computing employees must have a solid understanding of business fundamentals to succeed. Specifically designed to address these issues, the Bachelor of Science (BS) in Computing and Business applications and systems in a business environment.

Offered by the College of Computing Sciences, the BS in Computing and Business contains a mix of courses in computer science and business. With one of the most computing intensive campuses in the world, NJIT has pioneered in the applications of new technologies as learning tools. The College of Computing Sciences educates one of the largest groups of information technology students in the nation.

B. S. in Computing and Business (129 credits)

FIRST YEAR

1st Semester: (18 credits)

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.*

Acct 117	Survey of Accounting (3-0-3)
CS 100	Roadmap to Computing (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Math 111	Calculus I (4-1-4)
Elective	(Natural Science with Lab) (4)
CS 107	Computing as a Career (1-0-1)

2nd Semester: (18 credits)

CS 113	Introduction to Computer Science (3-0-3)
Econ 201	Economics (3-0-3)
Math 112	Calculus II (4-1-4)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Elective	(Natural Science with Lab) (4)

SECOND YEAR

1st Semester: (16 credits)

CS 114	Introduction to Computer Science II (3-0-3)
Mrkt 330	Principles of Marketing (3-0-3)
Math 333	Probability and Statistics (3-0-3)
HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
PE	(Physical Education) (0-1-1)
IS 350	Computers, Society and Ethics (3-0-3)

2nd Semester: (16 credits)

Eng 340	Oral Presentations (3-0-3) ***or***
Eng 352	Technical Writing (3-0-3)
CS 280	Programming Language Concepts (3-0-3)
Elective	(Social Science GUR) (3-0-3)
Mgmt 216	Business Statistics (3-0-3)
CS 241	Foundations of Computer Science I (3-0-3)
CS 207	Computing and Effective Communication (1-0-1)

THIRD YEAR

1st Semester: (15 credits)

Fin 315	Fundamentals of Corporate Finance (3-0-3)
CS 288	Intensive Programming in Linux (3-0-3)
HRM 301	Organizational Behavior (3-0-3)
CS 332	Principles of Operating Systems (3-0-3)
OM 375	Management Science (3-0-3)

2nd Semester: (15 credits)

IS 344	Computing Applications in Business (3-0-3)
CS 356	Introduction to Computer Networks (3-0-3)

		IT 310	E-commerce Technology (3-0-3)
		Elective	(Free Elective) (3-0-3)
		CS 431	Database System Design and Management (3-0-3)
		PE	(Physical Education) (0-1-1)

FOURTH YEAR

1st Semester: (15 credits)

		Mgmt 491	International Business (3-0-3)
		Elective	(Hum/Hist/Lit/Phil/STS) (3-0-3)
		CS 357	Fundamentals of Network Security (3-0-3)
		Elective	(Free Elective) (3-0-3)
		CS 490	Guided Design in Software Engineering (3-0-3)

2nd Semester: (16 credits)

		CS 435	Advanced Data Structures and Algorithm Design (3-0-3)
		CS 491	Senior Project (3-0-3)
		Elective	(HSS Capstone Seminar) (3-0-3)
		Elective	(Business Elective) (3-0-3)
		Elective	(Free Elective) (3-0-3)
		CS 407	Professional Development in Computing (1-0-1)

Catalog and curricula information approved by the relevant academic department.

Digital Design

Administered By: College of Architecture and Design

Administration

Dean	Urs P. Gauchat
Associate Dean for Administration	Margaret Fitzpatrick
Associate Dean for Academics	John M. Cays
Director, School of Art + Design	Glenn Goldman

Faculty

Advisor

Undergraduate Advisor	Sasha N. Corchado

A multi-disciplinary field that underlies many of today's fast-growing industries - from web-based communications to advertising to entertainment. Applications of digital design can be seen in the work of game designers, set designers for movies and television, producers of television commercials, technical illustrators, exhibit designers, animators, artists, futurists, educational software developers, and many others.

Students studying digital design at NJIT are exposed to a wide variety of digital and multiple media applications. After a common foundation year that includes art history, color and composition, and graphic communication in addition to general university requirements, students select from two different tracks: entertainment and interactive media/production. The curriculum provides opportunities to take a variety of courses like game history, video & animation, human factors/ergonomics, character modeling, architecture in motion pictures, management, Internet marketing, exhibit development, etc. Courses approved as design electives come from different programs including architecture, industrial design, fine arts, and information technology and include "Architoons," "Building Information Modeling," "Digital Tectonics," "Information Technology/Computer Forensics," and "The Architecture of Utopia," as well as a variety of traditional media art and art history classes.

The Bachelor of Arts in Digital Design incorporates free electives and design electives in the last two years which students may use to broaden their overall undergraduate education and treat their experience in digital design as a "major" within the university. Alternatively, students may elect to use their free and design electives to focus on one or more areas that can prepare them for employment in a particular field or more specific graduate study. With proper course selection, students can be prepared to apply to graduate programs in art (M.F.A.) or architecture (M. Arch - first professional degree).

The Bachelor of Arts in Digital Design requires the successful completion of a minimum of 134 credits.

The Digital Design curriculum below is separated into two tracks: Entertainment Track, and Interactive Media/Production Track. Please refer to the appropriate track for proper course distribution.

Bachelor of Arts in Digital Design (134 credits)

FOUNDATION YEAR

FIRST YEAR

1st Semester:

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.

	AD 150	Color and Composition (2-3-3)
	AD 161	History of Art and Design I (3-0-3)
	HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
	Math 115	Elements of Geometry (3-0-3)
	CS 104	Computer Programming and Graphics Problems (3-0-3)
	PE XXX	(Physical Education:GUR) (0-1-1)
	Math 120	Basic Concepts in Statistics (1-0-1)
	Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester

	AD 111	Communication in Art and Design - Traditional Media (1-5-3)
	AD 112	Communication in Art and Design - Digital Media (1-5-3)
	AD 162	History of Art and Design II (3-0-3)
	HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
	Math 116	Mathematics of Design (3-0-3)
	STS 201	Understanding Technological Society (3-0-3)
{	STS 257	Technology, Society and Culture: An American View (3-0-3) ***or***
	STS 258	Technology, Society and Culture: A Global View (3-0-3)
	EPS 202	Society, Technology, and the Environment (3-0-3)
	MATH XXX	(STATISTICS-TBD:GUR) (1-01)

ENTERTAINMENT TRACK

SECOND YEAR

1st Semester:

	DD 275	History of Games (2-3-3)
	Arch 251	History of Architecture I (3-0-3)
	IT 101	Introduction to Information Technology (3-0-3)
{	HUM 211	The Pre-Modern World (3-0-3) ***or***
	HUM 212	The Modern World (3-0-3) ***or***
	Hist 213	The Twentieth-Century World (3-0-3)
	Phys 102	General Physics (3-0-3)
	Phys 102A	General Physics Laboratory (0-2-1)
	PE XXX	(Physical Education:GUR) (0-1-1)

2nd Semester:

	DD 284	Video and Animation (3-0-3)
	IT 201	Information Design Techniques (3-0-3)
	Arch 282	Structures I (3-0-3)
{	STS 210	General Psychology (3-0-3) ***or***
	R830:101	Principles of Psychology I (3)
	AD 201	Human Factors/Ergonomics (3-0-3)

	Elective	(Bio/Chem/Phys:GUR) (3-0-3)

THIRD YEAR

1st Semester:

	Arch 434	Simulated Environments (3-0-3)
{	STS 347	Introduction to Music (3-0-3) ***or***
	DD303	
	DD 363	Digital Design Studio I (1-12-5)
{	IT 265	Game Architecture and Design (3-0-3) ***or***
	IT 266	Game Modification Development (3-0-3)
	Elective	(Int/DD/ID/FA XXX Design Elective) (3-0-3)
	Elective	(300+ Level Eng/Lit/Hist/Phil/STS/SS/THR:GUR) (3-0-3)

THIRD YEAR

2nd Semester:

	DD 364	Digital Design Studio II (1-12-5)
	DD 301	Acting Fundamentals for Animators (3-0-3)
	Elective	(ID/DD/FA/INT Design Elective 3-0-3)
	Elective	(ID/DD/FA/INT Design Elective 3-0-3)
	Eng 369	Creative Writing (3-0-3)

FOURTH YEAR

1st Semester:

	AD 463	Collaborative Design Studio (1-12-5)
	Mgmt 390	Principles of Management (3-0-3)
{	DD405	***or***
	STS 349	Advanced Music Technology (3-0-3)
	Arch 585	Imaginary Worlds: Architecture in Motion Pictures (3-0-3)

2nd Semester:

	DD 464	Digital Design Studio III (1-12-5)
	Elective	(INT/DD/ID/FA XXX Design Elective) (3-0-3)
	COM 345	Character Modeling and Animation (2-1-3)
	Elective	(Free Elective) (3-0-3)
	Elective	(Humanities Capstone:GUR) (3-0-3)

INTERACTIVE MEDIA/PRODUCTION TRACK

SECOND YEAR

1st Semester:

	DD 275	History of Games (2-3-3)
	Arch 251	History of Architecture I (3-0-3)
	IT 101	Introduction to Information Technology (3-0-3)
*	R830:101	Principles of Psychology I (3)
	Phys 102	General Physics (3-0-3)
	Phys 102A	General Physics Laboratory (0-2-1)
	PE XXX	(Physical Education:GUR) (0-1-1)

2nd Semester:

		DD 284	Video and Animation (3-0-3)
		IT 201	Information Design Techniques (3-0-3)
		Elective	(Free Elective) (3-0-3)
	*	Econ 201	Economics (3-0-3) ***or***
		Econ 265	Microeconomics (3-0-3) ***or***
		Econ 266	Macroeconomics (3-0-3)
		AD 201	Human Factors/Ergonomics (3-0-3)
		Elective	(Bio/Chem/Phys:GUR) (3-0-3)

THIRD YEAR

1st Semester:

		Arch 434	Simulated Environments (3-0-3)
		DD 363	Digital Design Studio I (1-12-5)
		IT 202	Internet and Applications (3-0-3)
		Mrkt 330	Principles of Marketing (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)

2nd Semester:

		DD 364	Digital Design Studio II (1-12-5)
		Mrkt 331	Consumer and Buyer Behavior ((3-0-3))
		Elective	(Int/DD/ID/FA XXX Design Elective) (3-0-3)
		Elective	(Int/DD/ID/FA XXX Design Elective) (3-0-3)
		Elective	(Eng/Lit/Hist/Phil/STS/SS/Thr:GUR) (3-0-3)

FOURTH YEAR

1st Semester:

		AD 463	Collaborative Design Studio (1-12-5)
		Mgmt 390	Principles of Management (3-0-3)
		DD 415	Web/Exhibit Development (3-0-3)
		IT 380	Educational Software Design (3-0-3)

2nd Semester:

		DD 464	Digital Design Studio III (1-12-5)
		Elective	(Int/DD/ID/FA XXX Design Elective) (3-0-3)
		Mrkt 360	Internet Marketing (3-0-3)
		Elective	(Free Elective) (3-0-3)
		Elective	(Humanities Capstone:GUR) (3-0-3)

Depending on interest and course availability, students may elect to take COM 345 Character Modeling & Animation in the third year and postpone a Design Elective until fourth year or vice versa.

The minimum credit requirement for graduation is the successful completion of 134 credits of prescribed courses within the curriculum and the maintenance of a 2.0 average. Students are required to maintain a 2.0 cumulative studio average to advance to each succeeding year.

Basic Social Sciences GUR: six (6) credits in basic (100 and 200 level) Social Sciences (Econ 201, Econ 265, Econ 266, EPS 202, STS 258 or any of the following Rutgers-Newark courses: R070:203, or 204, R790:201 or 202, R830:101 or 102, R920:201 or 202, R202:201. Students may take R220:101 or 102 instead of Econ 265 or 266).

Cultural History GUR: The Cultural History courses are the Pre-Modern World (HUM 211), The Making of the Modern World (HUM

212, and the Twentieth-Century World (Hist 213). Students may also take approved introductory courses at Rutgers-Newark.

Lit/Hist/Phil/STS: One 300+ level course in lit, hist or philosophy or STS approved 300-level Rutgers course with prefix 350 (English Literature), 352 (American Literature), 510 (History), 512 (American History) or 730 (Philosophy).

Natural Sciences GUR: At least seven (7) credits in natural sciences, including a laboratory experience. Courses may be selected from Biology Courses (R120:101, R120:102, R120:109, R120:110, R120:205, R120:206, R120:207, R120:208, R120:237, R120:241, R120:242), Chemistry Courses (Chem 122, Chem 123, Chem 124, Chem 125, Chem 126), Physics Courses (Phys 102, Phys 102A, Phys 103, Phys 103A, Phys 106, Phys 106A, Phys 111, Phys 111A, Phys 121, Phys 121A, Phys 202, Phys 202A, Phys 203, Phys 203A), Geology Courses (R460:101, R460:103, R460:104, R460:206, R460:207).

Open Elect in HUM/SS: One 300+ level course in English, social science, theater, literature, history, philosophy or STS or any 300-level Rutgers-Newark courses in humanities, social sciences, fine arts, or performing arts. (prefixes 070, 080, 081, 202, 220, 350, 352, 370,� 420, 510, 560, 570, 700, 701, 790, 810, 861, 920, 940, 965, 988).

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* Depending on interest and course availability, students may elect to take SS 201 (or accepted equivalent) in the Fall demester and postpone Principles of Psychology I (Rutgers) until the Spring semester of 2nd year.

Catalog and curricula information approved by the relevant academic department.

Electrical Engineering

Administered By: Department of Electrical and Computer Engineering

Administration

Chair	Leonid Tsybeskov
Associate Chair (Undergraduate)	Marek Sosnowski
Associate Chair (Graduate)	Durgamadhab Misra

Faculty

Distinguished Professors	Yeheskel Bar-Ness, Atam P. Dhawan, Bernard Friedland, Jacob Savir
Professors	Ali N. Akansu, Nirwan Ansari, John D. Carpinelli, Haim Grebel, Richard A. Haddad, Alexander M. Haimovich, Durgamadhab Misra, Edip Niver, Yun-qing Shi, Kenneth S. Sohn, Marek Sosnowski, Leonid Tsybeskov, Gerald Whitman, Mengchu Zhou, Sotirios G. Ziavras
Associate Professors	Ali Abdi, Hongya Ge, Sui-hoi E. Hou, Walid Hubbi, Roberto Rojas-Cessa, Osvaldo Simeone
Assistant Professors	Abdallah Khreishah
University Lecturers	Mohammed Feknous, Serhiy P. Levkov, Timothy W. Steele

Advisors

Undergraduate Advisor	Shivon S. Boodhoo
Undergraduate Advisor Upper Division and Transfers	Marek Sosnowski
MS Electrical Engineering Advisor	Durgamadhab Misra
PHD Electrical Engineering Advisor	Durgamadhab Misra
MS Computer Engineering Advisor	Mengchu Zhou
PHD Computer Engineering Advisor	Durgamadhab Misra
MS Telecommunications Advisor	Roberto Rojas-Cessa
MS Internet Engineering Advisor	Roberto Rojas-Cessa
MS Power and Energy Systems Advisor	Mengchu Zhou

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 (micron size machines, high density computer circuits), computers (global networking, multimedia), bio-electronics (medical imaging, bio-control, bio-sensors), energy conversion and distribution (novel energy sources, solar, tidal, wind), control systems (robotics), electro-optics (lasers), and communication systems (satellite 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 Mission Statement

The Mission Statement of the Electrical Engineering (EE) Program is to provide EE students a rigorous learning experience and to prepare them for professional careers.

Program Educational Objectives

In order to meet the Mission of both the institution and the ECE Department, the Department and its Industry Advisory Board have been approved the following Program Educational Objectives:

1. Graduates will succeed in electrical engineering areas or other diverse fields that require analytical and/or professional skills.

2. Graduates will pursue professional development, including continuing or advanced education., relevant to their career plans.

3. Graduates will contribute to their fields or professions and society.

Electrical Engineering Program Student Outcomes

This program is accredited by the Engineering Accreditation Commission of ABET (http://abet.org) and satisfies ABET a-K Program Students Outcome:

(a) An ability to apply knowledge of mathematics, science, and engineering;

(b) An ability to design and conduct experiments, as well as to analyze and interpret data;

(c) An ability to design a system, component or process to meet desired needs within realistic constrains such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability;

(d) An ability to function on multidisciplinary teams;

(e) An ability to identify, formulate, and solve engineering problems;

(f) An understanding of professional and ethical responsibility;

(g) An ability to communicate effectively;

(h) The broad education necessary to understand the impact of engineering solutions in a global economic, environmental, and social context;

(i) A recognition of the need for, and an ability to engage in, life-long learning;

(j) A knowledge of contemporary issues;

(k) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice;

B.S. in Electrical Engineering (131 credit minimum)

FIRST YEAR:
1st Semester:

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.*

Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
Chem 125	General Chemistry I (3-0-3)
FED 101	Fundamentals of Engineering Design (2-1-2)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Math 111	Calculus I (4-1-4)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

CS 115	Intro. to CS I in C++ (3-0-3)
Math 112	Calculus II (4-1-4)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
ECE 101	Introduction to Electrical and Computer Engineering (1-0-0)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Elective	(Physical Education: GUR) (0-1-1)

SECOND YEAR:
1st Semester:

ECE 231	Circuits and Systems I (3-1-3)
ECE 251	Digital Design (3-1-3)
Math 222	Differential Equations (4-0-4)
Elective	(Cultural History, HUM 211, HUM 212 or Hist 213) (3-0-3)
Elective	(Physical Education: GUR) (0-1-1)
Phys 234	Physics III (3-0-3)

2nd Semester:

ECE 232	Circuits and Systems II (3-1-3)
ECE 271	Electronic Circuits I (3-1-3)
ECE 291	Electrical Engineering Laboratory I (0-3-1)
ECE 252	Microprocessors (3-0-3)
Math 213	Calculus III B (4-0-4)
Econ 201	Economics (3-0-3)

THIRD YEAR:
1st Semester:

ECE 333	Signals and Systems (3-0-3)
ECE 361	Electromagnetic Fields I (3-0-3)
ECE 372	Electronic Circuits II (3-0-3)
ECE 395	Microprocessor Laboratory (0-4-2)
EPS 202	Society, Technology, and the Environment (3-0-3)
Mech 320	Statics and Strength of Materials (3-0-3)

2nd Semester:

ECE 321	Random Signals and Noise (3-0-3)
ECE 362	Electromagnetic Fields II (3-0-3)
ECE 374	Electronic Device I (3-0-3)
ECE 392	Electrical Engineering Laboratory II (1-2-2)

	Phil 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering (3-0-3)
	ECE 341	Energy Conversion (3-0-3)

FOURTH YEAR:
1st Semester:

	ECE 414	Electrical and Computer Engineering Project I (1-0-1)
	ECE 494	Electrical Engineering Laboratory III (1-2-2)
*	Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
	Elective	(EE Track Elective I) (3-0-3)
	Elective	(EE Track Elective II) (3-0-3)
	Elective	(ECE Technical Elective) (3-0-3)

2nd Semester:

	ECE 416	Electrical and Computer Engineering Project II (3-0-3) ***or***
	ECE 417	Independent Study (3-0-3)
	Mgmt 390	Principles of Management (3-0-3) ***or***
	IE 492	Engineering Management (3-0-3)
	Elective	(Capstone Seminar: GUR) (3-0-3)
	Elective	(EE Track Laboratory) (3-0-3)
	Elective	(ECE Technical Elective) (3-0-3)
	Elective	(ECE Technical Elective) (3-0-3)

Electives

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Cultural History GUR: Take one course (3 credits) from among HUM 211, HUM 212, Hist 213, and 200-level history courses at Rutgers-Newark.

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students also may satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends that electrical Engineering majors take Phil 334 to fulfill this requirement.

**Basic Social Sciences GUR:* Basic Social Sciences GUR: Three credits of the basic social sciences requirement must be taken in economics; acceptable courses are Econ 201, Econ 265, or Econ 266. The remaining 3 credits may be satisfied by HSS 202, STS 257, or STS 258. Students also may take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H.

Physical Education GUR: Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course. Students are urged to complete the requirement as soon as possible.

Management GUR: Students take IE 492 or Mgmt 390 or AS 333, which is acceptable only for students taking the aerospace option. Students enrolled in a dual degree program between architecture and management take HRM 601 to fulfill this requirement.EE Track: Students choose one of the following tracks: telecommunications, networking, computers, control, bio-electronics, RF/microwave/fiber optics, solid state. See advisor for appropriate courses.

EE Core and EE Core Laboratory: See advisor for appropriate courses.

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 is taken for zero credits, and ECE 410 is taken for 3 degree credits.

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* Student must take Phil 334.

Engineering Science

Administered By: Office of the Dean, Newark College of Engineering

Administration

Program Director	Yuan Ding

Faculty

Professors from Newark College of Engineering and College of Science and Liberal Arts, as appropriate.

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. The engineering science program is designed to prepare the student upon graduation to pursue advanced education in either graduate or professional school or to enter directly into the professional workforce. Students must consult with the program advisor before undertaking a course of study in any engineering science option.

B.S. in Engineering Science (136 credit minimum)
A minimum of 136 credits is required for the B.S. in Engineering Science. Of those 136 credits, at least 30 credits are in an option. Approval from the director is required prior to admission to the program.

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 UMDNJ.

A minimum of 30 engineering credits is required for the degree.

Materials Sciences and Engineering Provides a strong background in the principles underlying the development of novel engineering materials that will be needed for the advanced technologies of the future.

Premedicine/Pre-Dentistry/Pre-Optometry These options provide students with excellent preparation for medical, dental or optometric schools.

B.S. in Engineering Science (136 credits minimum)

FIRST YEAR:

1st semester:

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.

{		Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
		Chem 125	General Chemistry I (3-0-3)
	**	FED 101	Fundamentals of Engineering Design (2-1-2)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 111	Calculus I (4-1-4)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Phys 111W	Physics I Workshop (0-1-0)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd semester:

		Chem 124	General Chemistry Laboratory (0-2-1)
{		Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
		Chem 126	General Chemistry II (3-0-3)
	*	CS 101	Computer Programming and Problem Solving (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Math 112	Calculus II (4-1-4)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR:

1st semester:

		Math 211	Calculus III A (3-0-3)
		Econ 201	Economics (3-0-3)
		Elective	(Cultural History:GUR) (3-0-3)
		Elective	(Physical Education:GUR) (0-1-1)
		Elective	(3-0-3)

2nd semester:

		Math 222	Differential Equations (4-0-4)
		Elective	(Cultural History:GUR) (3-0-3)
		Elective	(Science/Engineering) (3-0-3)
		Elective	(3-0-3)

THIRD YEAR:

1st semester:

		Math 333	Probability and Statistics (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		Elective	(Science/Engineering) (3-0-3)
		Elective	(3-0-3)
		Elective	(3-0-3)

2nd semester:

		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		Elective	(3-0-3)
		Elective	(Science/Engineering) (3-0-3)
		Elective	(3-0-3)
		Elective	(3-0-3)
		Elective	(3-0-3)

FOURTH YEAR:

1st semester:

		ESC 491	Research and Independent Study I (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)
		Elective	(Engineering) (3-0-3)
		Elective	(Science/Engineering) (3-0-3)
		Elective	(Science/Engineering) (3-0-3)
		Elective	(3-0-3)

2nd semester:

		Elective	(Management:GUR) (3-0-3)
		Elective	(Science/Engineering) (3-0-3)
		Elective	(3-0-3)
		Elective	(3-0-3)
		Elective	(3-0-3)

Electives

Cultural History GUR: Take two courses (6 credits) from among HUM 211, HUM 212, Hist 213, and 200-level history courses at Rutgers-Newark.

Basic Social Sciences GUR: Three credits of the basic social sciences requirement must be taken in economics; acceptable courses are Econ 201, Econ 265, or Econ 266. The remaining 3 credits may be satisfied by HSS 202, STS 257, or STS 258. Students also may take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491-H-499H.

Physical Education GUR: Students who register as full-time undergraduate for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course. Students are urged to complete the requirement as soon as possible.

Management GUR: Students take IE 492 or Mgmt 390 or AS 333, which is acceptable only for students taking the aerospace option. Students enrolled in a dual degree program between architecture and management take HRM 601 to fulfill this requirement.

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* Half of the students will take this course in reverse order.Transfer students should subsititute EG101 for FED101

** FED101is taken conurrently with either HUM100 or HUM101

Engineering Technology

Administered By: Department of Engineering Technology, (973) 596-3228, email: engineeringtechnology@njit.edu

Adminstration

Chairperson	Ronald H. Rockland

B.S. in Engineering Technology

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. The degree awarded for each of the program options is a Bachelor of Science in Engineering Technology (BSET).

The Engineering Technology Program offer four-year bachelor degree options in: Concrete Industry Management Technology (CIMT), Construction Engineering Technology (CET), Electrical and Computer Engineering Technology (ECET), Mechanical Engineering Technology (MET), Medical Informatics Technology (MIT) and Surveying Engineering Technology (SET), Technology Education (TEED) and Telecommunications Management Technology (TMT).

The options in construction engineering technology, electrical and computer engineering technology, mechanical engineering technology and surveying engineering technology are accredited by the Engineering Accreditation Commission of ABET (TAC of ABET) http://abet.org

Many students choose to complete their freshman and sophomore years at a community college or 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 Department of Engineering 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 students are expected to meet with their faculty advisor each semester to schedule courses and review their progress in the program. The advisor must approve all courses, including electives, prior to registration.

CURRICULA:

- Computer Technology (CMPT)
- Concrete Industry Management Technology (CIMT)
- Construction Engineering Technology (CET)
- Construction Management Technology (CMT)
- Electrical and Computer Technology (ECET)
- Medical Informatics Technology (MIT)
- Mechanical Engineering Technology (MET)

- Surveying Engineering Technology (SET)
- Technology Education (TEED)
- Telecommunications Management Technology (TMT)

APPENDIX

All Engineering Technology options require the same English and Humanities electives in the upper division (i.e. junior and senior year).

Open Elective in Humanities and Social Science GUR (General University Requirement): Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students also may satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends telecommunications management technology option majors take Eng 352 to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or a 300-level course at Rutgers-Newark, approved by the Humanities department.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H.

Free Elective: 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 GUR. Consult the program coordinator.

Co-op: Engineering Technology students are encouraged to take an NJIT co-op course and receive degree credit as a technical elective under the following conditions: (1) the co-op employment is obtained through the NJIT co-op office and (2) this employment has no relation to any current or previous employment of the student. The student may not take more than one course concurrently with the co-op experience and, in all cases, the co-op experience must be approved by the co-op advisor for the student's program. An additional co-op experience may be taken for additive credit but not degree credit.

Computer Technology (CPT/CMPT)

Administered By: Department of Engineering Technology

Administration

Chairperson	Ronald H. Rockland
Coordinator	David J. Lubliner

Computer Technology (CPT) 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 64 semester hour credits 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.

B.S. in Engineering Technology (Computer Technology Option) (131 credits)

FIRST YEAR:

1st Semester:

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.

		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Science Elective	(Phys/Chem/Biol/A&P) (3-0-3)
		Elective	(Science Lab) (1-0-0)
{		Math 138	General Calculus I (3-0-3) ***or***
		Math 135	Calculus for Business (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)
		CS 106	Roadmap to Computing Engineers (3-0-3)

2nd Semester:

		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Science Elective	(Phys/Chem/Biol/A&P) (3-0-3)
		Elective	(Science Lab) (1-0-0)
{		CS 113	Introduction to Computer Science (3-0-3) ***or***
		CS 115	Intro. to CS I in C++ (3-0-3)
		IT 201	Information Design Techniques (3-0-3)
		Elective	(Technical Elective) (3-2-3)
		ET 101	Introduction to Engineering Technology (0-2-1)

SECOND YEAR:

1st Semester:

		Elective	(EPS 202 or Rutgers Equivalent) (3-0-3)
		Elective	(Free Elective) (3-0-3)
{		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		IT 202	Internet and Applications (3-0-3)
		IT 120	Introduction to Network Technology (3-3-3)
		Elective	(Technical Elective) (3-0-3)

2nd Semester:

		Elective	(Free Elective) (3-0-3)
		Econ 201	Economics (3-0-3)
		Specialization	(IT Security/Medical Informatics) (3-0-3)
		Specialization	(IT Security/ Medical Informatics) (3-0-3)
		IS 331	Database Design Management and Applications (3-0-3)
		Elective	(Technical Elective) (3-0-3)

THIRD YEAR:

1st Semester:

		CPT 310	Computer Design Fundamentals for Computer Technology (2-2-3)
		CPT 330	Software Web Applications for Engineering Technology I (2-2-3)
		CPT 341	Visual Basic.NET for Engineering Technology (2-2-3)
		Eng 352	Technical Writing (3-0-3)
{		Math 112	Calculus II (4-1-4) ***or***
		Math 346	Mathematics of Finance I (3-0-3) ***or***
		Elective	(Technical) (3-0-3)
		MIS 345	Management of Information Systems (3-0-3)

2nd Semester

		CPT 315	Computer Architecture for Computer Technology (2-2-3)
		CPT 335	Networks Applications for Computer Technology I (2-2-3)
		Math 305	Statistics for Technology (3-0-3)
{		MNET 416	Production Scheduling (3-0-3) ***or***
		Mrkt 330	Principles of Marketing (3-0-3)

{		MNET 414	Industrial Cost Analysis (3-0-3) ***or***
		Fin 315	Fundamentals of Corporate Finance (3-0-3)
		Humanities Elective	((Lit/Hist/Phil/STS:GUR) (3-0-3)

FOURTH YEAR:

1st Semester:

		CPT 401	Senior Project (0-4-2)
		CPT 430	Software Web Applications for Engineering Technology II (2-2-3)
		CPT 440	Visual Basic Applications for Engineering Technology (2-2-3)
{		Mgmt 480	Managing Technology and Innovation (3-0-3) ***or***
		Mrkt 360	Internet Marketing (3-0-3)
		OM 375	Management Science (3-0-3)
		Elective	(Capstone Seminar:GUR 3-0-3)

2nd Semester:

		CPT 435	Networks Applications for Computer Technology II (2-2-3)
		CPT 450	Computer Graphics for Computer Technology (2-2-3)
		Elective	(Science course in Physics or Chemistry) (3-0-3)
		Elective	(Free) (3-0-3)

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students may also satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends engineering technology majors take Eng 352 to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H

Suggested Technical Electives An upper division course in Computer Science or Information Science, which provides in depth study in the student's area of interest. It must be approved by the student's advisor before registration.

Catalog and curricula information approved by the relevant academic department.

Concrete Industry Management Technology(CIMT) Option

Administered By: Department of Engineering Technology, (973) 596-3228, email: engineeringtechnology@njit.edu

Adminstration

Chairperson	Ronald H. Rockland

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 126 credits is required for graduation.

Freshman (32 credits)

FIRST YEAR:
1st Semester:

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.

		Math 138	General Calculus I (3-0-3)
		Phys 102	General Physics (3-0-3)
		Phys 102A	General Physics Laboratory (0-2-1)
		CS 106	Roadmap to Computing Engineers (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		MET 103	Engineering Graphics & Intro. to CAD (1-2-2)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

		Acct 115	Fundamentals of Financial Accounting (3-0-3)

		Elective	(Technical or Management) (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		EPS 202	Society, Technology, and the Environment (3-0-3)
		CIMT 101	Introduction to Concrete (1-2-2)
		PE	(Physical Education) (0-1-1)

Sophomore (31 Credits)

SECOND YEAR:
1st Semester:

		Acct 215	Managerial Accounting I (3-0-3)
		Mgmt 290	Business Law I (3-0-3)
		CIMT 205	Concrete Properties and Testing (2-2-3)
		Econ 201	Economics (3-0-3)
		MIS 245	Introduction to Management Information Systems (3-0-3)
		PE	(Physical Education) (0-1-1)

2nd Semester:

		Chem 301	Chemical Technology (2-2-3)
		Elective	(Tech or Management) (3-0-3)
		CIMT 210	Concrete Applications I (3-0-3)
		Math 305	Statistics for Technology (3-0-3)
		Elective GUR	(HUM 211, HUM 212 or Hist 213) (3-0-3)

Junior (33 credits)

THIRD YEAR:
1st Semester:

		MNET 420	Quality Systems (2-2-3)
		CET 313	Construction Procedures I (3-0-3)
		CIMT 305	Concrete Applications II (3-0-3)
		Eng 352	Technical Writing (3-0-3)
		Fin 315	Fundamentals of Corporate Finance (3-0-3)
		CET 323	Construction Safety ((3-0-3))

2nd Semester:

		CET 314	Construction Procedures II (3-0-3)
		Mrkt 330	Principles of Marketing (3-0-3)
		CIMT 310	Concrete Products and Delivery (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		HRM 301	Organizational Behavior (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)

Senior (30 credits)

FOURTH YEAR:
1st Semester:

		CET 411	Cost Estimating (3-0-3)
		CET 415	Construction Project Management (3-0-3)
		CIMT 405	Advanced Concrete Testing & Quality Assurance (2-2-3)
		CIMT 497	Co-op Work Experience I (3-0-3)
		Elective	(Technical or Management) (3-0-3)

2nd Semester:

		hss400	(Capstone Seminar) (3-0-3)
		CET 413	Environmental Science (3-0-3)
		MNET 414	Industrial Cost Analysis (3-0-3)
		CIMT 410	Senior Project in CIM (3-0-3)

Electives:

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students may also satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends engineering technology majors take Eng 352 to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H .

* Free: 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 GUR.

Co-op:

Co-op is a required course in this program, and must be approved by the faculty advisor and Career Services.

Concrete Contracting Concentration (128 credits)

Freshman (33 credits)

FIRST YEAR:

1st Semester:

		Math 138	General Calculus I (3-0-3)
		Phys 102	General Physics (3-0-3)
		Phys 102A	General Physics Laboratory (0-2-1)
		CS 106	Roadmap to Computing Engineers (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		MET 103	Engineering Graphics & Intro. to CAD (1-2-2)
		ET 101	Introduction to Engineering Technology (0-2-1)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

		Acct 115	Fundamentals of Financial Accounting (3-0-3)
		Phys 103	General Physics (3-0-3)
		Phys 103A	General Physics Laboratory (0-2-1)
		Elective GUR	(HSS 202 or Rutgers Equivalent) (3-0-3)
		MET 105	Applied Computer Aided Design (1-2-2)
		CIMT105	
		Elective GUR	(HUM 211, HUM 212, or Hist 213) (3-0-3)
		PE	(Physical Education) (0-1-1)

Sophomore (32 credits)

SECOND YEAR:

1st Semester:

		Acct 116	Principles of Accounting II (3-0-3)
		Mgmt 290	Business Law I (3-0-3)
		MET 235	Statics for Technology (3-0-3)
		Econ 201	Economics (3-0-3)
		CIMT 205	Concrete Properties and Testing (2-2-3)
		PE	(Physical Education) (0-1-1)

2nd Semester:

		Chem 301	Chemical Technology (2-2-3)
		MET 237	Strength of Materials for Technology (2-2-3)
		CIMT 210	Concrete Applications I (3-0-3)
		Math 305	Statistics for Technology (3-0-3)
		Elective GUR	(HUM 211, HUM 212 or Hist 213) (3-0-3)

Junior (33 credits)

THIRD YEAR:

1st Semester:

		CET 233	Structural Analysis in Construction (3-0-3)
		CET 313	Construction Procedures I (3-0-3)
		Eng 352	Technical Writing (3-0-3)
		Fin 315	Fundamentals of Corporate Finance (3-0-3)
		MIS 245	Introduction to Management Information Systems (3-0-3)
		CIMT 305	Concrete Applications II (3-0-3)

2nd Semester:

		CET 314	Construction Procedures II (3-0-3)
		Mrkt 330	Principles of Marketing (3-0-3)
		HRM 301	Organizational Behavior (3-0-3)
		CIMT 310	Concrete Products and Delivery (3-0-3)
		CE 343	Geology with Laboratory (3-3-4)

Senior (30 credits)

FOURTH YEAR:

1st Semester:

		CET 411	Cost Estimating (3-0-3)
		CET 415	Construction Project Management (3-0-3)
		CET 331	Structural Systems (3-0-3)
		CIMT 497	Co-op Work Experience I (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)

2nd Semester:

		HSS400	
		CET 435	Design of Temporary Structures (3-0-3)
		MNET 414	Industrial Cost Analysis (3-0-3)
		MNET 420	Quality Systems (2-2-3)
		CIMT 410	Senior Project in CIM (3-0-3)

Catalog and curricula information approved by the relevant academic department.

Construction Engineering Technology (CET)

Administered By: Department of Engineering Technology, (973) 596-3228, email: engineeringtechnology@njit.edu

Administration

Chairperson	Ronald H. Rockland
Coordinator	John Wiggins

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 Accreditation Commission of ABET, **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 129 credits is required for graduation.

Program Educational Objectives:

1. Graduates of our program will attain positions of responsibility within the various aspects of the construction industry.

2. Graduates of our program will have the necessary skills to avail themselves of the opportunities for lifelong learning and professional development.

Student Outcomes:

a. An ability to select and apply the knowledge, techniques, skills, and modern tools of their disciplines to broadly-defined engineering technology activities; and,
b. 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,

c. An ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes; and,
d. An ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives; and,
e. An ability to function effectively as a member or leader on a technical team; and,
f. An ability to identify, analyze, and solve broadly-defined engineering technology problems; and,
g. 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,
h. An understanding of the need for and an ability to engage in self-directed continuing professional development; and,
i. An understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity; and,
j. A knowledge of the impact of engineering technology solutions in a societal and global context; and,
k. A commitment to quality, timeliness, and continuous improvement; and,
l. Producing and utilizing design, construction and operations documents; and,
m. Performing economic analyses and cost estimates related to design, construction and maintenance of systems in the construction technical specialties; and,
n. An ability to select appropriate construction materials and practices; and,
o. An ability to apply principles of construction law and ethics; and,
p. 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
q. 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.

Construction Engineering Technology Option

Freshman (31 credits)

FIRST YEAR:

1st Semester:

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.

Math 138	General Calculus I (3-0-3)
Phys 102	General Physics (3-0-3)
Phys 102A	General Physics Laboratory (0-2-1)
CS 101	Computer Programming and Problem Solving (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
MET 103	Engineering Graphics & Intro. to CAD (1-2-2)
Frsh Sem	Freshman Seminar (1-0-0)
PE	(Physical Education) (0-1-1)

2nd Semester:

Math 238	General Calculus II (3-0-3)
Phys 103	General Physics (3-0-3)
Phys 103A	General Physics Laboratory (0-2-1)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
MET 105	Applied Computer Aided Design (1-2-2)
EPS 202	Society, Technology, and the Environment (3-0-3)
PE	(Physical Education) (0-1-1)

Sophomore (33 credits)

SECOND YEAR:
1st Semester:

		MET 235	Statics for Technology (3-0-3)
		CET 313	Construction Procedures I (3-0-3)
		ECET 201	Circuits I (2-2-3)
		Acct 117	Survey of Accounting (3-0-3)
		CE 200	Surveying (3-0-3)
		CE 200A	Surveying Laboratory (0-3-1)

2nd Semester:

		MET 237	Strength of Materials for Technology (2-2-3)
		CET 314	Construction Procedures II (3-0-3)
		CET 322	Construction Codes and Regulations (3-0-3)
		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		Eng 352	Technical Writing (3-0-3)
		MET 304	Applied Fluid Mechanics (2-2-4)

Junior (33 credits)

THIRD YEAR:
1st Semester:

		CET 317	Construction Computing (3-0-3)
		CET 233	Structural Analysis in Construction (3-0-3)
		Math 305	Statistics for Technology (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)
		Econ 201	Economics (3-0-3)

2nd Semester:

		CET 323	Construction Safety ((3-0-3))
		CET 341	Soils and Earthworks (3-0-3)
		CET 331	Structural Systems (3-0-3)
		MNET 414	Industrial Cost Analysis (3-0-3)
		Elective	(300 Lit/Hist/Phil/STS GUR) (3-0-3)
		MET 303	Applied Thermodynamics (3-0-3)

Senior (32 credits)

FOURTH YEAR:
1st Semester:

		CET 411	Cost Estimating (3-0-3)
		CET 415	Construction Project Management (3-0-3)
		CET 431	Construction Testing (2-2-3)
		CET 435	Design of Temporary Structures (3-0-3)
		Elective	(Technical Elective) (3-0-3)

2nd Semester:

		CET 413	Environmental Science (3-0-3)
		CET 421	Construction Contracts (3-0-3)
		CET 416	Senior Construction Project (1-2-2)
		Elective	(Management Elective) (3-0-3)
		Elective	(Technical) (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)

Electives

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students also may satisfy this requirement with a course in Architectural History or by taking an approved 300-level course at Rutgers-Newark. The department recommends engineering technology majors take Eng 352 to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408 , HSS 409. Students enrolled in the honors college take one from HSS 491H-499H .

* *Free:* 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 GUR. Consult your program coordinator.

Suggested Technical Electives:

- CET 460 Construction Forensics
- MET 416 Air Conditioning and Refrigeration
- MNET 416 Production Scheduling
- MNET 420 Quality Systems
- CE 321 Water Resources Engineering
- CE 342 Geology
- CE 350 Transportation Engineering
- CE 406 Remote Sensing
- CE 450 Urban Planning
- CE 461 Professional Practice in Civil Engineering
- CE 465 Green & Sustainable Civil Engineering

Minors

Minors are available in several programs of study:

- Computer Science which is offered by the CIS Department
- Professional Communications offered by the Humanities Department
- Business offered by the School of Management

The exact requirements for each of these programs are established by each of the departments offering the Minor. Students seeking information regarding the requirements for minors should consult that department.

Construction Management Technology

Administered By: Department of Engineering Technology, (973) 596-3228, email: engineeringtechnology@njit.edu

Administration

Chairperson	Ronald H. Rockland
Coordinator	John Wiggins

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 129 credits is required for graduation.

Construction Management Technology(CMT) (129 credits)

FRESHMAN YEAR:

1st Semester: (16 credits)

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.

		Math 138	General Calculus I (3-0-3)
		Phys 102	General Physics (3-0-3)
		Phys 102A	General Physics Laboratory (0-2-1)
		CS 106	Roadmap to Computing Engineers (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		MET 103	Engineering Graphics & Intro. to CAD (1-2-2)
		ET 101	Introduction to Engineering Technology (0-2-1)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (16 credits)

Math 238	General Calculus II (3-0-3)
Phys 103	General Physics (3-0-3)
Phys 103A	General Physics Laboratory (0-2-1)
MET 105	Applied Computer Aided Design (1-2-2)
Elective	(HSS) (3-0-3)
CIMT 101	Introduction to Concrete (1-2-2)
HSS 202****	Society, Technology, and Environment (3-0-3)
PE	(Physical Education) (0-1-1)

SOPHOMORE YEAR:
1st Semester: (16 credits)

Acct 115	Fundamentals of Financial Accounting (3-0-3)
Mgmt 290	Business Law I (3-0-3)
Elective	(HSS) (3-0-3}) (econ201)
Econ 201	Economics (3-0-3)
CE 200	Surveying (3-0-3)
CE 200A	Surveying Laboratory (0-3-1)

2nd Semester: (16 credits)

Acct 116	Principles of Accounting II (3-0-3)
MIS 245	Introduction to Management Information Systems (3-0-3)
CIMT 205	Concrete Properties and Testing (2-2-3)
Eng 352	Technical Writing (3-0-3)
Elective	(HSS) (3-0-3)
PE	(Physical Education) (0-1-1)

JUNIOR YEAR:
1st Semester: (18 credits)

Math 305	Statistics for Technology (3-0-3)
CET 313	Construction Procedures I (3-0-3)
Fin 315	Fundamentals of Corporate Finance (3-0-3)
CET 317	Construction Computing (3-0-3)
CET 322	Construction Codes and Regulations (3-0-3)

2nd Semester: (15 credits)

CET 314	Construction Procedures II (3-0-3)
CMT 332	Structural Systems for Construction Management (3-0-3)
HRM 301	Organizational Behavior (3-0-3)
CET 323	Construction Safety ((3-0-3))
Elective	(300 Hist/Lit/Phil: GUR) (3)

SENIOR YEAR:
1st Semester: (15 credits)

CET 411	Cost Estimating (3-0-3)
CET 415	Construction Project Management (3-0-3)
MNET 414	Industrial Cost Analysis (3-0-3)
CMT 452	Mechanical and Electrical Systems for Construction (3-0-3)
CET 421	Construction Contracts (3-0-3)

2nd Semester: (17 credits)

		CET 413	Environmental Science (3-0-3)
		CMT 436	Temporary Structures for Construction Management (3-0-3)
		CET 416	Senior Construction Project (1-2-2)
		Mgmt 390	Principles of Management (3-0-3)
		Elective	(Technical or Mgmt.) (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)

Electives:
Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students also may satisfy this requirement with a course in Architectural History or by taking an approved 300-level course at Rutgers-Newark. The department recommends engineering technology majors take? Eng 352 to fulfill this requirement.*Lit/Hist/Phil/STS GUR:* Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.*Capstone Seminar in Humanities and Social Science GUR:* All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H.* *Free:* 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 GUR. Consult your program coordinator.Suggested

Management Electives:

- HRM 303 - Human Resources Management
- HRM 305 - Supervisor and Employee Relations
- HRM 310 - Managing Diversity in Organizations
- HRM 311 - Job and Work Environments
- MGMT 316 - Business Research Methods
- MGMT 480 Managing Technology & Innovation
- MGMT 490 Managing Technologies and Innovation
- MGMT 491 International Business

Suggested Technical Electives:

- MNET 416 Production Scheduling
- MNET 420 Quality Systems
- CE 342 Geology
- CE 350 - Transportation Engineering
- CE 406 Remote Sensing
- CE? 450 Urban Planning
- CE 465 Green & Sustainable Civil Engineering

Minors:

Minors are available in several programs of study:

- Computer Science which is offered by the CIS Department
- Professional Communications offered by the Humanities Department

- Business offered by the School of Management

The exact requirements for each of these programs are established by each of the departments offering the Minor. Students seeking information regarding the requirements for minors should consult that department.

		CET 323	Construction Safety ((3-0-3))
		CET 490	Special Project (3-0-3)
		CET 491	Special Project (1-0-1)
		CET 492	Special Project (2-0-2)
		ET 370	Technical Product Selling (3-0-3)

Suggested Management Electives:

		Acct 115	Fundamentals of Financial Accounting (3-0-3)
		CS 103	Computer Science with Business Problems (3-0-3)
		HRM 303	Human Resources Management (3-0-3)
		HRM 305	Supervision and Employee Relations (3-0-3)
		HRM 310	Managing Diversity in Organizations (3-0-3)
		HRM 311	Job and Work Environments (3-0-3)
		Mgmt 480	Managing Technology and Innovation (3-0-3)
		Mgmt 492	Business Policy (3-0-3)

Electrical and Computer Engineering Technology (ECET)

Administered By: Department of Engineering Technology, (973) 596-3228, email: engineeringtechnology@njit.edu

Administration

Chairperson	Ronald H. Rockland
Coordinator	William Barnes

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 Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC of ABET), **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 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). 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 129 credits is required for graduation.In their Junior and Senior years, ECET students have the option of following: General Electronics with its four technical electives or one of two Specializations: Biomedical or Telecommunications.

Program Educational Objectives:

1. Our graduates will establish productive careers in technology-based organizations in such diverse positions as design, manufacturing, teaching, management, system engineering and sales.

2. Our graduates will participate in lifelong learning activities including graduate school and other professional education.

Student Outcomes:

a. an ability to select and apply the knowledge, techniques, skills, and modern tools of their disciplines to broadly-defined engineering technology activities
b. 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
c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes
d. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives
e. an ability to function effectively as a member or leader on a technical team

f. an ability to identify, analyze, and solve broadly-defined engineering technology problems
g. 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;
h. an understanding of the need for and an ability to engage in self-directed continuing professional development
i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity
j. a knowledge of the impact of engineering technology solutions in a societal and global context
k. a commitment to quality, timeliness, and continuous improvement
l. the application of digital and analog circuit design, computer software, and embedded systems to the development of electrical and computer systems;
m. the ability to analyze and develop communications, control, computer, or power systems
n. the ability to apply project management techniques to computer and electrical systems.
o. the ability to utilize statistics/probability, transform methods and differential equations in support of electrical and computer systems

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Freshman Year (31 credits)

1st Semester: (15 credits)

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.

		Math 138	General Calculus I (3-0-3)
		Phys 102	General Physics (3-0-3)
		Phys 102A	General Physics Laboratory (0-2-1)
		CS 106	Roadmap to Computing Engineers (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		MET 103	Engineering Graphics & Intro. to CAD (1-2-2)
		ET 101	Introduction to Engineering Technology (0-2-1)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (16 credits)

		Math 238	General Calculus II (3-0-3)
		Phys 103	General Physics (3-0-3)
		Phys 103A	General Physics Laboratory (0-2-1)
		ECET 201	Circuits I (2-2-3)
		ECET 215	Introduction to Digital Electronics (2-2-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)

Sophomore Year (32 credits)

1st Semester: (16 credits)

		ECET 202	Circuits II (2-2-3)
		Elective	(Technical) (2-2-3)
		CPT 315	Computer Architecture for Computer Technology (2-2-3)

		Elective	(EPS 202 or Rutgers Equivalent) (GUR) (3-0-3)
{		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		PE	(Physical Education) (0-1-1)

2nd Semester: (16 credits)

		ECET 205	Fundamentals of Analog Electronics (2-2-3)
		ECET 214	Introduction to Communications (2-2-3)
		Elective	(Technical) (2-2-3)
		Econ 201	Economics (3-0-3)
		Elective	(Free) (3-0-3)
		PE	(Physical Education) (0-1-1)

Junior Year (33 credits)

1st Semester: (15 credits)

		Math 309	Mathematical Analysis for Technology (3-0-3)
		ECET 303	Circuit Measurements (1-3-2)
		ECET 311	Embedded Systems I (2-2-3)
		ECET 365	Digital Logic and Circuit Design (3-0-3)
		Eng 352	Technical Writing (3-0-3)

2nd Semester: (18 credits)

{		Math 305	Statistics for Technology (3-0-3) ***or***
		MNET 315	Industrial Statistics (2-2-3)
		ECET 411	Embedded Systems II (2-2-3)
		ECET 300	Circuit Analysis: Transform Methods (3-0-3)
		ECET 305	Integrated Circuit Applications (2-2-3)
		ECET 344	Numerical Computing for Engineering Technology (2-2-3)
		Elective	(Free) (3-0-3)

Senior Year (33 credits)

1st Semester: (17 credits)

		ECET 401	EET Senior Project I (2-0-2)
		Math 322	Differential Equations for Applications (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
	*	Elective	(Technical) (3-0-3)
	*	Elective	(Technical) (3-0-3)

2nd Semester: (16 credits)

		Chem 301	Chemical Technology (2-2-3)
		ECET 402	EET Senior Project II (0-2-1)
		MNET 414	Industrial Cost Analysis (3-0-3)

		Elective	(Capstone Seminar:GUR) (3-0-3)
	*	Elective	(Technical) (3-0-3)
	*	Elective	(Technical) (3-0-3)

Biomedical Specialization

The four Senior Technical Electives are as follows:

{		ECET 415	Fundamentals of Telecommunications (2-2-3) ***or***
		ECET 416	Networking Applications (2-2-3) ***or***
		ECET 418	Transmission Systems (2-2-3)
		ECET 440	Clinical Internship (3 credits)
		BME 302	Mechanical Fundamentals of Biomedical Engineering (1-3-3)
		BME 489	Medical Instrumentation (3-0-3)

Telecommunications Specialization

The four Senior Technical Electives are as follows:

		ECET 415	Fundamentals of Telecommunications (2-2-3)
		ECET 416	Networking Applications (2-2-3)
		ECET 418	Transmission Systems (2-2-3)
		Elective	(Technical) (3-0-3)

Note:

In the General Electronics curriculum, two of the four technical electives must be ECET courses. Students may take courses from other Specializations as technical electives, or they may wish to consider the following technical electives (be sure to check prerequisites):

		ECET 350	Computerized Industrial Controls (2-2-3)
		ECET 412	Power Generation and Distribution (3-0-3)
		ECET 395	Co-op Work Experience I (3 degree credits)
		ECET 444	Technology Applications of Object-Oriented Programming (2-2-3)
		ECET 495	Co-op Work Experience II (0 credits)

and the non-technical elective:

		ET 370	Technical Product Selling (3-0-3)

Electives

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students may also satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends engineering technology majors take Eng 352 to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H .

* *Free:* 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 GUR. Consult your program coordinator.

Suggested Technical Electives: Students in one concentration may take courses from another concentration as technical electives.

Co-op:
Co-op courses must be approved by the faculty advisor in the student's major department. For the B.S.E.T. option in Electrical and Computer Engineering Technology, ECET 395 may be taken as a technical elective and ECET 495 may be taken as additive credit.

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* Depending on whether student takes General Electronics, in which a student may take a technical elective from either of the Specilizations, or one of the two available Specializations.

Catalog and curricula information approved by the relevant academic department.

Mechanical Engineering Technology (MET)

Administered By: Department of Engineering Technology, (973) 596-3228, email: engineeringtechnology@njit.edu

Administration

Chairperson	Ronald H. Rockland
Coordinator	Thomas Juliano

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 Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC of ABET), **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 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). 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

1. 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.

2. 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.

3. Our graduates will have the foundation to take advantage of opportunities for life-long learning and professional development.

Student Outcomes:

a. an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;

b. 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;

c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;

d. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;

e. an ability to function effectively as a member or leader on a technical team;

f. an ability to identify, analyze, and solve broadly-defined engineering technology problems;

g. 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;

h. an understanding of the need for and an ability to engage in self-directed continuing professional development;

i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;

j. a knowledge of the impact of engineering technology solutions in a societal and global context;

k. a commitment to quality, timeliness, and continuous improvement;

l. technical expertise in dynamics, fluid mechanics, and thermodynamics;

m. technical expertise having added technical depth in mechanical design, solid mechanics, and electro-mechanical devices and controls.

Mechanical Engineering Technology Option (128 credits)

Freshman (31 credits)

FIRST YEAR:
1st Semester:

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.

Math 138	General Calculus I (3-0-3)
Phys 102	General Physics (3-0-3)
Phys 102A	General Physics Laboratory (0-2-1)
MET 103	Engineering Graphics & Intro. to CAD (1-2-2)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
CS 106	Roadmap to Computing Engineers (3-0-3)
ET 101	Introduction to Engineering Technology (0-2-1)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

Math 238	General Calculus II (3-0-3)
Phys 103	General Physics (3-0-3)
Phys 103A	General Physics Laboratory (0-2-1)
MET 105	Applied Computer Aided Design (1-2-2)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Elective	(EPS 202 or Rutgers Equivalent:GUR) (3-0-3)
PE	(Physical Education) (0-1-1)

Sophomore (33 Credits)

SECOND YEAR:
1st Semester:

		MET 235	Statics for Technology (3-0-3)
		Elective	(Technical) (2-2-3)
		ECET 201	Circuits I (2-2-3)
		Elective	(HUM 211, HUM 212 or Hist 213:GUR) (3-0-3)
		Chem 301	Chemical Technology (2-2-3)
		Elective	(Technical) (2-2-3)
		PE	(Physical Education) (0-1-1)

2nd Semester:

		MET 236	Dynamics for Technology (2-0-2)
		MET 237	Strength of Materials for Technology (2-2-3)
		ME 215	Engineering Materials and Processes (2-2-3)
		Elective	(HUM 211, HUM 212 or Hist 213:GUR) (3-0-3)
		Econ 201	Economics (3-0-3)
		Elective	(Technical) (2-2-3)

Junior (31 credits)

THIRD YEAR:
1st Semester:

		Math 309	Mathematical Analysis for Technology (3-0-3)
		MET 301	Analysis and Design of Machine Elements I (2-2-3)
		MET 303	Applied Thermodynamics (3-0-3)
		MET 314	Dynamics of Machinery (2-2-3)
		Eng 352	Technical Writing (3-0-3)

2nd Semester:

		MET 302	Analysis and Design of Machine Elements II (3-0-3)
		MET 304	Applied Fluid Mechanics (2-2-4)
		ECET 329	Analog and Digital Electronics (2-2-3)
{		Chem 301	Chemical Technology (2-2-3) ***or***
		Elective	(Technical) (2-2-3)
		Elective	(Free) (3-0-3)

Senior (33 credits)

FOURTH YEAR:
1st Semester:

		MET 401	Mechanical Design Project I (2-0-2)
		MET 415	Automatic Control Systems (2-2-3)
		MNET 414	Industrial Cost Analysis (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
		Elective	(Technical) (2-2-3)
		Elective	(Technical) (2-2-3)

2nd Semester:

		MET 448	Mechanical Design Project II (0-2-1)
		Mgmt 390	Principles of Management (3-0-3)
		MNET 315	Industrial Statistics (2-2-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)
		Elective	(Technical) (2-2-3)
		Elective	(Technical) (2-2-3)

Electives

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students also may satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends engineering technology majors take Eng 352 to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H.

* *Free:* 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 GUR.

** Computer programming or applications course.

Suggested Technical Electives:

MET 205 Advanced CAD (2-2-3)

MET 307 Plastics Technology (2-2-3)

MET 308? Plastics Processing Techniques (2-2-3)

MET 395 Co-op Work Experience I (3 degree credits)

MET 403 Applied Thermodynamics II (2-2-3)

MET 404 Applied Heat Transfer (2-2-3)

MET 407 Structural Design (2-2-3)

MET 409 Air Conditioning and Refrigeration (2-2-3)

MET 495 Co-op Work Experience II

MNET 300 Concepts in Machining (2-4-4)

MNET 303 Advanced Techniques in CAD/CAM (2-2-3)

MNET 420 Quality Systems (2-2-3)

CPT 330 Software Web Applications for Engineering Technology I (2-2-3)

CPT 341 Visual Basic for Engineering Technology (2-2-3)

Co-op

Co-op courses must be approved by the faculty advisor in the student's major department. For the B.S.E.T. option in Mechanical Engineering Technology, MET 395 may be taken as a technical elective, and may, with the approval of the department and Career Services, be taken in the sophomore year. MET 495, which is the second co-op course, may be taken as zero credits.

Medical Informatics Technology

Administered By: Department of Engineering Technology, (973) 596-3228, email: engineeringtechnology@njit.edu

Chair	Ronald H. Rockland
Coordinator	David J. Lubliner

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 130 credits is required for graduation.

Medical Informatics Technology(MIT) (130 credits)

FRESHMAN YEAR (30 credits)

First Semester: (15 credits)

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.

BME 105	Introduction to Human Physiology I (2-0-2)
Math 138	General Calculus I (3-0-3)
CS 106	Roadmap to Computing Engineers (3-0-3)
CS 110	Introduction to Computer Science IA (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
ET 101	Introduction to Engineering Technology (0-2-1)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (15 credits)

BME 106	Introduction to Human Physiology II (1-0-1)
CS 111	Introduction to Computer Science IB (3-0-3)
IT 120	Introduction to Network Technology (3-3-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
HUM 211	The Pre-Modern World (3-0-3) ***or***

HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
Phys Ed	(Physical Education) (0-1-1)

SOPHOMORE YEAR (33 Credits)

First Semester: (15 credits)

CS 115	Intro. to CS I in C++ (3-0-3)
CS 115A	Computer Science I Lab/C++ (0-1.5-0)
IT 120	Introduction to Network Technology (3-3-3)
IT 201	Information Design Techniques (3-0-3)
Eng 200	Communicating in Organizations (3-0-3)
Elective	(HSS 202 or Rutgers Equivalent:GUR) (3-0-3)
Elective	(Technical) (2-2-3)

2nd Semester: (17 credits)

IT 202	Internet and Applications (3-0-3)
IS 431	Database Design, Management and Applications (3-0-3)
Math 305	Statistics for Technology (3-0-3)
Econ 201	Economics (3-0-3)
HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
Elective	(Technical) (2-2-3)

Junior and Senior Years at NJIT (65-67 credits)

JUNIOR YEAR (36 Credits)

First Semester:

CPT 325	Medical Informatics Technology (3-0-3)
CPT 310	Computer Design Fundamentals for Computer Technology (2-2-3)
CPT 330	Software Web Applications for Engineering Technology I (2-2-3)
Eng 352	Technical Writing (3-0-3)
Hist 379	History of Medicine (3-0-3) ***or***
Hist 380	History of Public Health (3-0-3)
MIS 245	Introduction to Management Information Systems (3-0-3)

Second Semester:

CPT 425	Medical Informatics Technology II (2-2-3)
CPT 341	Visual Basic.NET for Engineering Technology (2-2-3)
CPT 335	Networks Applications for Computer Technology I (2-2-3)
Math 305	Statistics for Technology (3-0-3)
IT 230	Computer and Network Security (3-0-3)
MNET 414	Industrial Cost Analysis (3-0-3) ***or***
MIS 246	Tools and Technologies for the Digital Firm (3-0-3)

SENIOR YEAR

First Semester:

		CPT 401	Senior Project (0-4-2)
		CS 431	Database System Design and Management (3-0-3)
		IT220	
		HRM 301	Organizational Behavior (3-0-3)
		Phil 351	Biomedical Ethics (3-0-3)
		Elective	(Capstone Seminar Medical Informatics-HSS 4XX) (3-0-3)

Second Semester:

		IS 448	Design Studio for Ubiquitous Computing (3-0-3)
{		IS 447	Designing the User Experience (3-0-3) ***or***
		CPT 491	Special Projects in Computer Technology (1-0-1)
		CPT 492	Special Projects in Computer Technology (2-0-2)
		HUM 251	Ethical Issues in Business (3-0-3)
		Chem 310	Co-op Work Experience I (3 additive credits)
		IS 686	Pervasive Computing: An HCI Perspective (3 credits)
		Elective	(Any 300-400 level course)

Electives

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students may also satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends engineering technology majors take Eng 352 to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H .

Surveying Engineering Technology

Administered By: Department of Engineering Technology, (973) 596-3228, email: engineeringtechnology@njit.edu

Administration

Chairperson	Ronald H. Rockland
Coordinator	Laramie Potts

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 Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC of ABET), **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 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).

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 **128 credits is required for graduation.**

Program Educational Objectives:

1) Graduates will become licensed surveyors and/or GIS specialists.

2) Graduates will be able to take on supervisory roles in their firms. Some graduates will start their own surveying practice.

3) 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:

a. an ability to select and apply the knowledge, techniques, skills, and modern tools of their disciplines to broadly-defined engineering technology activities

b. 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

c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes

d. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives

e. an ability to function effectively as a member or leader on a technical team

f. an ability to identify, analyze, and solve broadly-defined engineering technology problems

g. 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;

h. an understanding of the need for and an ability to engage in self-directed continuing professional development

i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity

j. a knowledge of the impact of engineering technology solutions in a societal and global context

k. a commitment to quality, timeliness, and continuous improvement

l. an ability to utilize modern measurement technologies to acquire spatial data,

m. an ability to utilize industry-standard software to solve technical problems,

n. an ability to apply technical concepts to the design and implementation of measurement systems to meet project requirements,

o. an ability to design and implement procedures, and analyze data for conformance with precision and accuracy requirements, and

p. an ability to carry out or supervise surveying activities and processes such as measurements, positioning, mapping, boundary determination, and geographic/land information systems.

B.S. in Surveying Engineering Technology (SET) (Information or Technology Concentration) (128 credits)

FIRST YEAR
1st Semester

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.

		CS 113	Introduction to Computer Science (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 111	Calculus I (4-1-4)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Elective	(Introduction to Information /Technology) (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester

CE 200	Surveying (3-0-3)
CE 200A	Surveying Laboratory (0-3-1)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Math 112	Calculus II (4-1-4)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
Elective	(Intro. to CAD) (1-2-2)

SECOND YEAR
1st Semester

SET 301	Route Surveying (Surveying III) (3-3-4)
Mgmt 290	Business Law I (3-0-3)
Elective	(Math) (3-0-3)
Hum/Hist	(Cultural History) (3-0-3)
Phys Ed	(Physical Education) (0-1-1)

Concentration Elective

CS 114	Introduction to Computer Science II (3-0-3) ***or***
Elective	(Technology/Engineering) (3-0-3)

2nd Semester

SET 207	Evidence and Procedures for Property Surveys (3-0-3)
Math 305	Statistics for Technology (3-0-3)
Econ 201	Economics (3-0-3)
Hum/Hist	(Cultural History) (3-0-3)
Elective	(CAD Application) (3-0-3)
Phys Ed	(Physical Education) (0-1-1)

THIRD YEAR
1st Semester

SET 304	Adjustment Computations I (4-0-4)
SET 307	Boundaries and Adjacent Properties (3-0-3)
CE 321	Water Resources Engineering (3-0-3)
Eng 352	Technical Writing (3-0-3)

Concentration Elective

CS 431	Database System Design and Management (3-0-3) ***or***
Elective	(Technology/Engineering) (3-0-3)

2nd Semester

SET 407	Boundary Line Analysis (3-3-4)
SET 404	Adjustment Computations II (4-0-4)
SET 420	Geographic/Land Information Systems (3-3-4)
Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
Elective	(Science Elective) (3-0-3)

FOURTH YEAR
1st Semester

SET 302	Geodetic Control Surveying (Surveying IV) (3-3-4)
SET 303	Photogrammetry and Aerial Photo Interpretation (3-3-4)
Elective	(Technical) (3-0-3)
Elective	(Open) (3-0-3)

2nd Semester

		SET 401	Fundamentals of Geodesy (Surveying V) (3-0-3)
		SET 440	Land Development (2-3-3)
		SET 490	Senior Project in Surveying (2-0-2)
		Elective	(Mangement:GUR) (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)

Electives:

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students also may satisfy this requirement with an approved 300-level course at Rutgers-Newark. The department recommends engineering technology majors take Eng 352 to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students must take one HSS 400 level capstone course.**CAD Elective:** MET 103, CE 260.Math Elective**:** Math 337 Linear Algebra recommended. Other acceptable electives;

Math 213, 226, 240, 337, or 247.

Science Elective**:** Geology or Chemistry or Biology.

Suggested Technical Electives**:**

- SET 280 � Marine Surveying
- SET 403 � Remote Sensing for Geomatics

Other Technical/Engineering Elective**:** Civil/Environmental/Engineering, Construction Engineering Technology, Computer courses

Catalog and curricula information approved by the relevant academic department.

Technology Education(TEED) Option

Administered By: Department of Engineering Technology

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 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 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 131 credits is required for graduation.

Technology Education(TEED) Option (131 credits)

FIRST YEAR - 32 Credits

1st Semester: (16 credits)

CS 106	Roadmap to Computing Engineers (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Phys 102	General Physics (3-0-3)
Phys 102A	General Physics Laboratory (0-2-1)
Math 138	General Calculus I (3-0-3)
MET 103	Engineering Graphics & Intro. to CAD (1-2-2)
ET 101	Introduction to Engineering Technology (0-2-1)
Frsh Sem	Freshman Seminar (1-0-0)
PE	(Physical Education) (0-1-1)

2nd Semester: (16 credits)

Math 238	General Calculus II (3-0-3)
Phys 103	General Physics (3-0-3)
Phys 103A	General Physics Laboratory (0-2-1)
ECET 201	Circuits I (2-2-3)
MET 105	Applied Computer Aided Design (1-2-2)
PE	(Physical Education) (0-1-1)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)

SECOND YEAR - 33 Credits

1st Semester: (15 credits)

MET 235	Statics for Technology (3-0-3)
Chem 301	Chemical Technology (2-2-3)
R300:292	(Social Foundations of Education (replaces EPS 202 as GUR)) (3-0-3)
Elective	(Free) (3-0-3)
ECET 215	Introduction to Digital Electronics (2-2-3)
R21:300:295	(Adolescent Psychology) (3-0-3)

2nd Semester: (18 credits)

MET 237	Strength of Materials for Technology (2-2-3)
HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
R21:300:298	(Teaching in Urban Schools) (3-0-3)
ME 215	Engineering Materials and Processes (2-2-3)
IE 224	Production Process Design (2-2-3)
R21:300:390	(Understanding Educational Evaluation) (3-0-3)
Elective	(Technical) (3-0-3)

THIRD YEAR - 33 Credits

1st Semester: (18 credits)

CET 313	Construction Procedures I (3-0-3)
STS 310	Technology and Human Values (3-0-3)
R21:300:410	(Information & Communication Technologies in Secondary Classrooms) (3-0-3)
CPT 325	Medical Informatics Technology (3-0-3)
R21:300:388	(Curriculum and Instructions in Secondary Classrooms) (3-0-3)

2nd Semester: (15 credits)

Elective	(Culture) (seelist)
Mgmt 390	Principles of Management (3-0-3)
Math 305	Statistics for Technology (3-0-3) ***or***
MNET 315	Industrial Statistics (2-2-3)
R21:300:386	(Methods of Teaching) (3-0-3)

FOURTH YEAR - 27 Credits

1st Semester: (15 credits)

HSS 4XX	(Humanities Capstone Course) (3-0-3)
IE 473	Safety Engineering (3-0-3)
CET 317	Construction Computing (3-0-3)
Elective	(Technical ET) (3xx or 4xx)
Elective	(Technical) (3-0-3)

2nd Semester: (12 credits)

CET 314	Construction Procedures II (3-0-3)
Elective	(Technical ET) (3xx or 4xx)
Elective	(Technical) (3-0-3)
R21:300:418	(Clinical I: Practicum Seminar(Praxis must be taken prior to taking this class) (2 credits)

		R21:300:419	(Practicum Experience) (1 credit)

FIFTH YEAR - 6 Credits

1st Semester: (6 credits)

		R300:487	(Clinical II) (3 credits)
		R300:488	(Student Teaching and Seminar) (6 credits)

Electives:

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students may also satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends engineering technology majors take Eng 352 to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H .

Free: 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 GUR.

Catalog and curricula information approved by the relevant academic department.

Telecommunications Management Technology

Administered By: Department of Engineering Technology, (973) 596-3228, email: engineeringtechnology@njit.edu

Administration

Chairperson	Ronald H. Rockland
Coordinator	Michael Khader

The objective of the Telecommunications Management Technology (TMT) program is to provide students with the skills required to work with, administer and manage telecommunications networks and systems. Graduates of this program will have the technical knowledge to design, implement and procure telecommunications networks and the management skills to maximize the financial returns on these systems. This program prepares the student for such careers as telecommunications manager, network administrator, telecommunications sales representative, e-commerce developer and customer support representative.

The coursework provides the technical background to understand the underlying network architecture, protocols, and technology with a special emphasis on case studies and industrial implementations. The benefit/cost analysis of these networks and their impact on the business environment is studied in depth. Students who wish to enter the program as a transfer student are typically students with A.A.S. in Electrical Engineering Technology, but can also have their A.S. in Business.

A maximum of 64 semester hour credits may be transferred into this program, and students need most of the following courses: Oral and Written Communications, Calculus I, Physical Science, Computer Programming Language and Applications, Social Science/Humanities, Physical Education, Telecommunications, Networking, Business and Finance. Students with less than 64 credits or with deficiencies in the above subject areas are considered on a case by case basis.

Telecommunications Management Technology (TMT) (131 credits)

FIRST YEAR:
1st Semester

Math 138	General Calculus I (3-0-3)
Phys 102	General Physics (3-0-3)
Phys 102A	General Physics Laboratory (0-2-1)
CS 101	Computer Programming and Problem Solving (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
IT 101	Introduction to Information Technology (3-0-3)
ET 101	Introduction to Engineering Technology (0-2-1)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

Math 238	General Calculus II (3-0-3)
Phys 103	General Physics (3-0-3)
Phys 103A	General Physics Laboratory (0-2-1)
MIS 245	Introduction to Management Information Systems (3-0-3)
ECET 201	Circuits I (2-2-3)

Acct 115	Fundamentals of Financial Accounting (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)

SECOND YEAR:
1st Semester:

CS 113	Introduction to Computer Science (3-0-3)
ECET 215	Introduction to Digital Electronics (2-2-3)
HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
Acct 117	Survey of Accounting (3-0-3)
IT 120	Introduction to Network Technology (3-3-3)
PE	(Physical Education) (0-1-1)

2nd Semester:

Elective	(Hum/Hist GUR) (3-0-3)
IT 420	Computer Systems and Networks (3-0-3)
ECET 202	Circuits II (2-2-3)
Fin 218	Financial Markets and Institutions (3-0-3)
PE	(Physical Education) (3-0-3)
MIS 363	Project Management for Managers (3-0-3)

THIRD YEAR:
1st Semester:

Mgmt 390	Principles of Management (3-0-3)
ECET 365	Digital Logic and Circuit Design (3-0-3)
Eng 352	Technical Writing (3-0-3)
ECET 344	Numerical Computing for Engineering Technology (2-2-3)
Math 305	Statistics for Technology (3-0-3)
Fin 315	Fundamentals of Corporate Finance (3-0-3)

2nd Semester:

ECET 415	Fundamentals of Telecommunications (2-2-3)
ECET 214	Introduction to Communications (2-2-3)
ECET 416	Networking Applications (2-2-3)
MNET 414	Industrial Cost Analysis (3-0-3)
Elective	(Lit/Hist/Phil/STS GUR) (3-0-3)

FOURTH YEAR:
1st Semester:

ECET 444	Technology Applications of Object-Oriented Programming (2-2-3)
ECET 418	Transmission Systems (2-2-3)
Mgmt 480	Managing Technology and Innovation (3-0-3)
Elective	(Lit/Hist/Phil/STS GUR) (3-0-3)
IT 430	Ethical Hacking for System Administrators (3-0-3)

2nd Semester:

ECET 418	Transmission Systems (2-2-3)
Elective	(Technical) (3-0-3)
Mrkt 330	Principles of Marketing (3-0-3)
Elective	(Capstone Seminar) (3-0-3)

		ECET 493	Special Projects in ECET (3 credits)
		Elective	(300 or 400 bussiness/management Elective,3-0-)

Electives:

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students may also satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark. The department recommends engineering technology majors take Eng 352 to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H .

Free: 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 GUR.

Economics/Management: See the advisor.

Marketing/Management: Any 300- to 400-level Mgmt or Mrkt course.

Technical: Any 300- or 400-level ECET or CIS course.

Environmental Science

Administered By: Department of Chemistry and Environmental Science

Adminstration

Chairperson	Somenath Mitra
Associate Chairperson	Edgardo Farinas

Faculty

Distinguished Professors	Carol A. Venanzi, Joseph W. Bozzelli, Somenath Mitra
Professors	Tamara Gund, Lev N. Krasnoperov, Nancy L. Jackson
Associate Professor	Zeyuan Qiu, Maurie Cohen
Assistant Professors	Liping Wei, Haidong Huang
Special Lecturer	William Skawinski
Research Professor	Zafar Iqbal

Advisors

Undergraduate Advisors	Roumiana S. Petrova
Graduate Advisor	Somenath Mitra

The major in environmental science is an interdisciplinary program among the NJIT Department of Chemistry and Environmental Science, the Department of Earth and Environmental Sciences at Rutgers-Newark, and the NJIT and Rutgers Federated Biological Sciences Department.

The program provides students with a strong background in science and fundamentals as they relate to the environment. The program is designed to prepare graduates for technical positions in the environmental industry and/or to continue their education in the graduate level. The program also prepares students to pursue positions related to the environment in the fields of law, business, sociology, health, and political science.

Electives

B.S. in Environmental Science (128 credit minimum)

FIRST YEAR:
1st Semester:

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.

		Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
		Chem 125	General Chemistry I (3-0-3)

HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Math 111	Calculus I (4-1-4)
BNFO 135	Programming for Bioinformatics (3-0-3) ***or***
CS 113	Introduction to Computer Science (3-0-3)
R120:101	General Biology I (3-3-4)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
Chem 126	General Chemistry II (3-0-3)
Chem 124	General Chemistry Laboratory (0-2-1)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
R120:102	General Biology II (3-3-4)
PE	(Physical Education) (1)
EvSc 125	Fundamentals of Environmental Sciences (3-0-3)

SECOND YEAR:
1st Semester:

EPS 202	Society, Technology, and the Environment (3-0-3)
R460:103	Planet Earth (3) ***or***
R460:104	Planet Earth Laboratory (1)
Elective	(Cultural History) (3)
Chem 360	Environmental Chemistry I (3-0-3)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)

2nd Semester:

Chem 361	Environmental Chemistry II (3-0-3)
R460:206	Environmental Geology (3) ***or***
R460:207	Environmental Geology Laboratory (1)
PE	(Physical Education) (1)
Math 105	Elementary Probability and Statistics (3-0-3)
Chem 243	Organic Chemistry I (3-0-3)

THIRD YEAR:
1st Semester:

R120:380	Field Ecology (3)
Econ 201	Economics (3-0-3)
Chem 221	Analytical Chemical Methods (0-4-2)
Chem 222	Analytical Chemistry (3-0-3)
Elective	(Open Elective HUM or Social Science) (3)
Elective	(Technical) (3)

2nd Semester:

EvSc 375	Environmental Biology (3-0-3)
Mgmt 390	Principles of Management (3-0-3)
EvSc 325	Energy and Environment (3-0-3)
Elective	(Technical) (3)

		Elective	(Technical) (3)

FOURTH YEAR:
1st Semester:

		R120:335	General Microbiology (4)
		EvSc 416	Environmental Toxicology (3-0-3)
		Elective	(Technical) (3)
		Elective	(Technical) (3)

2nd Semester:

		EvSc 484	Environmental Analysis (2-2-3)
		Elective	(Technical) (3)
		Elective	(Technical) (3)
		Elective	(Technical) (3)
		Elective	(Technical) (3)
		HSS 4**	(HSS Capstone) (3)

Catalog and curricula information approved by the relevant academic department.

Fine Arts

Administered By: Architecture

Administration

Dean	Urs P. Gauchat
Associate Dean for Administration	Margaret Fitzpatrick
Associate Dean for Academics	John M. Cays
Director, School of Art + Design	Glenn Goldman

Faculty

Advisor

Undergraduate Advisor	Sasha N. Corchado

Please note that as of Fall 2013 this program is no longer admitting any new students.

Virtual and/or physical – art is important in our lives. Contemporary artists are exploring the intersection between art and technology. Experimental in nature and utilizing a variety of analog and digital media, these artists are performing a critical role in society: they tell us something about ourselves. They can make our environment better as they provide spiritual and emotional moments (and monuments) for those who create and observe.

The program in fine arts at the New Jersey Institute of Technology provides unique opportunities to aspiring artists. Students can become part of a vibrant and resurgent art scene in Newark, New Jersey. Gallery exhibits of local artists (and even a new art supply store opened by a recent NJIT School of Architecture graduate) are evident. There is a digital culture at NJIT that will expose students to the design process with a variety of tools. While some call this “new media,” it’s been part of the design environment at NJIT for more than twenty years! After a common foundation year that includes courses in color theory/electronic color, graphic communication (traditional and digital media), and art history as well as courses fulfilling general university requirements, students will enter a studio-based curriculum.

The program includes case studies and seminars, courses in art history, and exposure to the necessary skill of proposal writing that often is an important component in the life of a project - especially a large project that involves intervention in public spaces. But the focus is on the design studio where students will work both individually and collaboratively on various projects that may include interactive art installations, time-based media, landform/large-scale art installations, and so on. There are also design electives and free elective courses in the last two years that allow students to either broaden their exposure or to specialize in particular areas of interest.

While students who earn the degree of Bachelor of Fine Arts can (obviously) work as artists, they are also given opportunities to obtain a sufficiently broad education enabling them to utilize their background as effective spokespersons and workers in areas of public policy or education. A degree in fine arts also prepares students for graduate study leading to a first professional degree in interior design and architecture. And, of course, students may also pursue the degrees of M.F.A. or Ph. D. in fine arts often combining careers in art, education, and research.

Bachelor of Fine Arts (134)

FIRST YEAR

1st Semester (16 credits)

		AD 150	Color and Composition (2-3-3)
		AD 161	History of Art and Design I (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 115	Elements of Geometry (3-0-3)
		CS 104	Computer Programming and Graphics Problems (3-0-3)
		PE XXX	(Physical Education GUR) (0-1-1)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester (18 credits)

		AD 111	Communication in Art and Design - Traditional Media (1-5-3)
		AD 112	Communication in Art and Design - Digital Media (1-5-3)
		AD 162	History of Art and Design II (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Math 116	Mathematics of Design (3-0-3)
		HIST 211/212/213	(Cultural History: GUR) (3-0-3)
		MATH XXX	(STATISTICS-TBD:GUR) (1-0-1)

SECOND YEAR

1st Semester (18 credits)

		FA263	
		FA 285	Contemporary Aesthetics (3-3-3)
		R082:201	History of Non-Western Art (3)
		R830:101	Principles of Psychology I (3)
		Elective	(Natural Science) (3-0-3)
		Elective	(Natural Science Lab) (1-0-1)
		PE	(Physical Education GUR) (0-1-1)

2nd Semester (16 credits)

		FA264	
		FA 286	Case Studies in Industrialized Art (3-0-3)
		FA XXX	(Art History Elective) (3-0-3)
{		Econ 201	Economics (3-0-3) ***or***
		Econ 265	Microeconomics (3-0-3) ***or***
		Econ 266	Macroeconomics (3-0-3)
		Elective	(Bio/Chem/Phys GUR) (3-0-3)

THIRD YEAR

1st Semester (17 credits)

		FA363	
		FA XXX	(Art Studio Elective) (3-0-3)
		Elect.	(Design Elective INT/DD/FA/ID/ARCH) (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)
		Elective	(300+ level LIT/HIST/PHIL/STS GUR) (3-0-3)

2nd Semester (17 credits)

		FA364	
		FA XXX	(Art Studio Elective) (3-0-)
		FA392	
		Elective	(300+ ENG/LIT/HIST/PHIL/STS/SS/THR GUR) (3-0-3)

FOURTH YEAR

1st Semester (17 credits)

		AD 463	Collaborative Design Studio (1-12-5)
		Elective	(Design Elective) (3-0-3)
		FA XXX	(Art Hist/Crit. Elective) (3-0-3)
		Elective	(Free Elective) (3-0-3)
		(Elective	(Free Elective) (3-0-3)

2nd Semester (15 credits)

		FA464	
		Elective	(Design Elective INT/DD/FA/ID/ARCH) (3-0-3)
		FA XXX	(Art Hist/Crit. Elective) (3-0-3)
		FA498	
		Elective	(400 level Humanities Capstone GUR) (3-0-3)

Depending on interest and course availability, students may elect to take Econ 201 (or accepted equivalent) in the Fall semester and postpone Principles of Psychology I (Rutgers) until the Spring semester of 2nd year.The minimum credit requirement for graduation is the successful completion of 134 credits of prescribed courses within the curriculum and the maintenance of a 2.0 average. Students are required to maintain an annual cumulative studio average of 2.0 to advance in studio each succeeding year.

The Cultural History courses are the Pre-Modern World (HUM 211), The Making of the Modern World (HUM 212), and the Twentieth-Century World (HIST 213). Students may also take approved introductory courses at Rutgers-Newark.

Open Elect in Hum/SS: One 300+ level course in English, social science, theater, literature, history, philosophy or STS or any 300-level Rutgers-Newark courses in humanities, social sciences, fine arts, or performing arts. (prefixes 070, 080, 081, 202, 220, 350, 352, 420, 510, 560, 570, 700, 701, 370, 790, 810, 861, 920, 940, 965, 988)

Lit/Hist/Phil/STS: One 300+ level course in lit, hist or philosophy or STS approved 300-level Rutgers Course with prefix 350 (English Literature), 352 (American Literature), 510 (History), 512 (American History) or 730 (Philosophy).

Basic Social Sciences GUR: Six (6) credits in basic (100 and 200 level) Social Sciences (ECON 201, ECON 265, ECON 266, EPS 202, STS 258 or any of the following Rutgers-Newark courses: R070:203 or 204, R790:201 or 202, R830:101 or 102, R920:201 or 202, R202:201. Students may take R220:101 or 102 instead of ECON265 or 266.)

Natural Science GUR: At least seven (7) credits in natural sciences, including a laboratory experience. Courses may be selected from Biology Courses(R120:101, R120:102, R120:109, R120:110, R120:205, R120:206, R120:207, R120:208, R120:237, R120:241, R120:242) Chemistry Courses (CHEM 122, CHEM 123, CHEM 124, CHEM 125, CHEM 126), Physics Courses (PHYS 102, PHYS 102A, PHYS 103, PHYS 103A, PHYS 106, PHYS 106A, PHYS 111, PHYS 111A, PHYS 121, PHYS 121A, PHYS 202, PHYS 202A, PHYS 203, PHYS 203A), Geology Courses (R460:101, R460:103, R460:104, R460:206, R460:207).

The minimum credit requirement for graduation is the successful completion of 133 credits of prescribed courses within the curriculum and the maintenance of a 2.0 average GPA. Students are required to maintain an annual cumulative studio average of 2.0 to advance in studio each successive year.

Basic Social Sciences GUR: six (6) credits in basic (100 and 200 level) Social Sciences (SS 201, Econ 265, Econ 266, EPS 202, STS 258 or any of the following Rutgers-Newark courses: R070:203, or 204, R790:201 or 202, R830:101 or 102, R920:201 or 202, R202:201. Students may take R220:101 or 102 instead of Econ 265 or 266).

Cultural History GUR: The Cultural History courses are the Pre-Modern World (HUM 211), The Making of the Modern World (HUM 212, and the Twentieth-Century World (Hist 213). Students may also take approved introductory courses at Rutgers-Newark.

Lit/Hist/Phil/STS: One 300+ level course in lit, hist or philosophy or STS approved 300-level Rutgers course with prefix 350 (English Literature), 352 (American Literature), 510 (History), 512 (American History) or 730 (Philosophy).

Natural Sciences GUR: At least seven (7) credits in natural sciences, including a laboratory experience. Courses may be selected from Biology Courses (R120:101, R120:102, R120:109, R120:110, R120:205, R120:206, R120:207, R120:208, R120:237, R120:241, R120:242), Chemistry Courses (Chem 122, Chem 123, Chem 124, Chem 125, Chem 126), Physics Courses (Phys 102, Phys 102A, Phys 103, Phys 103A, Phys 106, Phys 106A, Phys 111, Phys 111A, Phys 121, Phys 121A, Phys 202, Phys 202A, Phys 203, Phys 203A), Geology Courses (R460:101, R460:103, R460:104, R460:206, R460:207).

Open Elect in HUM/SS: One 300+ level course in English, social science, theater, literature, history, philosophy or STS or any 300-level Rutgers-Newark courses in humanities, social sciences, fine arts, or performing arts. (prefixes 070, 080, 081, 202, 220, 350, 352, 370,� 420, 510, 560, 570, 700, 701, 790, 810, 861, 920, 940, 965, 988).

Catalog and curricula information approved by the relevant academic department.

History

Administered By: Federated History Department of Rutgers-Newark and NJIT [http://history.njit.edu/]

Administration

NJIT Chairperson	Richard B. Sher
Rutgers-Newark acting Chair	Karen Caplan
Director, Graduate Programs	Karen Caplan
NJIT Graduate Coordinator	Neil M. Maher
Rutgers-Newark Undergraduate Advisor	Eva Giloi

Faculty

Distingushed Professors	Richard B. Sher
History Advisor	Richard B. Sher, Maureen O'Rourke
Professors	Karl W. Schweizer
Associate Professor	Neil M. Maher, Norman Tobias
Assistant Professors	Alison Lefkovitz
Senior University Lecturer	Lisa Nocks
University Lecturer	Kyle Riismandel
Adjunct Faculty	Scott L. Kent, Joyce Mullan, Mary Catherine Moran
Emeritus Faculty	John E. O'Connor, Doris H. Sher

Rutgers-Newark Faculty

Board of Governors Distinguished Service Professor	Clement Price
Professors	Susan L. Carruthers, Steven J. Diner, James Goodman, Jan Ellen Lewis, Said S. Samatar, Beryl E. Satter, Marc S. Weiner, Odoric Y. K. Wou
Associate Professors	Karen Kaplan, Jon Cowans, Gary D. Farney, Ruth Feldstein, Eva Giloi
Assistant Professors	Kornel Chang, Mark Krasovic, Amita Satyal, Timothy Stewart-Winter, Whitney Strub, Nukhet Varlik
Adjunct Faculty	Elizabeth Aaron, Danielle Bradley, Andrew Daily, Courtney Doucette, Leigh-Anne Francis, Matthew Friedman, Stuart Gold, Jose Gomez-Rivera, Susan Helft, Lacey Hunter, Benjamin Hutchins, Rebecca Lubot, Thomas McCabe, Abigail Mellen, Christopher Mitchell, Raymond Ojserkis, Sonia Robles
Emeritus Faculty	Norma Basch, Norman Dain, Peter B. Golden, David H. Hosford, Taras Hunczak, Warren F. Kimball, Jonathan Lurie, Irwin L. Merker, John W. Osborne, Elliot Rosen, Frederick H. Russell, Gabor P. Vermes, Olga J. Wagenheim, Odoric Y. Wou

The B.A. in History is offered jointly by the Federated History Department of Rutgers and NJIT and draws on faculty and courses from both universities. The major in history gives students a broad grasp of world history and the cultural backgrounds of many segments of contemporary society. Students learn methods of historical research and exposition that may be applied not only by the professional historian but also by those interested in pursuing careers in government, education, law, the media, business, and other fields. Although not required, proficiency in at least one foreign language is recommended, especially for students who are considering graduate study in history.

Major Requirements

The major requires 39 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). Each program is subject to approval by an advisor or by the chairperson of the department. Specific requirements are as follows:

1. 6 credits in introductory western civilization: R510:201 and R510:202. (Students who transfer into the history major after fulfilling the GUR in cultural history with different courses may, at the discretion of their advisor, substitute other courses for R510:201 and R510:202).
2. 6 credits in any U.S. history courses (any level).
3. 6 credits in any Asian, African, Latin American, World, or Comparative history courses (any level).
4. 6 credits in the two-semester Senior History Seminar (R510:489/Hist 489 and R510:490/Hist 490). Qualified juniors may enroll in R510:489 with permission.
5. 15 additional credits in history, at least 12 of which must be taken at the 300 or 400 level.

Students considering the history major are encouraged to contact the NJIT Chair of the Federated History Department to discuss their interests and career options.

Preparing for a Career as a Social Studies Teacher

History majors at NJIT are eligible to apply for admission to the teacher certification program in social studies offered by the Department of Urban Education at Rutgers-Newark. Students accepted into this program use "free elective" slots in their curriculum to take appropriate courses in education, as listed in the Rutgers-Newark undergraduate catalog. Upon satisfactory completion of the program, they are qualified to apply for state certification in social studies.

Double Majors

Students may earn a second major in addition to the history major. Two of the most popular double majors with the history major are the communication major, and the science, technology and society major. Completion of these double majors is often feasible within four years of full-time study. For general rules about double majors, see Degree Options in the Academic Policies and Procedures section of this catalog. http://catalog.njit.edu/undergraduate/frontmatter/academicpoliciesproc.php

Accelerated Professional Programs

Accelerated programs in medicine, dentistry, optometry, physical therapy, and law are available to History majors enrolled in the Albert Dorman Honors College. In all these programs, students are awarded the B.A. in History form NJIT after successfully completing their first year of coursework in a professional school.

- Six-Year History B.A./JD with Seton Hall School of Law
- Seven-Year History B.A. and Professional Degree in Medicine (MD), Dentistry (DMD or DDS), or Optometry (OD) with UMDNJ and other universities
- Six-Year History B.A./DPT (Doctor of Physical Therapy) with UMDNJ

B.A. in History (123 credits minimum)

FIRST YEAR:

1st semester: (16 credits)

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.*

		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)
		Math 101	Foundations of Mathematics for the Liberal Arts (3-0-3)
		CS 100	Roadmap to Computing (3-0-3)
		Elective	(Natural Sciences:GUR) (3-1-4)
		R510:201	History of Western Civilization I (3-0-3)

2nd semester: (15 credits)

		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Math 105	Elementary Probability and Statistics (3-0-3)
		Elective	(Social Sciences:GUR) (3-0-3)
		Elective	(Natural Sciences:GUR) (3-0-3)
		R510:202	History of Western Civilization II (3-0-3)

SECOND YEAR:

1st semester: (16 credits)

		Elective	(American or Global/Comparative History) (3-0-3)
		Elective	(Social Sciences:GUR) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)
		PE	(Physical Education:GUR) (0-1-1)

2nd semester: (16 credits)

		Elective	(Social Science or STS) (3-0-3)
		Elective	(American or Global/Comparative History) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Physical Education:GUR) (0-1-1)

THIRD YEAR:

1st semester: (15 credits)

		Mgmt 390	Principles of Management (3-0-3)
		Elective	(American or Global/Comparative History) (3-0-3)
		Elective	(History) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)

2nd semester: (15 credits)

		Elective	(Global/Compartive History) (3-0-3)
		Elective	(History Upper Level) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)

Fourth Year:

1st semester: (15 credits)

	**		

{		R510:489	Senior Seminar: Readings (3-0-3) ***or***
		Hist 489	Seminar-Readings (3-0-3)
		HSS	(Senior Seminar GUR:3-0-3)
		Elective	(History Upper Level) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)

2nd semester: (15 credits)

{	**	R510:490	Senior Seminar: Research (3-0-3) ***or***
		Hist 490	Seminar Research (3-0-3)
		Elective	(History Upper Level) (3-0-3)
		Elective	(History Upper Level) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)

Electives

American History (6 credits): Students select two American history courses, at any level.

Global/Comparative History (6 credits): Students select two courses in Asian, African, Latin American, World, or Comparative history, at any level.

History (15 credits): Students select five courses in history, at least four of which must be at the 300 or 400 level.

Free (45 credits): Students select appropriate electives in consultation with a history major advisor.

Natural Sciences GUR (7 credits): Coursework totaling 7 credits in any of the following disciplines: biology, botany, chemistry, geology, and physics. Students may take a sequence of courses in one of these disciplines or courses in different disciplines. Laboratory credit must be included in the 7 credits.

Physical Education GUR (2 credits): Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course.

Senior Seminar GUR (3 credits): Three (3) credits in a 400-level senior seminar in the humanities and social sciences (HSS 401, HSS 402, HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408). HSS 404 may be counted as a history elective.

Social Sciences GUR (6 credits): At least 6 credits in basic (100-and 200-level social sciences). History majors are encouraged to fulfill this requirement with a two-semester sequence in a single social science, such as, anthropology (R070:203 and R070:204), political science (R790:201 and R790:202), psychology (R830:101 and R830:102), and sociology (R920:201 and R920:202).

Social Science or STS (3 credits): Any course in anthropology, criminal justice, economics, geography, political science, psychology, sociology, STS, or EPS 202.

** 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.

6-Year Accelerated B. A. in History/JD Curriculum (Honors Program with Seton Hall School of Law)

(123 credits: 105 at NJIT and 18 in the first year at Seton Hall School of Law)

The accelerated pre-law curriculum in History differs from the standard curriculum in the following ways:

1. Students complete a total of 105 credits at NJIT instead of 123. The remaining 18 credits of coursework for the B.A. are taken during the first year of law school.

2. Students complete all NJIT course requirements (105 credits) in their three years at NJIT. Twelve of these 105 credits are taken during the first two summers at NJIT or by taking 3 extra credits during particular semesters.

3. Students complete the minor in Legal Studies (15 credits). Courses that are counted for the minor cannot also be counted for the major.

4. Students take 9 credits of free electives instead of 42.

5. Students fulfill all the requirements of the Albert Dorman Honors College.

7-Year Accelerated Programs in History (B. A.) and Medicine (MD)/Dentistry (DMD or DDS)/ or Optometry (OD) (110 credits at NJIT)

FIRST YEAR:

1st Semester: (17 credits)

		R510:201	History of Western Civilization I (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 111	Calculus I (4-1-4)
		Chem 125	General Chemistry I (3-0-3)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (18 credits)

		R510:202	History of Western Civilization II (3-0-3)
		Math 105	Elementary Probability and Statistics (3-0-3)
		Elective	(Social Sciences:GUR) (3-0-3)
		Chem 126	General Chemistry II (3-0-3)
		Chem 124	General Chemistry Laboratory (0-2-1)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		PE	(Physical Education:GUR) (0-1-1)

Summer I: (8 credits)

		Biol 200	Concepts in Biology (4-0-4)
		R120:102	General Biology II (3-3-4)

SECOND YEAR:

1st Semester: (17 credits)

		Elective	(American History) (3-0-3)
		Elective	(History) (3-0-3)
		Biol 206	Foundations of Biology: Ecology and Evolution Lab (0-3-1)
		Biol 206	Foundations of Biology: Ecology and Evolution Lab (0-3-1)
		BNFO 135	Programming for Bioinformatics (3-0-3)
		Chem 243	Organic Chemistry I (3-0-3)
		PE	(Physical Education:GUR) (0-1-1)

2nd Semester: (17 credits)

		History Elective	(History of Medicine/Health) (3-0-3)
		History Elective	(Global/Comparative History) (3-0-3)
		History Elective	(American History) (3-0-3)
		Social Science Elective	(Social Sciences:GUR) (3-0-3)
		Chem 244	Organic Chemistry II (3-0-3)
		Chem 244A	Organic Chemistry II Laboratory (0-4-2)

Summer II: (3 credits)

		Elective	(Internship or Independent Study in Medicine or History of Medicine/Health) (3-0-3)

THIRD YEAR:

1st Semester: (15 credits)

{		R510:489	Senior Seminar: Readings (3-0-3) ***or***
		Hist 489	Seminar-Readings (3-0-3)
		History Elective	(Upper Level History Elective) (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)
		History Elective	(History of Medicine/Health) (3-0-3)
		HSS 404	(Senior Seminar Honor Section) (3-0-3)

2nd Semester: (15 credits)

{		R510:490	Senior Seminar: Research (3-0-3) ***or***
		Hist 490	Seminar Research (3-0-3)
		History Elective	(Global/Comparative History) (3-0-3)
		History Elective	(Upper Level History) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)

Electives

American History (9 credits): Students select two courses in American History, at any level.

Global/Comparative History (6 credits): Students select two courses in Asian, African, Latin American, World, or Comparative History, at any level.

History (6 credits): Students select three courses in History (9 credits), at least two of which must be at the 400 level or honors courses. HSS 404 may count toward this requirement if the seminar is in History.

History of Medicine/Health (6 credits): Students select two courses from among Hist 379: History of Medicine, Hist 380: History of Public Health, and Hist 381: Germs, Genes & the Body: Science and Technology in Modern Medicine. At least one of these courses must be taken in an honors section.

Internship or Independent Study in Medicine or History of Medicine/Health (3 credits): Students elect an independent research experience in consultation with their advisor.

Free (6 credits): Students select appropriate electives in consultation with the history major advisor.

Physical Education GUR (2 credits): Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course.

Social Sciences GUR (6 credits): At least 6 credits in basic (100-and 200-level) Social Sciences. History majors are encouraged to fulfill this requirement with a two-semester sequence in a single social science, such as, anthropology (R070:203 and R070:204), political science (R790:201 and R790:202), psychology (R830:101 and R830:102), and sociology (R920:201 and R920:202).

All students in this program are expected to write an honors-level research paper that incorporates methods of historiography and research learned in the seminar.

6-Year Accelerated Program in History (B.A.) and Physical Therapy (DPT) with UMDNJ (111 credits at NJIT)

Students in this program follow the curriculum for the 7-Year Accelerated Programs in History (B.A.) and Medicine (MD)/Dentistry (DMD or DDS) or Optometry (OD), with the following differences:

1. Students take R120:241, 242 Anatomy and Physiology (4 credits each) in place of R120:301 and one free elective.

2. Students take R830:101 Principles of Psychology (3 credits) in partial fulfillment of the Social Sciences GUR. R830:102 Principles of Psychology (3 credits) is also recommended for the second Social Sciences GUR course.

Human-Computer Interaction

Administered By: Information Systems College of Computing Sciences, Guttenberg Information Technologies Center, Room 5500. For more details, please visit the IS web page at http://is.njit.edu

Administration

Interim Dean, College of Computing Sciences	James Geller
Associate Dean, College of Computing Sciences	Barry Cohen
Assistant to the Dean, College of Computing Sciences	Serena Branson
Chair, Information Systems Department	Yi-fang Wu
Assistant to the Chair, Information Systems	Michelle D. Craddock-Bouler
Director of Undergraduate HCI Program	Quentin Jones
Director of Undergraduate IS Programs	Lin Lin
Director of Master's Programs	Michael P. Bieber
Director of Emergency Management & Business Continuity	Michael J. Chumer
Director of PhD Program	Michael P. Bieber
Secretary	Patricia B. Lundberg

Faculty

Professors Emeriti	S R. Hiltz, Marilyn Tremaine, Murray Turoff
Professors	Michael P. Bieber, Fadi Deek
Associate Professors	Quentin Jones, Michael L. Recce, Julian M. Scher, Yi-fang Wu
Assistant Professors	Lian Duan, Songhua Xu
Senior University Lecturers	Richard W. Egan, Lin Lin, Keith A. Williams

Advisors

Advisor B.A./ B.S.	Amanda D. Ackerman, George W. Olsen, Casey L. Hennessey
Advisor M.S.	George W. Olsen
Advisor Ph.D.	Michael P. Bieber

Human-computer interaction (HCI) combines disciplines within the fields of computing and information sciences (information systems, software engineering, artificial intelligence) and the behavioral sciences (cognitive science, cognitive psychology, sociology, organizational psychology, and social psychology) to study the design, implementation, and evaluation of interactive computer-based technology. The main purpose of this field is to solve real problems in the design and human use of technology. Examples of HCI products include Smart Phones, wearable computers, and highly interactive Web applications.

The Bachelor of Science in Human Computer Interaction, a joint degree program with Rutgers-Newark, provides the student with the necessary background to conduct design activities including: eliciting from the client, formulating, and articulating functional specifications; knowing how human factors and cognitive models influence design; knowing the principles of, and having experience with, communication design; understanding how implementation constraints influence design; and incorporating evaluation results into iterated designs.

Students implement their design knowledge by using their analysis and programming skills and demonstrating their computational literacy, such as knowledge sufficient for effective communication and decision making about interface construction tools and languages, multimedia authoring tools, data structures and algorithms and systems development. They also become proficient in evaluation activities, including experimental design, survey methods, usability testing and statistical analysis.

B.S. in Human-Computer Interaction (129 credits)

FIRST YEAR:

1st Semester: (17 credits)

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.

	CS 100	Roadmap to Computing (3-0-3)
	HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
	Math 138	General Calculus I (3-0-3)
*	Elective	(Science with Lab) (4-1-4)
	IS 117	Introduction to Website Development (3-0-3)
	CS 107	Computing as a Career (1-0-1)

2nd Semester: (16 credits)

	R830:101	Principles of Psychology I (3) ***or***
	STS 210	General Psychology (3-0-3)
	HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
	Math 105	Elementary Probability and Statistics (3-0-3)
	PE	(Physical Education) (0-1-1)
*	Elective	(Science with lab) (3-1-4)
	CS 113	Introduction to Computer Science (3-0-3)

SECOND YEAR:

1st Semester: (16 credits)

	R830:102	(Principles of Psychology II) (3-0-3)
	IS 350	Computers, Society and Ethics (3-0-3)
	IS 247	Designing the User Experience (3-0-3)
	HUM 211	The Pre-Modern World (3-0-3) ***or***
	HUM 212	The Modern World (3-0-3) ***or***
	Hist 213	The Twentieth-Century World (3-0-3)
	Elective	(General Elective) (3-0-3)
	PE	(Physical Education) (0-1-1)

2nd Semester: (17 credits)

	R830:304	(Cognitive Processes) (3-0-3)
	Eng 340	Oral Presentations (3-0-3) ***or***
	Eng 352	Technical Writing (3-0-3)
	Elective	(HCI Specialization) (3-0-3)
	AD 150	Color and Composition (2-3-3) ***or***
	R830:102	***or***

	R830:103	***or***
	R830:121	
	R830:301	Empirical Methods in Psychology (4,4)
	CS 207	Computing and Effective Communication (1-0-1)

THIRD YEAR:

1st Semester: (15 credits)

	IE 355	Human Factors (3-0-3) ***or***
	AD 201	Human Factors/Ergonomics (3-0-3)
	IS 331	Database Design Management and Applications (3-0-3)
	IS 322	Mobile Applications: Design, Interface, Implementation (3-0-3)
	R830:372	Perception (3)
	IS 390	Requirements Analysis and Systems Design (3-0-3)

2nd Semester: (16 credits)

	IS 375	Evaluating the User Experience (3-0-3)
	Elective	(HCI Specialization) (3-0-3)
	IE 492	Engineering Management (3-0-3)
	Elective	(Elective) (3-0-3)
	R830:302	Experimental Methods for the Cognitive and Behavioral Sciences (4)

FOURTH YEAR:

1st Semester: (16 credits)

	IS 448	Design Studio for Ubiquitous Computing (3-0-3)
	Elective	(Elective) (3-0-3)
	Elective	(Elective) (3-0-3)
	Elective	(HCI Specialization) (3-0-3)
	Elective	(Upper Elective Lit/Hist/Phil/STS) (3-0-3)
	CS 407	Professional Development in Computing (1-0-1)

2nd Semester: (15 credits)

	IS 333	Social Networking: Application and Interface Design (3-0-3)
	IS 491	Senior Project (3-0-3)
	Elective	(HSS Capstone Seminar) (3-0-3)
	Elective	(Elective) (3-0-3)
	Elective	(HCI Specialization) (3-0-3)

HCI Specializations:

Students choose, with Advisor approval, a coherent sequence of four courses, focusing on a discipline and/or subject area relevant to HCI methodologies, and /or the design of computing applications from an HCI perspective, and chosen from one of the HCI specializations given below. The specialization courses must form a coherent unit, should be chosen from a set of courses complementary to the Information Systems and Psychology courses required for this major, and must be approved by the department. A list of possible courses is available from the Department Advisor.

Learning Systems: Studies of human learning and the systems and technology to support learning and educational processes.

Human Systems: Studies of groups and organizations and their use of information and computer applications.

Publishing and Multimedia: Further studies of the technology involving the production of material in multimedia forms and specialized areas such as graphics and data visualization.

Communications, Networks, and the Web: Further studies of the technology involving the nature of applications in communication environments and the relationship of design to groups, communities, and organizations.

Tailored: Any possible area of computer application of particular interest to the student. This is also for students with graduate school objectives in a specific field. This choice must be developed with the approval of the Department HCI advisor. Below are presented some exemplary tailored specializations:

Cognitive Psychology: Four courses from R830:335 (Social Psychology), R830:327 (Cognitive Development), R830:354 (Adulthood and Aging), R830:330 (Psychology of Learning), R830:405 (Psychology of Emotion), R830:417 (Theories of Interpersonal Conflict).

Game Design and Production: Four courses from AD 275 (History of Games), Arch 434 (Simulated Environments), IT 201 (Information Design Techniques), IT 265 (Game Development), IT 286 (Foundations of Game Production), COM 335 (3D Modeling and Animation), COM 345 (Character Modeling and Animation), COM 350 (Digital Video Production), COM 376 (Game Design Studio).

Graphical Arts Design: Four courses from Arch 155 (Modes of Design Communication I), Arch 156 (Modes of Design Communication II), AD 112 (Communication in Art & Design-Digital Media), AD 150 (Color and Composition), R081:101 (Artmaking-Design Fundamentals I), R081:102 (Artmaking-Design Fundamentals II), R080:121 (Introduction to Drawing Fundamentals I, R080:245 (Introduction to Computer Art), R080:351 (Interactive Design I), R080:354 (Interactive Design II, R080:231 (Graphic Design I), R080:232 (Graphic Design II), R080:331 (Graphic Design III), R080:332 (Graphic Design IV). (Note that AD 112 or the Rutgers course R080:121, if used to fulfill the required Art/Design/Drawing requirement, may not then also be used to fulfill a course requirement in the Graphical Arts Design HCI Specialization.)

Web & Multimedia Design: Four courses from IS 421 (Rich Internet Applications), Com 350 (Digital Video Production), ENG 353 (Electronic Publishing), ENG 354 (Advanced Electronic Publishing), COM 390 (Electronic Writing Workshop), STS 347 (Music and Technology), STS 349 (Advanced Music Technology).

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* Science: A two-course related sequence (8 credit minimum) of laboratory science in physics, chemistry, biology, or as approved by advisor. These courses fulfill the Natural Sciences GUR.

Catalog and curricula information approved by the relevant academic department.

Industrial Design

Administered By: College of Architecture and Design

Administration

Dean	Urs P. Gauchat
Associate Dean for Administration	Margaret Fitzpatrick
Associate Dean for Academics	John M. Cays
Director, School of Art + Design	Glenn Goldman

Faculty

Advisor

Undergraduate Advisor	Sasha N. Corchado

Industrial designers create many of the objects and products we all use today that make our lives better - they make a difference. From Apple's iPod to chairs to the toys many of us played with as children, industrial designers combine skills from art and engineering as they travel the road from idea conception to production, packaging, and selling. They are concerned with user needs as well as the structural, malleable, and sustainable properties of materials. Creativity and environmental impacts; products and users; manufacturing and marketing - all of these fascinating issues are found and dealt with in the day-to-day professional lives of industrial designers.

As part of a comprehensive university with a variety of design disciplines, industrial design students at NJIT find themselves in an environment where they will interact with students of architecture, interior design, digital design, and fine art. The industrial design program is a four-year program leading to the Bachelor of Science degree. A studio-centric curriculum follows an initial foundation year during which students take courses in color theory and composition, graphic communication with both digital and traditional media, and art history - as well as a variety of general university requirements. Industrial design students will find themselves immersed in a design environment with a digital focus at the School of Art + Design. Students will be given opportunities to interact with digital fabrication equipment as they study the process and production aspect of a project from design to implementation. Students will take courses that range from "Human Factors/Ergonomics" to "Modeling and Prototyping" to Ethnographic and marketing Research" in addition to a rigorous design studio sequence.

Students who graduate with a Bachelor of Science in Industrial Design may find themselves working as independent artists or consultants, or as part of a large design team on long-term projects. They may also find themselves involved in public policy or education or transportation. While students with undergraduate preparation may enter the workforce, they may also continue their education in graduate school in industrial design, fine art or interior design, or in architecture pursuing the first professional degree at the Masters level.

Credit distribution for the Bachelor of Science in Industrial Design:

Required Industrial Design Credits	72
Specialization	3

Design Electives	9
Free Electives	9
General University Requirements	46
Total Minimum Credits	134

The curriculum as described below is for students entering NJIT as freshman in the Fall of 2008 or after that date. Students entering before that date may have a different program and should consult the school to learn which curriculum applies.

Bachelor of Science in Industrial Design (136 credits)

FOUNDATION YEAR

FIRST YEAR

1st Semester:

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.

		AD 150	Color and Composition (2-3-3)
		AD 161	History of Art and Design I (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 115	Elements of Geometry (3-0-3)
		CS 104	Computer Programming and Graphics Problems (3-0-3)
		PE	(Physical Education:GUR) (0-1-1)
		Math 120	Basic Concepts in Statistics (1-0-1)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

		AD 111	Communication in Art and Design - Traditional Media (1-5-3)
		AD 112	Communication in Art and Design - Digital Media (1-5-3)
		AD 162	History of Art and Design II (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Math 113	Finite Mathematics and Calculus I (3-0-3)
		STS 201	Understanding Technological Society (3-0-3)
{		STS 257	Technology, Society and Culture: An American View (3-0-3) ***or***
		STS 258	Technology, Society and Culture: A Global View (3-0-3)
		EPS 202	Society, Technology, and the Environment (3-0-3)

SECOND YEAR

1st Semester:

		ID 263	Industrial Design Studio I (0-8-4)
		ID 203	Past, Present and Future of Design (3-0-3)

	ID 216	Modeling and Prototyping (3-0-3)
{	HUM 211	The Pre-Modern World (3-0-3) ***or***
	HUM 212	The Modern World (3-0-3) ***or***
	Hist 213	The Twentieth-Century World (3-0-3)
	STS 210	General Psychology (3-0-3)
	Phys 102	General Physics (3-0-3)
	Phys 102A	General Physics Laboratory (0-2-1)
	PE XXX	(Physical Education:GUR) (0-1-1)

2nd Semester:

	ID 264	Industrial Design Studio II (0-8-4)
	ID 201	Human Factors/Ergonomics (3-0-3)
	ID 217	Modeling and Manufacturing (3-0-3)
{	STS 210	General Psychology (3-0-3) ***or***
	R830:101	Principles of Psychology I (3)
	Elective	(Bio/Chem/Phys:GUR) (3-0-3)
	PE	(Physical Education) (0-1-1)

THIRD YEAR

1st Semester:

	ID 363	Industrial Design Studio III (0-8-4)
	ID 340	Materials and Processes (3-0-3)
	ID 310	Ethnographic and Marketing Research (3-0-3)
	Mgmt 390	Principles of Management (3-0-3)
	Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)

2nd semester:

	ID 364	Industrial Design Studio IV (1-12-5)
	ID 341	Sustainable Materials and Processes (3-0-3)
	ID 301	Industrial Design Specialization (3-0-3)
	ID 312	Mechanics and Electronics (3-0-3)
	Elective	(Eng/Lit/Hist/Phil/STS/SS/Thr:GUR) (3-0-3)

FOURTH YEAR

1st Semester:

	AD 463	Collaborative Design Studio (1-12-5)
	ID 410	Professional Practice and Ethics (3-0-3)
	Elective	(Design Elective: ID/DD/FA/INT XXX) (3-0-3)
	Elective	(Free Elective) (3-0-3)
	Elective	(Free Elective) (3-0-3)

2nd Semester:

	ID 464	Industrial Design Studio V (1-12-5)
	Elective	(Design Elective: ID/DD/FA/Int XXX Design Elective) (3-0-3)
	Elective	(Design Elective: ID/DD/FA/INT XXX Design Elective) (3-0-3)
	Elective	(Humanities Capstone:GUR) (3-0-3)
	Elective	(Free Elective) (3-0-3)

The minimum credit requirement for graduation is the successful completion of 134 credits of prescribed courses within the curriculum and the maintenance of a 2.0 average. Students are required to maintain a 2.0 cumulative studio average to advance to each succeeding year.

Basic Social Sciences GUR: Six (6) credits in basic (100 and 200 level) Social Sciences (Econ 201, Econ 265, Econ 266, EPS 202, STS 258, or any of the following Rutgers-Newark courses: R070:203 or 204, R790:201 or 202, R830:101 or 102, R920:201 or 202, R202:201. Students may take R220:101 or 102 instead of Econ 265 or 266).

Cultural History GUR: The Cultural History courses are the Pre-Modern World (Hum 211), The making of the Modern World (Hum 212), and the Twentieth Century World (Hist 213). Students may also take approved introductory courses at Rutgers-Newark.

Lit/Hist/Phil/STS: One 300+ level course in literature, history or philosophy or STS approved 300-level Rutgers course with prefix 350 (English Literature), 352 (American Literature), 510 (History), 512 (American History) or 730 (Philosophy).

Natural Science GUR: At least seven (7) credits in natural sciences, including a laboratory experience. Courses may be selected from Biology Courses (R120:101, R120:109, R120:110, R120:205, R120:206, R120:207, R120:208, R120:237, R120:241, R120:242), Chemistry Courses (Chem 122, Chem 123, Chem 124, Chem 125, Chem 126), Physics Courses (Phys 102, Phys 102A, Phys103, Phys 103A, Phys 106, Phys 106A, Phys 111, Phys 111A, Phys 121, Phys 121A, Phys 202, Phys 202A, Phys 203, Phys 203A), Geology Courses (R460:101, R460:103, R460:104, R460:206, R460:207).

Open Elective in Hum/SS: One 300+ level course in English, social science, theater, literature, history, philosophy or STS or any 300-level Rutgers-Newark courses in humanities, social sciences, fine arts, or performing arts. (prefixes 070, 080, 081, 202, 220, 350, 352, 370, 420, 510, 560, 570, 700, 701, 790, 810, 861, 920, 940, 964, 988).

Accounting: Offered by the School of Management. See Management course list for faculty.

UNDERGRADUATE COURSES:

Acct 115 - Fundamentals of Financial Accounting (3-0-3)
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. **Effective From: Fall 2010**

Acct 116 - Principles of Accounting II (3-0-3)
Prerequisite: Acct 115. A continuation of Acct 115. Valuation, depreciation, costing methods, overhead accumulations, and distribution. Emphasis given to standard costs, cost estimating and budgets. **Effective Until: Spring 2010**

Acct 117 - Survey of Accounting (3-0-3)
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. **Effective From: Spring 2011**

Acct 215 - Managerial Accounting I (3-0-3)
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. **Effective From: Fall 2010**

Acct 315 - Accounting for Managerial Decision Making (3-0-3)
This course wil concentrate on management decisions and the contribution of accounting toward making these decisions. Emphasis is upon using accounting information to solve business problems.

Acct 317 - Managerial Accounting (3-0-3)
Prerequisites: Acct 115, Acct 116. The techniques of evaluating labor, material and overhead costs. Rate of return, variance analysis, and break-even analysis. **Effective Until: Spring 2010**

Acct 325 - Intermediate Accounting I (3-0-3)
Prerequisites: Acct 115 or 117 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. **Effective From: Fall 2010**

Acct 335 - Managerial Accounting II (3-0-3)
Acct 335, Managerial Accounting II Prereq: 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. **Effective From: Fall 2010**

Acct 415 - Auditing (3-0-3)
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. **Effective From:**

Spring 2010

Acct 425 - Tax Accounting I (3-0-3)
Prerequisite: Acct 115 or Acct 117. 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. **Effective From: Fall 2010**

Acct 435 - Intermediate Accounting II (3-0-3)
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. **Effective From: Fall 2010**

GRADUATE COURSES:

Acct 515 - ManagerialAccounting (3 credits)
Case study approach to accounting issues that have an impact on management decision making: nature of managerial accounting, cost behavior, cost-volume-profit analysis, full costing and its use, standard costs, variances, differential cost analysis, and responsibility accounting.

Acct 610 - Internal Auditing Concepts and Procedures (3 credits)
The entire internal audit function including planning, surveying, audit performance, work paper documentation, reporting, standards, controls, sampling, and fraud detection.

Acct 615 - Management Accounting (3 credits)
Builds on traditional concepts of managerial accounting (break-even analysis, alternate choice decisions, profit planning, and transfer pricing) and develops the skills that an executive needs in strategic cost analysis. Explores strategic decisions of value chains and activity-based management. Emphasis on using managerial accounting data in executive planning and control.

Acct 630 - Concepts and Applications of Control (3 credits)
Examines the need for and implementation of internal controls to protect corporate assets. Emphasizes the role of the controller in the organization.

Acct 650 - Operational Auditing (3 credits)
Stresses the functions of the auditor in assessing the effectiveness and efficiency of operations. Includes such areas as environmental auditing, auditing the human resource management function, auditing OSHA, psychological impact on internal auditors, auditing in a just-in-time environment, ethics, and auditing for fraud. Financial areas are discussed only to the extent of their operational impact.

Acct 670 - Seminar in Accounting Theory (3 credits)
Focuses on contemporary areas relating to accounting theory. Taught from the viewpoint of the corporate controller.

Acct 680 - Seminar in Auditing (3 credits)
Discusses contemporary auditing topics as they impact on management control and decisions.

Acct 690 - Seminar in Taxation (3 credits)
Focuses on contemporary issues in taxation as they impact on the corporate decision making process.

AeroSpace Studies: AeroSpace Studies

UNDERGRADUATE COURSES:

AS 111 - Foundation of the US Air Force (1-1.5-1)
Explores the mission and organizational structure of the United States Air Force. Introduces the student to Reserve Officer Training Corps by examining air power, customs and courtesies, officership, and core values. Examines Air Force opportunities, benefits, career choices, and installations which provides information needed to determine whether or not to pursue a career as an Air Force officer. An introduction to effective communication is included. One hour of class, and, two hours of Leadership Laboratory per week (not required for those with Special Student status). **Effective From: Fall 2012**

AS 112 - The Air Force Today II (1-1.5-1)
Prerequisite: AS 111 or approval of the professor of aerospace studies. Continues with the mission and organizational structure of the Air Force. A macro view of U.S. military history is introduced with emphasis on U.S. air power. Air Force communications is developed with emphasis on interpersonal communications, oral communications, and written communications. Leadership abilities are developed through group leadership problems and Leadership Laboratory. One hour of class and two hours of Leadership Laboratory per week (not required for those with Special Student status). **Effective From: Fall 2005**

AS 221 - Evolution of USAF Air & Space Power (1-1.5-1)
Prerequisite: AS 112 or approval of the professor of aerospace studies. Examines the development of air power from its earliest beginnings to the present, including in-depth examination of World War I, World War II, Korean Conflict, Vietnam War, Cold War, and Desert Storm. Traces the evolution of air power concepts and doctrine and continues to develop leadership abilities through Leadership Laboratory. One hour of class and two hours of Leadership Laboratory per week (not required for those with Special Student status). **Effective From: Fall 2012**

AS 222 - Air Power Key To Deterence (1-1.5-1)
Prerequisite: AS 221 or approval of the professor of aerospace studies. Emphasizes the concepts and skills required by the Air Force officer including oral communications, Air Force quality, leadership, followership, ethics, and values. Continues to develop leadership abilities through group leadership problems and Leadership Laboratory. One hour of class and two hours of Leadership Laboratory per week (not required for those with Special Student status). **Effective From: Fall 2012**

AS 333 - Leadership and Management I (3-1.5-3)
Prerequisite: AS 222 or approval of the professor of aerospace studies. Emphasizes the concepts and skills required by the successful management and leader. Curriculum includes individual motivational and behavioral processes, leadership, communication, and group dynamics, providing the foundation for developing the junior officer's professional skills. Course material stresses decision making, and the use of analytic aids in planning, organizing, and controlling in a changing environment. Develops communication skills through writing and speaking exercises. Three hours of class and two hours of Leadership Laboratory per week. Note: AS 333 may be taken to satisfy the Management GUR. **Effective From: Fall 2005**

AS 334 - Leadership and Management II (3-1.5-3)
Prerequisite: AS 333 or approval of the professor of aerospace studies. A continuation of AS 333. Organizational and personal ethics, management of change, organizational power, politics, and managerial strategy are discussed within the context of the military. Actual Air Force case studies are used throughout the course. Three hours of class and two hours of Leadership Laboratory per week. **Effective From: Fall 2005**

AS 443 - National Security Affairs/Prep Act (3-1.5-3)
Prerequisite: AS 334 or approval of the professor of aerospace studies. Focusing on the U.S. Armed Forces as an integral element of American society, this course examines a wide variety of topics concerning American civil and military relations and the environment in which U.S. defense policy is formulated. Specific topics include the role of the professional officer in a democratic society, socialization processes within the American military forces, and the requisites for maintaining adequate national security forces. A special emphasis is placed on further refining the student's communications skills in the context of the course material. Three hours of class and one and one-half hours of Leadership Laboratory per week. **Effective From: Fall 2012**

AS 444 - Preparation for Active Duty (3-1.5-3)
Prerequisite: AS 443 or approval of the professor of aerospace studies. Focuses on the role of the Air Force officer while on active duty. Includes responsibilities as an officer, a commander, a leader, and a manager. Topics include a review of military law, nonjudicial punishment, role of the staff judge advocate, laws of armed conflict, military ethics, officer professional development, an officer's social responsibilities, fraternization, personal finances, staff work, and Air Force base services and activities. Concludes with a review of the Air Force Core Values. Three hours of class and two hours of Leadership Laboratory per week. **Effective From: Fall 2005**

Afro-American and African Studies : Offered by the Department of Afro-American and African Studies at Rutgers-Newark Conklin Hall (973/353-5428)

UNDERGRADUATE COURSES:

R014:301 - African Cultural Retentions in the Americas (3)
For more details go to Rutgers Catalog.

R014:302 - Special Topics in Black Studies (3)
For more details go to Rutgers Catalog.

R014:305 - Black Women in the United States (3)
For more details go to Rutgers Catalog.

R014:306 - Comparative Race Relations: South Africa and the United States (3)
For more details go to Rutgers Catalog.

R014:358 - Black Writers of Africa and the Caribbean (3)
For more details go to Rutgers Catalog.

R014:403 - The Third World and The Media (3)
For more details go to Rutgers Catalog.

R014:465 - African Religions and Philosophical Thought Systems (3)
For more details go to Rutgers Catalog.

Anthropology: Offered by the Department of Afro-American and African Studies at Rutgers-Newark Conklin Hall (973/353-5428)

UNDERGRADUATE COURSES:

R070:204 - Introduction to Cultural Anthropology (3)
For more details go to Rutgers Catalog.

R070:303 - Anthropology of Postcolonialism (3)
For more details go to Rutgers Catalog.

R070:309 - Medical Anthropology (3)
For more details go to Rutgers Catalog.

R070:310 - Comparative Religion (3)
For more details go to Rutgers Catalog.

R070:319 - Anthropology Through Film (3)
For more details go to Rutgers Catalog.

R070:331 - Urban Anthropology (3)
For more details go to Rutgers Catalog.

R070:337 - Anthropology of Inequality (3)
For more details go to Rutgers Catalog.

R070:340 - Comparative Roles of Women (3)
For more details go to Rutgers Catalog.

R070:369 - New World Archaeology (3)
For more details go to Rutgers Catalog.

R070:420 - Tribal Warfare (3)
For more details go to Rutgers Catalog.

Architecture: Offered by the College of Architecture and Design

UNDERGRADUATE COURSES:

Arch 155 - Modes of Design Communication I (2-3-3)
Techniques of graphic presentation introduced as a basic language of architecture. Students work with a broad range of graphic presentation methods. Skills developed in drawing and architectural delineation. Fundamentals of perspective drawing, rendering techniques and format layout examined through an array of projects.

Arch 156 - Modes of Design Communication II (2-4-3)
Prerequisite: Arch 155. This course deals with advanced knowledge and skill acquisition of the diverse categories of information delivery required by the design professionals. **Effective From: Spring 2007**

Arch 163 - Introduction to Design I (1-12-5)
Introduction to an array of basic principles and elements of design. Emphasis on design methods, sensitivity to context, manipulation of form and space, and representation skills. General design fundamentals presented in the lecture hour.

Arch 164 - Introduction to Design II (1-12-5)
Prerequisite: Arch 163. A continuation of Arch 163.

Arch 223 - Construction I (3-0-3)
This course is an introduction to construction processes, focusing on wood, steel, masonry, concrete materials and their related assemblies. **Effective From: Fall 2011**

Arch 225 - Building Systems I (0-3-3)
This course is an introductory survey of the general principles and application of Sustainable Design, Site Systems, Structural Systems, Environmental Systems, Envelope Systems, Materials and Assembly Systems. This course will primarily focus on low-rise wood and steel structures. **Effective From: Fall 2007 Until: Spring 2013**

Arch 227 - Environmental Control Systems I (3-0-3)
This course introduces passive environmental design emphasizing sun, wind, daylight, heat flow, insulation/mass, visual comfort, thermal comfort, shading, climate, natural ventilation. The course uses ecotect software for thermal analysis. **Effective From: Spring 2012**

Arch 229 - Structures I (3-0-3)
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. **Effective From: Spring 2012**

Arch 251 - History of Architecture I (3-0-3)
Prerequisite: Hum 101. Introduces architectural history, theory and design, providing a conceptual framework for looking at the built environment. This course introduces key architectural concepts beginning with the earliest examples of human occupation, the shaping of space, and the transformation of natural landscape. Its geographic scope is global and its chronological scope ranges from prehistory to the middle ages. **Effective From: Fall 2011**

Arch 252 - History of Architecture II (3-0-3)
Prerequisite: Arch 251. This survey of the social, political, technological, functional, and aesthetic concerns of architectue, urban forms, and built and natural landscapes is a continuation of Arch 251. It covers the period from the 15th century to 1900 in Europe, the Americas, the Middle East, and Asia. Among its emphases are the impact and significance of absolutism, colonialism, nationalism, humanism, the enlightenment, industrialization and modernity. **Effective From: Spring 2012**

Arch 263 - Architecture Studio I (1-12-5)
Prerequisite: Arch 164. Utilizing knowledge and skills gained in Introduction to Design I and II, students learn about architectural

design. Examination of the technological, social and environmental issues as they relate to architectural design. Lecture hour used to explore in-depth aspects of architecture.

Arch 264 - Architecture Studio II (1-12-5)
Prerequisite: Arch 263. A continuation of Arch 263. Lecture hour used to explore in-depth aspects of architectural design.

Arch 282 - Structural Principles (3-0-3)
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. **Effective From: Fall 2013**

Arch 283 - Special Topics (3)
Investigation of problem of special interest in architecture.

Arch 301 - Digital Modeling and Fabrication (3-0-3)
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. **Effective From: Fall 2010**

Arch 310 - Co-op Work Experience I (3)
Prerequisites: 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 (2-3-3)
Prerequisite: Arch 264. 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 316 - Computer Applications to Architecture (2-3-3)
Prerequisite: CIS 104. Introduces both philosophical and technical approaches to the use of the computer in architectural design and analysis. Explores the use of existing computer programs for spatial allocation, energy analysis, life cycle costing, problem analysis, and computer simulation. Projects include development of computer programs applicable to architecture.

Arch 317 - Advanced Architectural Graphics (2-3-3)
Prerequisite: Arch 155, Arch 264. Gives students advanced techniques for architectural expression, including Chinese ink wash and air brush techniques. Emphasis on how drawing may be used to reveal the inner qualities of design. A basic knowledge of drawing methods, media, materials, and projection techniques is assumed.

Arch 318 - New York City Lab (1-6-3)
Prerequisite: Arch 364. Explores the architectural and environmental development of New York City during the past 200 years in an organized series of field trips. Each week's trip encompasses a section and/or representative aspect of the city's evolution.

Arch 323 - Construction II (3-0-3)
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). **Effective From: Fall 2012**

Arch 327 - Environmental Control Systems II (3-0-3)
Prerequisite: Arch 227. This course focuses on active mechanical systems related to environmental controls including HVAC, plumbing, electrical and alternative energy systems. Additional areas covered include, elevators, electric lighting and acoustics. The course continues the use of ecotect software as an analytical tool.

Arch 328 - Urban Values (2-3-3)

Prerequisites: Arch 363. A survey of urban planning practice and historical, contemporary, and theoretical urban design approaches. Considers the physical environment as a response to human values, and explores how nature, the city, and the user influence the form and content. Case studies include cities, towns, and specialized recreation and retirement communities. Laboratory work includes field trips, demonstration exercises, and analysis of case studies.

Arch 329 - Structures II (3-0-3)
Prerequisite: Arch 229. This course examines lateral forces, foundations, stability, deflection, long spans and special case structural systems. Methodology involves advanced static structural analysis.

Arch 331 - Landscape Architecture (3-0-3)
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 (2-3-3)
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. **Effective From: Fall 2007**

Arch 333 - Architecture: Image and Word II (2-3-3)
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. **Effective From: Fall 2007**

Arch 334 - Color Theory/Electronic Color (3-0-3)
The multiple-media course includes lectures with supplemental readings, videos, in-class analysis and laboratory work, and homework requiring a variety of media including watercolor and computer graphics - all of which address a range of issues including interaction of color, psychology of color, design for color deficient vision, color mixing and color palettes, color reproduction, color models, color composition in art and architecture, and others. Digital applications are integrated throughout. **Effective From: Fall 2007**

Arch 335 - Digital Tectonics (3-0-3)
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. **Effective From: Fall 2007**

Arch 337 - Building Information Modeling (3-0-3)
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; the formal prerequisite course is Arch 316/647. **Effective From: Fall 2007**

Arch 363 - Architecture Studio III (1-12-5)
Prerequisite: Arch 264, Arch 223, Arch 227 and Arch 229. 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. **Effective From: Spring 2013**

Arch 364 - Architecture Studio IV (1-12-5)
Prerequisites: 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 (3-0-3)
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. **Effective From: Fall 2012**

Arch 382 - History of Architecture IV (3-0-3)
Prerequisite: Arch 381. 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. **Effective From: Spring 2013**

Arch 403 - The American Home and Household I (3-0-3)
Prerequisite: junior or senior standing. A cultural, architectural analysis of American homes and households throughout history. Included are the Puritan society and Colonial home, the Victorian home and family, the frontier homestead, 19th century utopian communes, immigrants, the working class poor and urban tenements, war housing, and suburban homes. Students explore the meaning, use and design of each domestic setting from the point of view of society, the family and the individual, considering differences based on race, sex and class.

Arch 404 - The American Home and Household II (3-0-3)
Prerequisite: junior or senior standing. Analyzes the architecture of 20th century American homes and households, hotels, apartment houses, war housing, suburban homes, public projects, collectives, communes, self-help housing, and housing concepts for the future. Psychological, sociological, and cultural perspectives are considered insofar as they affect the architecture of the home.

Arch 408 - Advanced Landscape Architecture (2-3-2)
Prerequisite: Arch 331. 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)
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 419 - Architectural Photography (2-3-3)
Prerequisite: Arch 364. Gives a wide range of photographic solutions for presentations and portfolios. Lectures consist of orientation on general topics, including light and space, using relevant text selections and slide presentations for reinforcement. Includes basic demonstrations of darkroom techniques and unorthodox methods to encourage experimentation.

Arch 422 - Mythical House (3-0-3)
Prerequisites: Arch 172, Arch 252, Arch 363. Shows that the house develops not only in response to reasoning, laws of physics, and biological needs, but also in response to magic, ritual, culture, personality, fantasy, and dreams.

Arch 423 - Construction III (3-0-3)
Prerequisite: Arch 323. This course focuses on non-normative systems, hybrid and integrated assemblies and new materials. An emphasis is placed on systems integration, materials selection, specifications and construction documents associated with the comprehensive design of buildings using Building Information Modeling (BIM)

Arch 429 - Structures III (3-0-3)
Prerequisite: Arch 329. This course focuses on wood systems analysis, steel systems analysis, indeterminate systems and integrated structural systems. Methodology involves finite member analysis.

Arch 431 - Advanced Representational Techniques (3-0-3)
This course is intended for upper level architecture students who have completed a number of academic or professional projects. Students must have a basic understanding of computer use. Topics covered will be critical analysis of content, organization of material, and translation of existing work. Instruction will be given in layout software packages such as Adobe Illustrator. Direction will also be given in web site design using Macromedia Flash in an architectural content. **Effective From: Spring 2008**

Arch 432 - P3 Post Presentation Processing (2-3-3)
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? **Effective From: Fall 2007**

Arch 433 - Cinematic Literacy for Architects & Urban Designers (3-0-3)
This course will use the digital video camera, digital compositing, and interactive DVD to introduce alternate means of communicating architectural ideas. The course will explore narrative techniques, linear and random-access sequencing and will cover critical analysis of film technique, storyboarding, and the authoring of short vignettes. The final project will be a digital image set on authored DVD expressing an architectural case study of a chosen building, site analysis, and/or urban issue. **Effective From: Fall 2007**

Arch 434 - Simulated Environments (3-0-3)
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. **Effective From: Fall 2007**

Arch 460 - Studio Abroad (1-12-5)
Prerequisite: Arch 364. Studio coursework taken fully or partially abroad with an emphasis on urban design and recognition of local conditions and situations. Lecture hour coordinates with studio subject matter. Course materials purchase required. **Effective From: Spring 2012**

Arch 463 - Option Studio 1 (1-12-5)
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. **Effective From: Fall 2011**

Arch 464 - Option Studio II (1-12-5)
Prerequisite: Arch 463. Studio methodology allows students to select from various building programs, the nature of design dealing with technology, environment and the social order. **Effective From: Fall 2007**

Arch 472 - Architectural Programming and Project Development (3-0-3)
Prerequisite: Arch 264. 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 483/483H - Special Topics (3)
Group investigation of problem of special interest in architecture.

Arch 491 - Independent Study (1)
null

Arch 492 - Independent Study (2)
null

Arch 493 - Independent Study (3)
null

Arch 525 - Building Systems VII (0-3-3)
Prerquisite: Arch 425. This is an advanced course that uses in-depth, detailed case studies of four to six well-designed buildings of various types, from small scale to large, from simple to complex, to illustrate the totality of building systems integration. **Effective From: Fall 2007 Until: Spring 2013**

Arch 530 - Methodologies of Architectural History, Theory and Criticism (3-0-3)
Prerequisites: Arch 382. A seminar examining the salient methodologies of architectural history, theory and criticism. Structured around a series of critical texts, with each set of core readings intended to provide a basis for analyzing and assessing the approach in question.

Arch 531A - History of Renaissance Architecture (3-0-3)
Prerequisites: Arch 382. An examination of the development of Renaissance architecture and urban design in Italy and elsewhere in Europe. The re-emergence of the classical tradition is considered within the context of social, political and economic developments as well as formal intentions.

Arch 531B - History of Baroque Architecture (3-0-3)
Prerequisites: Arch 382. An investigation of architectural development from the 17th and 18th centuries in Europe and Latin

America, including consideration of stylistic variations, social and political factors, and trends in garden and urban design.

Arch 531C - History of Modern Architecture (3-0-3)
Prerequisites: Arch 382. A study of major tendencies of architectural theory and practice from the mid-19th to the mid-20th centuries. Formal and stylistic transformation is considered in relation to theoretical intentions as well as social, cultural, and technical developments.

Arch 531D - History of American Architecture (3-0-3)
Prerequisites: Arch 382. An investigation of the guiding ideals and dominant stylistic trends in American architecture and planning from colonial times to the mid-20th century. Critical shifts in conception and scope of architectural production considered in relation to the prevailing cultural, socio-economic, and technical contexts out of which they evolved.

Arch 531E - History of Non-Western Architecture (3-0-3)
Prerequisites: Arch 382. An examination of major architectural traditions of China, Japan, Southeastern Asia, India, and the Middle East. Each area is considered with reference to a conceptual, iconographic and stylistic paradigm that evolved from a particular historical context.

Arch 531F - Thresholds of Architectural Theory (3-0-3)
Prerequisites: Arch 382. A seminar that investigates key thresholds of Western architectural theory, from Vitruvius to Robert Venturi, with emphasis on examining the corresponding critical theoretical texts and related didactic buildings and projects.

Arch 531H - Aspects of Urban Form (3-0-3)
Prerequisites: Arch 382. An examination of the major forms and patterns of urban development from classical antiquity to the 20th century, considered in relation to the changing conceptions of the city as well as cultural, socio-economic, and political development.

Arch 532 - Problems and Methods in Architectural Preservation (3-0-3)
Prerequisites: Arch 382. Theory and practice of preservation planning, with emphasis on current concepts, problems and techniques of area preservation in the United States. Exploration of the successive guiding ideals and _approaches to historic preservation in America, together with their European parallels and ante-edents. Discussion of theories of continuity and change in the urban environment and of planning concepts and techniques that further preservation planning objectives in relation to programs for community development and neighborhood conservation.

Arch 533 - Case Studies in Architectural Creativity (3-0-3)
Prerequisite: Arch 364. Considers creativity in architecture from psychological, philosophical and autobiographical perspectives. The buildings, writings and lives of contemporary architects are discussed in the context of general theories of creativity. Each student chooses an individual architect noted for creative accomplishments and prepares a case study of his or her life.

Arch 534 - History of Architectural Technology (3-0-3)
Prerequisites: Arch 382. Survey of the development of building methods and materials. Impact of structural and environmental technology on architectural form and the design process. The role of technology in contemporary architectural theory and practice, including the modern movement, is emphasized.

Arch 535 - History of Architectural Ideas (3-0-3)
Prerequisite: Arch 382. 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 (3-0-3)
Prerequisite: Arch 331. 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 - Advanced Structures (3-0-3)
Prerequisite: Arch 384. Covers advanced material in structures related to steel and wood design including: steel industrial buildings, rigid frames and earthquake design, wood structures under axial loads, and combined bending and axial loads.

Arch 538 - Sustainable Architecture (3-0-3)
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 cost benefit analysis of building systems, and adaptive reuse.

Arch 539 - Advanced Construction (3-0-3)
Pre-requisite: Arch 242. Explores the relationship between an architect's design intention and the construction document. Design

a small building or addition and complete construction drawings of the design. Addresses problems and procedures encountered by an architect during the construction documents phase. **Effective Until: Spring 2013**

Arch 540 - Acoustics (3-0-3)
Prerequisites: Arch 241, Arch 242, Arch 342. Architectural acoustics: how we hear, physics of sound and materials, aesthetics of design and the processes of construction. Audible sounds, their interaction, perception of echo and directional hearing are applied to interior and exterior building transmission, room acoustics, and setting acceptable acoustical environments.

Arch 543 - Lighting (2-2-3)
Prerequisites: Arch 386 and Arch 387 or equivalents. 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 (3-0-3)
Prerequisite: senior standing. 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 (3-0-3)
Prerequisites: Arch 386, CIS 104. 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 547 - Special Topics in Computer Applications (2-2-3)
Prerequisite: senior standing. Evaluation, utilization, and development of computer programs for analysis, simulation and information management. Programs range from energy analysis, building structures analysis, and mechanical systems design to spatial allocation, graphics and computer-aided design. Different theories of information transformation and delivery used in terms of architectural applications. Course hardware ranges from computer-aided design and drafting systems, through micro and mini, to mainframe computers.

Arch 549 - Life Safety Issues in Contemporary Buildings (3-0-3)
Prerequisites: Arch 386, Arch 387. A variety of life safety and comfort situations studied in terms of specific building types. Topics include building evacuation, compartmentalization, fire fighting and suppression, evaluation and testing of new building materials and systems, systems control and management. Special emphasis is on such building types as multi-use, high-density, schools, hospitals, and other institutional categories.

Arch 550 - Building Economics (3-0-3)
Prerequisite: senior standing. Economic issues and methods of analysis influencing the building process and product are presented. The focus is on relations between architectural decisions and economic consequences. Students use computer models to manage building cost data and conduct life cycle costing.

Arch 552 - Real Estate Analysis for Architects (3-0-3)
Prerequisite: completion of the third year. Introduction to the economic, financial and political aspects of real estate and their effect on architectural decision-making. Topics include needs assessment, real estate appraisal, financial instruments, regulations and real estate, design as value-adding, and the effect of tax policies on real estate development.

Arch 556 - Systems Approach to Design and Construction (3-0-3)
Prerequisite: completion of the third year. Lectures, case studies and student projects on understanding human aspiration and needs through design. Topics include land, finance, management, technology, and labor.

Arch 557 - Problems in Modern Housing (3-0-3)
Prerequisite: Arch 382 Historical approach places housing in its social, economic, and political context. 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 558 - Professional Architectural Practice (3-0-3)
Prerequisite: Arch 364. 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 559 - Social Issues in Housing (3-0-3)

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. **Effective From: Spring 2013**

Arch 563 - Comprehensive Studio I (1-12-5)
Prerequisites: Arch 464, Arch 423, Arch 327 and Arch 429. This studio focuses on the student's ability to assess, select, and conceptually integrate structural systems, building envelope systems, environmental systems, life-safety systems, and building service systems in the building design. Lecture hour coordinates with studio subject matter. Course materials purchase required. **Effective From: Fall 2011**

Arch 564 - Comprehensive Studio II (1-12-5)
Prerequisite: Arch 563. This Studio focuses on the student's ability to produce a comprehensive architectural project based on a building program and site that includes development of programmed spaces demonstrating an understanding of structural and environmental systems, building envelop systems, life-safety provisions, wall sections and building assemblies and the principles of sustainability. Lecture hour coordinates with studio subject matter. Course materials purchase required. **Effective From: Spring 2012**

Arch 565 - Comprehensive Studio Lab (0-3-1)
Prerequisites: Arch464. Corequisite: Arch 563 or Arch 564. Held in design studio each week, the lab consists of presentations by the instructor on relevant technical and life safety -issues and student exercises applying these principles to their current design studio project or to existing buildings.

Arch 566 - Advanced Architectural Design Studio (1-12-5)
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. **Effective From: Fall 2011**

Arch 571 - Everyday Life in the Public Realm (3-0-3)
A significant portion of everyday life takes place in the public realm of streets, sidewalks, parks, transit stations, government buildings, commercial establishments, and cultural institutions. Focuses on recent descriptions and critiques of public space and proposals for change.

Arch 572 - Architecture and Social Change (3-0-3)
Prerequisite: senior standing. Architectural form is analyzed in relation to political, economic and technological change, and change in social values. Buildings and other designed environments such as parks, streets and neighborhoods are studied relative to the social processes and institutions that generate and transform them. The role of the design professions in initiating or supporting change also is considered

Arch 573 - Technologies for Community and Urban Design (3-0-3)
Prerequisite: senior standing. Advanced and traditional technologies analyzed with regard to their role in community and city design, construction and reconstruction. Emphasis on technological systems influencing location, configuration and use. Examples are infrastructures, communication systems and construction technologies. Develops skills in using methods to evaluate alternative technologies relative to their social, economic and physical promise, problems and feasibility.

Arch 574 - Case Studies in Community and Urban Design (3-0-3)
Prerequisite: senior standing. 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 - The Architecture of Utopia (3-0-3)
Prerequisite: senior standing. 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 583/583H - Special Topics (3)
Group investigation of problem of special interest in architecture.

Arch 584 - Video and Animation (3-0-3)

Prerequisite: Arch 363. Presents the concepts of 3-D surface modeling, rendering, key frame animation, and video production in the context of the design process using the computer program ALIAS STUDIO. Emphasizes the underlying geometric principles of surface modeling, the components of color theory and texture mapping, the principles of key frame animation, and video production. The project for the semester is a short animated video. Also discusses scene Description Language programming. **Effective Until: Spring 2010**

Arch 588 - Architoons (3-0-3)
Prerequisite: Arch 364. Through the medium of film, applies literary devices to architectural contexts, including caricature, parody, lampoon, satire and farce. Studies historical and contemporary animations and short films for their treatment of meaning, story line and sequence, timing, environmental and psychological mood, atmosphere and emotion. Using 3-D modeling and animation software, each student produces an animated short subject illustrating an architectural principle or providing a humorous look at architectural history and theory.

Arch 591 - Independent Study (1)
null

Arch 592 - Independent Study (2)
null

Arch 593 - Independent Study (3)
null

GRADUATE COURSES:

Arch 500G - Advanced Architectural Graphics (3 credits)
Introductory computer science with applications in computer graphics for architecture. Emphasizes programming methodology using a high-level language as the vehicle to illustrate concepts. Basic concepts of computer systems, software engineering, algorithm design, programming languages, and data abstraction, with applications. **Effective From: Spring 2014**

Arch 501G - Architectural Design I (6 credits)
Prerequisite: graduate level standing. Core Studio. Fundamentals of architectural design. Sequence of projects explore two- and three-dimensional design. Choice of form and aesthetics is related to spatial resolution of function and context. Design as a representational medium is emphasized. Taken concurrently with Arch 555G. **Effective From: Spring 2014**

Arch 502G - Architectural Design II (6 credits)
Prerequisites: Arch 501G, Arch 528G, Arch 541G, Arch 555G. Core Studio. Extends the knowledge of design, basic concepts and ideas introduced in Arch 501G. Emphasis is on developing technical drawing, and model-making skills. Also covered are two- and three-dimensional composition. Links to the history and theory sequence are made. **Effective From: Spring 2014**

Arch 503G - Architectural Design III (6 credits)
Prerequisites: Arch 500G, Arch 502G, Arch 529G, Arch 543G, and Arch 545G. Core Studio, Intermediate design studio. Introduction to structure. Properties of materials both physical and in the abstract. Builds on knowledge gained from construction and structures courses, spatial demands and design possibilities of different structural systems. Design of structure type, model and context, and comparisons of building typology for rational structure. Drawing and its role in design thinking. **Effective From: Spring 2014**

Arch 504G - Architectural Design IV (6 credits)
Prerequisites: Arch 503G, Arch 542G, Arch 544G. Arch 548G. Corequisite:547G. Second semester intermediate design studio. Design of buildings and integration of systems, physical and conceptual. Design methodology generates new information on buildings as coherent assemblies of systems. Also covers analysis and synthesis of form and introduction to applications of computer-assisted design (CAD). Preparation of design portfolio will complete core studio sequence. **Effective From: Spring 2014**

Arch 505G - Advanced Design Options I (6 credits)
Prerequisites: 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. **Effective From: Spring 2014**

Arch 506G - Advanced Design Options II (6 credits)
Prerequisites: 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. **Effective From: Spring 2014**

Arch 507G - Advanced Design Options III (6 credits)
Prerequisites: 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. **Effective From: Spring 2014**

Arch 512G - Structures II (3 credits)
Prerequisites: Arch 511G, Arch 522G. Builds on information presented in Arch 511G. Emphasizes details and methods of concrete design, mixing, pouring and testing. Methods and details of steel design are summarized. **Effective Until: Summer 2007**

Arch 513G - Structures III (3 credits)
Prerequisite: Arch 512G. Review of methods and procedures for choosing structural systems. Overview of differences among wood, steel and concrete systems. Students are introduced to complex structural behavior, prestressed concrete and new structural technology.

Arch 528G - History of Architecture I (3 credits)
Prerequisite: graduate level standing. Introduction to the history of architecture. Emphasis on classical architecture from antiquity to the modern period. Evolution of the various themes and theories that underlie western architecture is presented chronologically.

Arch 529G - History of Architecture II (3 credits)
Prerequisite: Arch 528G. Continuation of Arch 528G. Introduces concepts of modernism and brings the history of western architecture to the contemporary period.

Arch 541G - Construction I (3 credits)
This course is an introductory survey of the general principles and application of Sustainable Design, Site Systems, Structural Systems, Environmental Systems, Envelope Systems, Materials and Assembly Systems. This course will primarily focus on low-rise wood and steel structures. **Effective From: Spring 2014**

Arch 542G - Integrated Building Technologies (3 credits)
Prerequisites: Arch 541G This course is an introductory survey of the interrelationship of the principles and applications of Sustainable Design, Site Design, Structural Systems, Environmental Systems, Envelope Systems and Materials and Assembly Systems. This course will primarily focus on low and medium-rise concrete and masonry structures and is coordinated with a studio design/build experience. **Effective From: Spring 2014**

Arch 543G - Environmental Control Systems I (3 credits)
An introductory survey of the basic principles of building, environmental control, and service systems as these relate to the building envelope. This course will primarily cover thermal enclosure, climate modification, environmental systems, energy use, and sustainable design. It also introduces the principles of health and safety in the design of buildings. **Effective From: Spring 2014**

Arch 544G - Environmental Control Systems II (3 credits)
This is an intermediate course focusing on the understanding of the principles, performance criteria, and applications of environmental and building service systems including lighting, acoustical, plumbing, electrical, vertical transportations, egress, communication, security, and fire protection systems. **Effective From: Spring 2014**

Arch 545G - Structures I (3 credits)
This is an intermediate course focusing on the principles of structural behavior in withstanding gravity and lateral forces and on the evolution, range, and appropriate application of structural systems and the criteria for selecting various structural systems in contemporary architecture. Specific architectural procedents from the 20th century are used as validating examples. **Effective From: Spring 2014**

Arch 546G - Structures: High Rise and Special Applications (3 credits)
Prerequisite: 545G. This is an advanced course focusing on the integration of all building systems including new materials and methods as they relate to high-rise structures and other specialty building types. **Effective From: Spring 2014**

Arch 547G - 4D Integration (3 credits)
Arch 542G, Arch 544G, Arch 548G. Corecquisite: Arch 504G. This is a required, advanced design course that uses in-depth, detailed case studies of various construction types, from small scale to large, from simple to complex, to illustrate the totality of building systems integration. In conjunction with site visits, coursework will employ software to examine construction sequences, building components and shop drawings and their relationship to the design processes **Effective From: Spring 2014**

Arch 548G - Structures II (3 credits)
Prerequisite: 545G. This is an advanced course dealing with structural computation that will conclude with rigorous case study investigation of hybrid and complex structural systems. **Effective From: Spring 2014**

Arch 555G - Architectural Graphics (3 credits)
Prerequisite: graduate level standing. Documentary, descriptive and denotative media are introduced. Also covers methods of representation, delineation and reproduction. Skills are developed in technical drawing, perspective construction, projections, and format design. Taken concurrently with Arch 501G.

Arch 569G - Building and Development (3 credits)
Familiarization with the larger process of building production, of which architecture is one important part. Focus on the role of the architect in the areas of current building development: an examination of how redefinition or change might improve the process. Lectures deal with all factors of the building process and interviews with the various actors involved in designing, approving, financing and making buildings. Students have various assignments including a major term project.

Arch 579G - Professional Architectural Practice (3 credits)
Prerequisite: completion of M.Arch. core sequence. Review of the formal, informal, legal, and ethical obligations of the professional architect. Traditional relationships among the architect, clients, engineers and other participants in the design and building industry are studied. Principles of office management and problems of liability are introduced. Also fulfills core requirement of dual degree option for M.Arch./Master of Science in Management.

Arch 619 - Architectural Photography (3 credits)
Prerequisites: Arch 501G, Arch 502G, Arch 503G. Photography for architectural presentations and portfolios. Lectures include orientation on light and space, slide presentations, and the use of text to reinforce photographic material. Demonstrations include basic darkroom techniques, and methods to encourage experimentation in photography.

Arch 630 - Methodology of Architectural History, Theory and Criticism (3 credits)
Prerequisites: Arch 528G, Arch 529G. This seminar is structured around notable readings on architectural history, theory and criticism to provide students with a sound basis for critical analysis and assessment. It is recommended for students who select history and theory as their area of concentration.

Arch 631A - History of Renaissance Architecture (3 credits)
Prerequisites: Arch 528G, Arch 529G. Development of architecture and urban design in Italy and elsewhere in Europe during the Renaissance: re-emergence of the classical Greek and Roman architectural tradition; social, political and economic developments; formal intentions and transformations in the 16th and 17th centuries.

Arch 631B - History of Baroque Architecture (3 credits)
Prerequisites: Arch 528G, Arch 529G. The emergence of baroque architecture and urban design in Rome in the 17th century; analysis of the works of Bernini, Borromini, Cortona and their contemporaries and successors through 1750. Development of baroque architecture elsewhere in Italy and Europe; late baroque and rococo; the advent of neo-classicism.

Arch 631C - History of Modern Architecture (3 credits)
Prerequisites: Arch 528G, Arch 529G. Major tendencies in architectural theory and practice from the mid-19th to the mid-20th centuries. Formal and stylistic transformation considered in relation to theory, social, cultural, and technical developments.

Arch 631D - History of American Architecture (3 credits)
Prerequisites: Arch 528G, Arch 529G. Aesthetic, social, cultural and technical developments in American architecture and planning, from colonial times to the mid-20th century.

Arch 631E - History of Non-Western Architecture (3 credits)
Prerequisites: Arch 528G, Arch 529G. Examination of major architectural traditions and styles of China, Japan, Southeast Asia, India and the Middle East.

Arch 631F - Thresholds of Architectural Theory (3 credits)
Prerequisites: Arch 528G, Arch 529G. Seminar on Western architectural theory dating from Vitruvius to the present time. Examines critical texts and studies related building and projects.

Arch 631H - History and Theory of Infrastructure (3 credits)
Prerequisites: Arch 528G, Arch 529G. The historical role of infrastructure in the formation of cities and the relation of planning theories to urban culture. Case studies are used to develop effective ways of learning urban design; method and substance are equally emphasized. Concentration on the social, economic, political, technological and topographic factors that affect urban form; analysis of urban design schemata and their relation to patterns of use; and the critical appraisal of planning ideologies and strategies. Same as MIP 631.

Arch 632 - Problems and Methods in Architectural Preservation (3 credits)
Prerequisites: Arch 528G, Arch 529G. Theory and practice of preservation planning. Compares American and European preservation concepts, problems and techniques. Also covers theories on continuity and change in urban environments, and

preservation-planning for community development and neighborhood conservation.

Arch 633 - Case Studies in Architectural Creativity (3 credits)
Prerequisite: Arch 528G, Arch 529G. Considers creativity in architecture from psychological, philosophical and autobiographical perspectives. The buildings writings and lives of contemporary architects are discussed in the context of general theories of creativity. Each student chooses an individual architect noted for creative accomplishments and prepares a case study of his or her life.

Arch 634 - History of Architectural Technology (3 credits)
Prerequisites: Arch 528G, Arch 529G. Survey of the development of building methods and materials. Impact of structural and environmental technology on architectural form and the design process. The role of technology in contemporary architectural theory and practice including the modern movement is emphasized. Recommended for students who select building science as their area of concentration.

Arch 640 - Acoustics (3 credits)
Prerequisites: completion of core sequence or equivalent. Architectural acoustics: how we hear, physics of sound and materials, aesthetics of design and the processes of construction. Audible sounds, their interaction, perception of echo and directional hearing are applied to interior and exterior building transmission, room acoustics, and setting acceptable acoustical environments.

Arch 641 - Experiments in Structural Form (3 credits)
Prerequisites: completion of core sequence or equivalent. Architectural form through model design, construction and testing of minimum structures, including elements of soap film study, orthogonal and diagonal grids, design of tension grids through deflection loading, photoelastic models and calculation. Also compares geometric systems, patterning and proportion, symmetry, asymmetry, relative size, nesting, linearity and spiral orders, rectilinear patterns, and randomness in architectural structure and form.

Arch 643 - Lighting (3 credits)
Prerequisites: Arch 501G and Arch 502G. Through modeling and calculation, influence of the luminous environment on architectural form and detail. Perceptions of visual comfort and daylight are examined. Topics include daylighting footprints, model design and testing, and computer-assisted, light-level analysis. Relationship between daylight and artificial light in architecture, 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 644 - Systems Approach to Design and Construction (3 credits)
Prerequisite: completion of core sequence. Lectures, case studies and student projects on understanding human aspirations and needs through design. Topics include land, finance, management, technology and labor.

Arch 645 - Case Studies in Architectural Technology (3 credits)
Prerequisite: completion of core sequence. Case-study method used for in-depth investigation of the relationship among various technological systems in a building and technologically-related problems in architecture and construction.

Arch 646 - Designing and Optimizing the Building Enclosure (3 credits)
Prerequisite: completion of core sequence. Considers the "building envelope," the boundary dividing the inside of a structure from the outside environment. Students study and design optimal enclosures considering energy exchange, the relationship between energy and lighting, and life cycle costs.

Arch 647 - Special Topics in Computer Applications (3 credits)
Prerequisite: completion of core sequence. Evaluation and use of computer graphics hardware and software for architectural applications. Focus is on computers as tools, operating systems and methods of data manipulation. Two- and three-dimensional modeling software are discussed, and assignments using such software are given to provide understanding of the modeling of built environments.

Arch 649 - Life Safety Issues in Contemporary Buildings (3 credits)
Prerequisite: completion of core sequence. A variety of life safety and comfort situations are studied in different building types. Topics include building evacuation, compartmentalizing, fire fighting and suppression, evaluation and testing of new building materials and systems, systems control and management. Special attention is placed on multi-use, high-density buildings.

Arch 650 - Economy of Building (3 credits)
Prerequisite: completion of core sequence or equivalent. Economic consequences of design decisions. Topics include: relationship among economy, efficiency and quality; life-cycle cost of design; improving the economy of building processes and products through innovation; and environmental concerns. This course is required for the dual degree M.Arch./Master of Science in Management program. It can also be used as an elective in the M.Arch. program.

Arch 651 - Real Estate Analysis for Architects (3 credits)
Prerequisite: completion of core sequence. Introduction to the economic, financial and political aspects of real estate and their effect on architectural decision-making. Topics include: needs assessment, real estate appraisal, financial instruments, regulations and real estate, design as value-adding, and the effect of tax policies on real estate development. This course is required for the dual degree M.Arch./Master of Science in Management program. It can also be used as an elective in the M.Arch. program.

Arch 652 - Architectural Project Management (3 credits)
Prerequisites: completion of core sequence and Arch 579G. Management of architectural projects: project costs, timing, personnel, documentation, professional ethics and resource management. This course is required for the dual degree M.Arch./Master of Science in Management program. It may be used as an elective in the M.Arch. program.

Arch 661 - Directed Studies of Architecture (3 credits)
Prerequisites: completion of core and two elective courses; and approval from the graduate advisor. Independent, in-depth research on an analytical, theoretical or technical area of architecture. Student prepares formal research proposal with permission of faculty advisor and approval of graduate advisor. Required as pre-thesis research. See also course description for MARC 701.

Arch 662 - Special Topics in Architecture (3 credits)
Topics vary each semester. Refer to the School of Architecture bulletin during university registration periods for a list of current topics and possible prerequisites.

Arch 663 - Introduction to Sustainable Architecture (3 credits)
Prerequisite: Arch 523G. Environment design of buildings. The five characteristics of green buildings: sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. The US Green Building Council's Green Building Rating System, review of several major buildings of exemplary design.

Arch 664 - Indoor Environmental Quality in Sustainable Design Buildings (3 credits)
Prerequisite: Arch 523G. Supportive ambient conditions, including thermal comfort and acceptable indoor air quality, visual comfort, and appropriate acoustical quality, overall physical and psychological well-being for workplace quality, performance and productivity.

Arch 665 - Sustainable Design of Energy Efficient Buildings (3 credits)
Prerequisite: Arch 523G. Evaluation of heating and cooling loads, impact on fuel consumption, energy software analysis for design and efficiency. Technology of passive solar design and building integrated photovoltaics.

Arch 666 - Sustainable Design with Efficient Materials and Resources (3 credits)
Prerequisite: Arch 523G. Environmentally sensitive site design; issues of wildlife habitat, erosion, ground water recharge, and threats to water quality of surface water bodies and aquifers. Water reclamation, materials and energy conservation, waste reduction and recycling.

Arch 672 - Architecture and Social Change (3 credits)
Prerequisite: graduate level standing. Analysis of architectural form with respect to political, economic and technological change. The built environment is studied in relation to society and culture. The role of design professions in initiating or supporting change is also considered.

Arch 673 - Infrastructure Planning in Practice (3 credits)
Infrastructure planning principles, methods and tools. Through selected examples, acquaintance with infrastructure planning theories and models, quantitative methods of research and analysis, information management, decision making, and implementation techniques. Same as MIP 673.

Arch 674 - Infrastructure and Architecture (3 credits)
Examination of areas of overlap and continuity between architecture, landscape architecture, urban design, building science and infrastructure. Topics include the typology, programming and design of public facilities; the housing fabric; the relation between built form, urban space and infrastructure. Same as MIP 674.

Arch 675 - Elements of Infrastructure Planning (3 credits)
Introductory survey of the basic principles, operation and design of physical infrastructure systems including roads, public transportation, community facilities, public open space, surface drainage, and electric, gas, water, waste disposal, and telecommunications services. Same as MIP 675.

Arch 676 - The Architecture of Utopia (3 credits)
Prerequisite: graduate level standing. Seminar looks at several ideas of utopia from literature and philosophy and how they embody transformations in the structure of space, and their architectural implications.

Arch 678 - Graduate Problems in Modern Housing (3 credits)
Prerequisite: graduate level standing. Students learn to analyze political, technical and economic aspects of contemporary housing policy and practice. Attempts to provide well-designed, affordable housing responsive to the needs of large numbers of people are examined. Examples of housing from the mid-19th century to the present day are outlined.

Arch 679 - Envisioning Newark (3 credits)
This seminar combines classroom discussion based on historical, analytical and literary texts; field visits to Newark's districts and neighborhoods; and meetings with leaders in government, business, art, education, and community-based organizations. The objective is to introduce students to the redevelopment process underway in Newark, and to use the city as a springboard for a broader investigation of the theory and practice of urban development. **Effective From: Spring 2011**

Arch 680 - Graduate Co-op Work Experience I (3 additive credits)
Prerequisites: completion of core sequence, permission from graduate advisor and Division of Career Development Services. Students gain work experience and reinforcement of their academic programs. An architecture faculty Co-op advisor monitors and evaluates student work and project. Co-op work experiences may be acceptable equivalents for apprenticeships mandated by the New Jersey State Board of Architects and for eligibility to take the architecture licensing examination. This course is required for participation in the Housing Scholars Program. Course does not fulfill degree requirements.

Arch 681/682 - Graduate Co-op Work Experience II and III (3 additive credits)
Prerequisites: completion of core sequence, permission of graduate advisor and Division of Career Development Services. Used for extended summer-fall (681) or spring-summer (682) work experience. Does not fulfill degree requirements.

Arch 686 - Research Methods for Environmental Design (3 credits)
Introduction to methods of inquiry useful to professionals planning and designing buildings, communities and cities. Skills developed in problem definition and phenomena: measurement, modeling, testing and evaluation. Open to undergraduates with permission of instructor.

Arch 770 - Development of the American City (3 credits)
Prerequisite: Enrollment in the Urban Systems PhD program or permission of the instructor. Introduction to research in urban history, focusing on the American city. Key texts that deal with the development of the American city will be studied in depth, with particular emphasis on the approaches, methodologies, and sources. Each student will conduct bibliographic research on a city or urban sector from a defined perspective.

Arch 771 - Pathology of Urban Systems (3 credits)
Prerequisite: Enrollment in the Urban System PhD program or permission of the instructor. Definition of pathology of urban systems as large-scale disasters that have resulted in major destruction of the urban fabric and called for radical re-planning projects. Investigation of historic case studies. The aftermath of natural and man-made disasters including war; contemporary case studies.

MARC 701 - Master's Thesis (6 credits)
Prerequisites: Arch 506G, Arch 661, and approval from graduate advisor. Alternative to Arch 507G. Under the supervision of a faculty advisor, independent study of issues in the student's area of concentration developed during Arch 661.

MSAS 701 - Master of Science in Architectural Studies Thesis (6 credits)
Prerequisites: completion of required courses, electives, Arch 661 and approval from MSAS advisor. Under supervision of a thesis advisor, independent, in-depth examination of a subject in the student's area of concentration developed during Arch 661.

art design: Offered by the School of Art + Design

UNDERGRADUATE COURSES:

AD 111 - Communication in Art and Design - Traditional Media (1-5-3)
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. **Effective From: Fall 2008**

AD 112 - Communication in Art and Design - Digital Media (1-5-3)
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 techiques and other methods of graphic (and architectural) representation. **Effective From: Fall 2008**

AD 150 - Color and Composition (2-3-3)
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. **Effective From: Fall 2009**

AD 161 - History of Art and Design I (3-0-3)
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. **Effective From: Fall 2008**

AD 162 - History of Art and Design II (3-0-3)
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. **Effective From: Spring 2009**

AD 201 - Human Factors/Ergonomics (3-0-3)
Prerequisite: Sophomore level or higher. 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. **Effective From: Fall 2009**

AD 221 - Building and Interior Systems I (3-0-3)
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. **Effective From: Fall 2008 Until: Spring 2009**

AD 222 - Building and Interior Systems II (3-0-3)
Prerequisite: Phys 102. 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. **Effective From: Spring 2009 Until: Summer 2009**

AD 241 - Introduction to Design for Interior Designers I (1-9-4)
Prerequisites: AD 111 and Arch 344. A hands-on studio based introduction to the basic principles and elements of design for interior designer students. Emphasis on design methods using multiple media, manipulating form and space. Course includes lectures, readings, and (primarily three-dimensional) design projects. **Effective From: Fall 2008 Until: Summer 2009**

AD 242 - Introduction to Design for Interior Designers II (1-9-4)
Prerequisites: AD 112 and AD 241. A continuation of Introduction to Design for Interior Designers I. A hands-on studio course that expands 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. The integration of multiple technical variables/requirements to be considered by the designer is introduced. **Effective From: Spring 2009 Until: Fall 2011**

AD 275 - History of Games (2-3-3)
Prerequisites: AD 111, 112 or ID 155, 156 or Arch 163, 164 and Cultural History GUR. 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. **Effective From: Fall 2008 Until: Fall 2008**

AD 340 - Photography and Imaging (3-0-3)
Prerequisites: AD 150 or (ARCH 155/156/163/164) or permission of instructor. 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. **Effective From: Fall 2012**

AD 463 - Collaborative Design Studio (1-12-5)
Prerequisites: (DD 364 or ID 364 or FA 364 or INT 364 or Arch 364) and PHYS 102. 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. **Effective From: Fall 2013**

AD 490 - Special Topics (3-0-3)
Prerequisites: As determined by individual sections and topics. 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. **Effective From: Fall 2010**

AD 490H - Special Topics (3-0-3)
Prerequisites: As determined by individual sections and topics. 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. **Effective From: Fall 2010**

AD 491 - Independent Study (1-0-1)
Prerequisite: 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. **Effective From: Spring 2011**

AD 492 - Independent Study (2-0-2)
Prerequisite: 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. **Effective From: Spring 2011**

AD 493 - Independent Study (3-0-3)
Prerequisite: 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. **Effective From:**

Spring 2011

BioInformatics: BioInformatics

UNDERGRADUATE COURSES:

BNFO 135 - Programming for Bioinformatics (3-0-3)
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 unerstanding 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. **Effective From: Spring 2009**

BNFO 136 - Programming for Bioinformatics II (3-0-3)
Advanced programming skills in Perl or Python with appliations to bioinformatics. **Effective From: Spring 2010**

BNFO 235 - Programming for Bioinformatics (3-0-3)
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. **Effective From: Fall 2006 Until: Fall 2008**

BNFO 240 - Principles of Bioinformatics II (3-0-3)
Prerequisites: Math 211, R120:301, CS 114 or permission of the instructor. This course provides an introduction to the field of bioinformatics. It includes a description of the molecular basis of genomics and proteomics, the computer-based and mathematical methods used in bioinformatics, and the application of these methods toward understanding biological systems at the cellular and molecular level. It also includes a description of the application of bioinformatics to drug discovery. **Effective From: Fall 2006**

BNFO 340 - Data Analysis for Bioinformatics (3-0-3)
Advanced data analysis skills with applicaitons to popular bioinformatics problems. **Effective From: Spring 2010**

BNFO 482 - Databases and Data Mining in Bioinformatics (3-0-3)
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. **Effective From: Spring 2010**

BNFO 491 - Computer Science Project (3-0-3)
Prerequisites: CS 490, senior standing in the Honors College and project proposal approval. A course similar to CS 491, with a project of greater depth and scope **Effective From: Spring 2011**

GRADUATE COURSES:

BNFO 601 - Foundations of Bioinformatics I (3 credits)
Introduction to script programming and basic biomolecular sequence analysis. Topics covered include sequence alignment, dynamic programming algorithms, hidden Markov models, and their implementation with a scripting language. **Effective From: Fall 2009**

BNFO 602 - Foundations of Bioinformatics II (3 credits)
Topics in bioinformatics such as phylogeny reconstruction, genome-wide association study analysis, structure and sequence analysis, and machine learning and statistical approaches. Focus of the course is on a hands-on project on a contemporary bioinformatics problem. **Effective From: Fall 2009**

BNFO 615 - Data Analysis in Bioinformatics (3 credits)
Data structures, algorithms, and statistical approaches in bioinformatics. The course emphasis is on statistical models, algorithms,

and data structures with relevant biological background and motivation. **Effective From: Fall 2009**

BNFO 620 - Genomic Data Analysis (3 credits)
This course will introduce students to the practice of analyzing large-scale genomic data generated by recent high throughput bio-techniques. It will cover microarray data and short-read sequencing data. It presents widely used analytical methods and software. The course includes several case studies on real large-scale genomics datasets. Students will gain practical experience in large-scale data analysis, which is highly desirable by both industry and academia employers. **Effective From: Spring 2012**

BNFO 644 - Data Mining and Management in Bioinformatics (3 credits)
Concepts and principles of data management in bioinformatics. Presents methods for indexing, querying, and mining data obtained from molecular and evolutionary biology. Provides hands-on experience in designing a simple information system for querying and mining genomic data using ORACLE or MySQL.

Biology: Offered by the Federated Department of Biological Sciences at NJIT and Rutgers-Newark

UNDERGRADUATE COURSES:

Biol 200 - Concepts in Biology (4-0-4)
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. **Effective From: Fall 2011**

Biol 205 - Foundations of Biology: Ecology and Evolution Lecture (3-0-3)
Prerequisite: R120:102 or BIOL200 or R120:200. This introductory course considers the population level of biological organizations. Topics include Mendelian and population genetics, evolution, and ecology of populations and communities. **Effective From: Fall 2010**

Biol 206 - Foundations of Biology: Ecology and Evolution Lab (0-3-1)
Prerequisite: R120:102 or R120:101/102 or BIOL 200 or R120:200. 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. **Effective From: Fall 2010**

Biol 222 - Evolution (3-0-3)
Prerequisite: R120:101 and R120:102 and BIOL 205/206 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. **Effective From: Spring 2009**

Biol 225 - Insects and Human Society (3-0-3)
Prerequisite: R120:101 and R120:102 (General Biology sequence). This course, through lecture and discussion, will cover the breadth of influence insects have on society, from the provision of ecosystem services to the economic and social costs associated with their role as vectors of disease. Student will learn how insects are used in science, agriculture and indicators of global climate change and water quality. Students will also learn some insect biology and have the opportunity to observe insects (living and dead) to gain a better understanding of the diversity and complexity of these creatures. **Effective From: Spring 2010**

Biol 250 - Biology of Neotropical Habitats: Ecuador and Galapagos Islands (2-2-3)
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. **Effective From: Spring 2014**

Biol 310 - Research and Independent Study (3-0-3)
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 **Effective From: Spring 2013**

Biol 315 - Principles of Neurobiology (3-0-3)
Prerequisite: R120:201 with a grade of C or better and R120:202 with a 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. **Effective From: Fall 2013**

Biol 320 - Discovering Biological Research (3-0-3)

Prerequisites: Hum 102, Biol 201, Biol 202, Biol 205, Biol 206 all with a 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. **Effective From: Fall 2013**

Biol 338 - Ecology of the Dining Hall (3-0-3)
Prerequisites: BIOL 205 with a C or better and BIOL 206, or permission of instructor. 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. **Effective From: Fall 2012**

Biol 340 - Mammalian Physiology (3-3-4)
Prerequisites: R120:201 and R120:202 and BIOL 205 and BIOL 206. 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. **Effective From: Spring 2011**

Biol 341 - Introduction to Neurophysiology (3-0-3)
Prerequisite: 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. **Effective From: Fall 2012**

Biol 342 - Developmental Biology (Embryology) (3-0-3)
Prerequisite: R120:201/202 and BIOL 205/206. Descriptive and experimental approaches to molecular, cellular and organismal changes during embryonic development; mechanisms of cell differentiation, organogenesis, morphogenesis, and pattern formation. **Effective From: Spring 2009**

Biol 344 - Physiological Mechanisms (3-0-3)
Prerequisites: Biol 340. 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. **Effective From: Spring 2013**

Biol 346 - Neurobiology (3-0-3)
Prerequisite: R120:201/202 and BIOL 205/206. This course will examine the basic principles that govern neuronal function, emphasizing cellular, developmental, and physiological aspects. The course begins with cellular properties of neurons and synaptic communication and will review the organization, function, development, and disorders of neural systems. **Effective From: Fall 2010**

Biol 368 - The Ecology and Evolution of Disease (3-0-3)
Prerequisite: R120:201/202 and MATH 111 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. **Effective From: Spring 2009**

Biol 375 - Conservation Biology (3-0-3)
Prerequisites: R120:201/202 and BIOL 205/206 General Biology I & II. This course will provide a comprehensive introduction to the field of conservation biology, as well as philosophical and economic concerns. **Effective From: Fall 2009**

Biol 383 - Neural Basis of Behavior (3-0-3)
Prerequisite: R120:201/202 and BIOL 205/206. 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. **Effective From: Spring 2009**

Biol 385 - Evolution of Animal Behavior Laboratory (2-2-4)
Prerequisite: BIOL 205, BIOL 206, R120:201 and R120:202 with a 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. **Effective From: Fall 2012**

Biol 400 - Biology in Science Fiction (3-0-3)
Prerequisite: R120:340/BIOL 340 or R120:345 and R120:355 or R120:356 or R120:352 with a grade of C or better. 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. **Effective From: Fall 2012**

Biol 405 - Cell Physiology and Imaging (1-3-4)
NOTE: COURSE HAS BEEN CHANGED TO BIOL 451. Prerequisites: Phys 111, Phys 121 and R120:355. 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. **Effective From: Spring 2009 Until: Summer 2010**

Biol 410 - Work Experience II (3-0-3)
Prerequisites: Biol 310, 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 **Effective From: Spring 2013**

Biol 440 - Cell Biology of Disease: Cells gone Bad! (3-0-3)
Prerequisites: R120340 and R120355 or R120356. 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. **Effective From: Fall 2011**

Biol 445 - Endocrinology (3-0-3)
Prerequisites:R120201, R120202, BIOL340 and CR120355 or R120356. 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. **Effective From: Fall 2011**

Biol 447 - Cellular and Systems Neuroscience (3-0-3)
Prerequisite: R120:201,R120:202 and BIOL 205/206. Foundations of Biology. This course will examine, from both a cellular and a systems perspective, neurophysiological phenomena such as excitability, impulse conduction, integration of activity at the cellular and at the network level, and network level behavior of the nervous system. The goal is to provide students with the basic knowledge to understand neurobiological processes at all levels of complexity. **Effective From: Spring 2010**

Biol 448 - Neuropathophysiology: Nervous System Gone Bad! (3-0-3)
Prerequisites: R120:340 or R120:346 or Biol 346 or Biol 447. 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. **Effective From: Fall 2010**

Biol 451 - Cell Physiology and Imaging (1-3-4)
Prerequisites: Phys 111, Phys 121 and R120:355. 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. **Effective From: Fall 2010**

Biol 463 - Insects and Human Society (3-0-3)
This course, through lecture and discussion, will cover the breadth of influence insects have on society, from the provision of ecosystem services to the economic and social costs associated with their role as vectors of disease. Students will learn how insects are used in science, agriculture and as indicators of global climate change and water quality. Students will also learn some insect biology and have the opportunity to observe insects (living and dead) to gain a better understanding of the diversity and complexity of these creatures. **Effective From: Spring 2010 Until: Fall 2011**

Biol 475 - Ecological Field Methods and Analysis (3-0-3)
Prerequisites: R120:370 Plant Ecology or R120:280 Animal Ecology or 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. **Effective From: Fall 2009**

Biol 491 - Research and Independent Study (0-3-3)

Prerequisites: 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. **Effective From: Fall 2012**

Biol 492 - Research and Independent Study (3-0-3)
Prerequisite: Departmental approval required. Research in Biology. Each student works under the supervision of a Biology or associated faculty member. **Effective From: Spring 2007**

Biol 495 - Honors Seminar in Biology (3-0-3)
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. **Effective From: Fall 2014**

R120:101 - General Biology I (3-3-4)
Prerequisite: None. For more details go toRutgers Catalog. **Effective From: Spring 2009**

R120:102 - General Biology II (3-3-4)
Prerequisite: None For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:104 - Human Health and Disease (3)
For more details go to Rutgers Catalog.

R120:109 - Basic Plant Science (3)
For more details go to Rutgers Catalog.

R120:110 - Basic Plant Science Laboratory (1)
For more details go to Rutgers Catalog.

R120:203 - Plant Biology (3)
For more details go to Rutgers Catalog.

R120:204 - Economic Botany (3)
For more details go to Rutgers Catalog.

R120:205 - Environmental Issues (3)
For more details go to Rutgers Catalog.

R120:206 - General Horticulture (3)
For more details go to Rutgers Catalog.

R120:207 - Horticulture Laboratory (1)
For more details go to Rutgers Catalog.

R120:208 - Human Sexuality (3)
For more details go to Rutgers Catalog.

R120:211 - Plant Kingdom (4)
Prerequisite: Biol 205 with grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:227 - Biology of Invertebrates (4)
Prerequisite: Biol 205/206 with grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:230 - Biology of Seed Plants (4)
Prerequisite: Biol 205 with grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:235 - Microbiology (3)
For more details go to Rutgers Catalog.

R120:241 - Anatomy and Physiology (4,4)
For more details go to Rutgers Catalog.

R120:280 - Animal Ecology (3)
Prerequisite: R120:101 and R120:102 with grade of C or better. For more details go to Rutgers Catalog.

R120:282 - Animal Behavior (3)
Prerequisite: Biol 205/206 with grade of C or better. For more details go to Rutgers Catalog.

R120:285 - Comparative Anatomy of Vertebrates (3-3-4)
Prerequisite: Biol 205/206 with grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:301 - Foundations of Biology: Cell and Molecular Biology (3-0-3)
Prerequisite: R120:101 and R120:102 and Chem 125 with grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:311 - Taxonomy of Vascular Plants (4)
Prerequisite: R120:211 or R120:230 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:313 - Mycology (4)
Prerequisite: R120:201 and R120:202 and Biol 205/206 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:325 - Animal Parasites (3)
Prerequisite: R120:201 and Biol 205/206 and Hum 102 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:326 - Laboratory Exercises in Parasitology (1)
Corequisite: R120:325. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:328 - Ecology of Birds (3-0-3)
Prerequisite: R120:201/202 and Biol 205/206 with grade of C or better. For more details go to Rutgers Catalog.

R120:330 - Plant Physiology (4)
Prerequisite: R120:201/202 and Biol 205/206 with a grade of C or better. For more details go to Rutgers Catalog.

R120:335 - General Microbiology (4)
Prerequisite: R120:201/202 and Biol 205/206. For more details go to Rutgers Catalog.

R120:340 - Mammalian Physiology (3-3-4)
Prerequisite: R120:201/202 and Biol 205/206 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:342 - Developmental Biology (4)
Prerequisite: R120:201/202 and Biol 205/206 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:343 - Developmental Bio Lab (1)
Corequisite: R120:342. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:346 - Neurobiology (3)
Prerequisite: R120:201 and Biol 205/206 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:350 - Immunology (3)
Prerequisite: R120:201 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:352 - Genetics (3)
Prerequisite: R120:201 and Biol 205/206 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:355 - Cell Biology (3)
Prerequisite: R120:201 and Biol 205/206 and Chem 126 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:356 - Molecular Biology (3)
Prerequisite: R120:201 and Biol 205/206 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:360 - Elementary Biochemistry (3)
Prerequisite: R120:201, Chem 243, Chem 244, and Chem 244A with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:365 - Human Ecology (3-0-3)
Prerequisite: R120:201 and R120:202 an Biol 205/206 and Hum 102 with grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:370 - Plant Ecology (3)
Prerequisite: R120:201/202 and Biol 205/206 with grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:371 - Field Studies in Plant Ecology (3)
Prerequisite: R120:370 or R120:280 with a grade of C or better; Juniors and Seniors Only. For more details go to Rutgers Catalog.

R120:380 - Field Ecology (3)
Prerequisite: R120:370 or R120:280 with a grade of C or better; Juniors and Seniors Only. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:381 - Field Studies in Animal Ecology (2)
Prerequisite: R120:370 or R120:380 with a grade of C or better, HUM 102; Juniors and Seniors Only. For more details go to Rutgers Catalog.

R120:403 - Biological Ultrastructure (3)
Prerequisite: R120:301 and R120:302 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:404 - Light and Electron Microscopy (4)
For more details go to Rutgers Catalog.

R120:405 - Microanatomy of Cells and Tissues (4)
Prerequisite: R120:201 and R120:202 and Biol 205/206 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:414 - Phycology (4)
For more details go to Rutgers Catalog.

R120:415 - Paleobotany (4)
For more details go to Rutgers Catalog.

R120:422 - Biological Invasions (3)
Prerequisite: R120:370, or R120 280 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:430 - Plant Growth and Development (4)
Prerequisite: R120:201/202 and Biol 205/206 and R120:211 or 230 or 330 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:435 - Microbial Physiology and Metabolism (3)
For more details go to Rutgers Catalog.

R120:445 - Endocrinology (3)
Prerequisite: R120:340 or Biol 340 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:451 - Laboratory in Cellular and Molecular Biology I: Cellular Biophysics (4)
Prerequisite: R120:355 with a grade of C or better; Permission of Instructor. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:452 - Laboratory in Cellular and Molecular Biology II: Molecular Biotechniques (4)
Prerequisite: R120:355 or R120:356 with a grade of C or better; Permission of Instructor. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:455 - Molecular Cell Biology (3)
Prerequisite: R120:355 and R120:356 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:456 - Virology (3)
Prerequisite: R120:335 with a grade of C or better. For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R120:471 - Ecological Physiology (3)
Prerequisite: R120:370 or R120:280 with a grade of C or better. For more details go to Rutgers Catalog.

R120:472 - Environmental Assessment (3)
Prerequisite: R120:370 or 371. For more details go to Rutgers Catalog.

R120:473 - Ecology of Microorganisms (3)
Prerequisite: R120:335. For more details go to Rutgers Catalog.

R120:481 - Marine Biology (4)
Prerequisite: R120:201/202 and Biol 205/206 with grade of C or better. For more details go to Rutgers Catalog.

R120:486 - Tropical Field Biology (2)
Prerequisite: Permission of the Instructor; Juniors and Seniors Only. For more details go to Rutgers Catalog.

R120:491 - Problems in Biology (BA,BA)
For more details go to Rutgers Catalog.

GRADUATE COURSES:

Biol 601 - Computational Biology I (3-0-3)
This course will describe mathematical and simulation techniques used in modeling a variety of biological systems. Students will learn stability analysis, phase space analysis, basic bifurication theory and numerical simulation techniques with examples from neuroscience, cell and molecular biology as well as ecology and evolution. Students enrolling in this course are expected to have basic knowledge of calculus, linear algebra and some programming abilities. **Effective From: Fall 2010**

Biol 612 - Comparative Animal Physiology (3 credits)
This course will explore how animals, from invertebrates to vertebrates, function from the cellular to the organism level. The study of the structure and function of the various organs provides insight into how animals survive extreme environments and how they respond to changes in their environment. The comparative approach shows that the underlying physiological principles that govern life are common to all animals and yet animals have evolved unique and sometimes startling physiological solutions to problems posed by their particular environments. **Effective From: Fall 2009**

Biol 622 - Evolution (3 credits)
This course will provide a comprehensive overview of research in the field of evolutionary biology. Topics will include: the development of evolutionary theory, the history of the evolution of life on Earth, the genetic bases of variation and heredity, natural selection, evolution and development, and speciation. The format will be brief lectures to review topics covered in text, followed by class discussions of relevant primary literature. Students will write two papers on the topic of their choice and will be required to lead a minimum of one class discussion. **Effective From: Spring 2010**

Biol 628 - Cell Biology of Disease: Cells Gone Bad (3-0-3)
This course will briefly review normal physiological function of humans and will then extensively explore the basis of many human diseases at cellular lever. The goal is to understand how alterations in normal cell functions affect human physiology by reviewing current research in the field of cell biology. **Effective From: Fall 2011**

Biol 630 - Critical Thinking for the Life Sciences (3 credits)
Researchers in the biological sciences must understand and be able to effectively apply the scientific method, and they must also be able to clearly communicate their ideas and results. This course will involve heavy student participation and discuss the scientific method, analyze and discuss data gathering and organizing, and will analyze existing grant proposals with the goal of enabling graduate students to write a clear and convincing grant proposal. **Effective From: Fall 2009**

Biol 638 - Computational Ecology (3-0-3)
An overview of computational approaches to the study of mathematical models in ecology. Topics include one-, two-, and multi-species models, life history analysis, spatial dynamics, epidemiology. The course is taught as a hands-on computer lab in which students explore models, perform simulations and solve problems. **Effective From: Spring 2006**

Biol 641 - Systems Neuroscience (3 credits)
This course will examine neurophysical phenomena from a systems perspective. The course will review basic concepts of cellular neuroscience, such as excitability, impulse conduction, and integration of activity at the cellular, before focusing on network level physiology of the nervous system and its role in the generation of behavior. The goal is to provide students with the basic knowledge to understand neurobiological processes at all levels of complexity. **Effective From: Spring 2011**

Biol 698 - Selected topics in Biology (3-0-3)
Survey of recent research topics in Biology at the Master's level. **Effective From: Spring 2008**

Biol 699 - Selected Topics in Biology (3-0-3)
Survey of recent research topics in Biology at the Masters level. **Effective From: Spring 2008**

Biol 788 - Selected Topics in Biology (3-0-3)
Survey of recent research topics in Biology at the doctoral level. **Effective From: Spring 2008**

Biol 789 - Selected Topics in Biology (3-0-3)
Survey of recent research topics in Biology at the doctoral level. **Effective From: Spring 2008**

Biol 791 - Biology Seminar (0)
This seminar includes student and faculty presentations on current papers, student presentations related to their research and occasional outside speakers. It will acquaint students with possible topics for dissertation search, and provide an opportunity to present and receive feedback on current work.

Biol 794 - Computational Biology Colloquium (1 credit)
Prerequisite: graduate standing. Students and outside speakers present and discuss current research activities in computational biology and related scientific areas.

R120:501 - Neuroanatomy (3 credits)
For more details go to Rutgers Catalog.

R120:503 - Plant Morphology (3 credits)
For more details go to Rutgers Catalog.

R120:504 - Plant Physiology (3 credits)
For more details go to Rutgers Catalog.

R120:505 - Biostatistics and Computer Methodology (3 credits)
For more details go to Rutgers Catalog.

R120:506 - Quantitative Plant Ecology (3 credits)
For more details go to Rutgers Catalog.

R120:509 - Advanced Problems in Biology (1 to 6 credits by arrangement)
For more details go to Rutgers Catalog.

R120:512 - Mammalian Physiology (3 credits)
For more details go to Rutgers Catalog.

R120:515 - Molecular Biology of Eukaryotes (3 credits)
For more details go to Rutgers Catalog.

R120:516 - Microbial Ecology (3 credits)
For more details go to Rutgers Catalog.

R120:517 - Developmental Neurobiology (3 credits)
For more details go to Rutgers Catalog.

R120:518 - Nucleic Acids (3 credits)
For more details go to Rutgers Catalog.

R120:519 - Microbial Metabolism (3 credits)
For more details go to Rutgers Catalog.

R120:523 - Biogeography (3 credits)

For more details go to Rutgers Catalog.

R120:526 - Cell Biology (3 credits)
For more details go to Rutgers Catalog.

R120:530 - Biophysical Membrane Physiology (4 credits)
For more details go to Rutgers Catalog.

R120:532 - Evolution (3 credits)
For more details go to Rutgers Catalog.

R120:536 - Multivariate Biostatistics (3 credits)
For more details go to Rutgers Catalog.

R120:538 - Topics in Molecular Genetics (3 credits)
For more details go to Rutgers Catalog.

R120:548 - Biology of Cancer (3 credits)
For more details go to Rutgers Catalog.

R120:551 - Biology of Pollution (3 credits)
For more details go to Rutgers Catalog.

R120:552 - Paleobotany (4 credits)
For more details go to Rutgers Catalog.

R120:561 - Quantitative and Analytical Light Microscopy (4 credits)
For more details go to Rutgers Catalog.

R120:563 - Developmental Plant Physiology (3 credits)
For more details go to Rutgers Catalog.

R120:564 - Techniques in Developmental Botany (2 credits)
For more details go to Rutgers Catalog.

R120:565 - Medical Mycology (3 credits)
For more details go to Rutgers Catalog.

R120:566 - Neurophysiology and Behavior (3 credits)
For more details go to Rutgers Catalog.

R120:568 - Neuroendocrinology and Behavior Laboratory (3 credits)
For more details go to Rutgers Catalog.

R120:571 - Biochemistry (4 credits)
For more details go to Rutgers Catalog.

R120:573 - Pharmacology (3 credits)
For more details go to Rutgers Catalog.

R120:584 - Plant Responses to the Environment (3 credits)
For more details go to Rutgers Catalog.

R120:585 - Behavioral Ecology (3 credits)
For more details go to Rutgers Catalog.

R120:586 - Landscape Ecology (3 credits)
For more details go to Rutgers Catalog.

R120:587 - Systems Ecology: Ecosystems in the Landscape (3 credits)
For more details go to Rutgers Catalog.

R120:588 - Topics in Advanced Ecology (3 credits)
For more details go to Rutgers Catalog.

R120:589 - Chemical Bases of Neural Function (3 credits)
For more details go to Rutgers Catalog.

R120:593 - Physiological Ecology (3 credits)
For more details go to Rutgers Catalog.

R120:594 - Systematics (3 credits)
For more details go to Rutgers Catalog.

R120:601 - Human Molecular Genetics (3 credits)
For more details go to Rutgers Catalog.

R120:604 - Microbiology: Principles and Applications (3 credits)
For more details go to Rutgers Catalog.

R120:616 - Topics in Biology (1 to 3 credits by arrangement)
For more details go to Rutgers Catalog.

R120:640 - Topics in Immunology (3 credits)
For more details go to Rutgers Catalog.

R120:697 - Neuroendocrinology (3 credits)
For more details go to Rutgers Catalog.

Biomedical Engineering: Offered by the Department of Biomedical Engineering

UNDERGRADUATE COURSES:

BME 101 - Introduction to Biomedical Engineering (1-0-0)
This course is open only to freshmen and new transfer students. Faculty members describe their research in biomedical engineering.

BME 105 - Introduction to Human Physiology I (2-0-2)
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. This course is the first of two freshman courses; this one will focus on cellular and neural-system basic physiology. **Effective From: Fall 2006**

BME 106 - Introduction to Human Physiology II (1-0-1)
Prerequisite: BME 105. 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. This course is the first of two freshman courses; this one will focus on basic physiology of respiratory and cardiovascular systems. **Effective From: Spring 2007**

BME 301 - Electrical Fundamentals of Biomedical Engineering (1-3-3)
Prerequisites: Grade of C or higher in Phys 121 & Math 112, or Math 133. 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 topics. 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. **Effective From: Fall 2012**

BME 302 - Mechanical Fundamentals of Biomedical Engineering (1-3-3)
Prerequisites: Grade of C or higher in Phys 121 & Math 112, or Math 133. BME 301 is not a prerequisite. The format is identical to that of BME 301. 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 biomaterials (tissues), biomechanics (forces and motion), biofluids and biostatistics, and then integrates them with a final design project on neuromuscular engineering. **Effective From: Fall 2012**

BME 303 - Biological and Chemical Foundations of Biomedical Engineering (3-0-3)
Prerequisites: Grade of C or higher in Chem 126 and Phys 121. 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 biomedical engineering, which focus on the application of engineering principles to medicine and surgery.

BME 304 - Material fundamentals of Biomedical Engineering (3-0-3)
Prerequisites: R120:102-Bilogy II with a grade of C or better or BME 303 with a grade of C or better. 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. **Effective From: Fall 2012**

BME 310 - Biomedical Computing (3-1-3)

Prerequisite: Grade of C or higher in BME 301. This course covers the application of digtal signal processing to biomedical problems. Labview, a graphical programming language common in engineering, is used for both signal acquisition and processing. Applications include analysis of the electrocardiogram and other electrical signals generated by the body. **Effective From: Fall 2012**

BME 311 - Co-op Work Experience (3 degree credits)
Prerequisites: sophomore standing, 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 **Effective From: Spring 2013**

BME 333 - Biomedical Signals and Systems (3-0-3)
Prerequisites: BME 310 and Math 222. 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. **Effective From: Fall 2006**

BME 351 - Introduction to Biofluid Mechanics (3-0-3)
Prerequisites: BME 302 and Mech 236. Recommended co-requisite: Mech 320. 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 bioengineering 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 bioengineering. **Effective From: Spring 2007**

BME 372 - Biomedical Electronics (3-0-3)
Prerequisite: BME 301. The first of a two-semester sequence. It 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. Pspice 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 (3-0-3)
Prerequisite: BME 372. A continuation of BME 372 emphasizing biomedical applications of oscillators, active filters, and wave-shaping circuits.

BME 381 - Engineering Models in Physiology I (3-2-3)
Prerequisites: Math 222, BME 106 and Phys 121. Some knowledge of programming required. Mathematical models of organs and organ systems are described from an engineering viewpoint. Anatomy and physiology are quantified. Heart and circulation, gas exchange in the lungs, electrical properties of excitable membranes, renal countercurrent mechanism and muscle mechanics are among the topics covered. Emphasis will be placed on feedback control, mathematical modeling and numerical simulation. **Effective From: Spring 2006**

BME 382 - Engineering Models in Physiology II (3-2-3)
Prerequisites: Math 222, BME 106 and Phys 121. BME 381 is not a prerequisite. Some knowledge of programming required. Mathematical models of organs and organ systems are described from an engineering viewpoint. Anatomy and physiology are quantified. Heart and circulation, gas exchange in the lungs, electrical properties of excitable membranes, renal countercurrent mechanism and muscle mechanics are among the topics covered. **Effective From: Spring 2006**

BME 383 - Measurement Lab for Physiological Systems & Tissue (1-3-3)
Prerequisites: BME 105, BME 106, BME 302, BME 310. 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, and epithelial transport. **Effective From: Spring 2008**

BME 384 - Biomechanics Laboratory (1-3-3)
Prerequisites: BME 105, BME 106, BME 301, BME 302 and CS 101. 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. **Effective From: Spring 2009**

BME 385 - Cell and Biomaterial Engineering Laborarory (1-3-3)
Prerequisite: BME 303. Co-requisite: BME 420. This laboratory course is designed to provide students with valuable hands-on experience in the field of cell 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. **Effective From: Spring 200**

BME 386 - Bioinstrumentation Laboratory (1-3-3)
Prerequisites: ECE 251, BME 372 and BME 373. Laboratory exercises involve projects at all levels of a bioinstrumentation system from sensors to data acquisition and data processing. Analog and digital 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 develope the skills to integrate various parts of a bioinstrumentation system, collect and analyze data and troubleshoot a circuit. **Effective From: Spring 2009**

BME 411 - Co-op Work Experience (0 credits)
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. **Effective From: Fall 2011**

BME 420 - Advanced Biomaterials Science (3-0-3)
Prerequisites: BME 304 and (MTSE 301 or MECH 320). 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. **Effective From: Fall 2012**

BME 422 - Biomaterials Characterization (3-0-3)
Prerequisites: BME 420 or MTSE 301. 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. **Effective From: Spring 2007**

BME 427 - Biotransport (3-0-3)
Prerequisite: Math 222 and CHE 230. Introduction to basic concepts in thermodynamics and transport phenomena as applied to biological systems. The structure and composition of the body will be covered followed by an exploration of 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). Design of artificial kidneys and heart-lung machines is also explored.

BME 430 - Fundamentals of Tissue Engineering (3-0-3)
Prerequisite: BME 420. 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. **Effective From: Fall 2006**

BME 451 - Biomechanics I (3-0-3)
Prerequisites: Mech 320 and BME 351. 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. **Effective From: Fall 2007**

BME 452 - Mechanical Behavior & Performance of Biomaterials (3-0-3)
Prerequisite: BME 302, BME 304, MATH 222, and MECH 320. 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. **Effective From: Spring 2013**

BME 469 - Introduction to Human Physiology (3-0-3)
This course is not open to Biomedical Engineering students. Available to non-biomedical engineering students who have an interest in going on to medical, dental or allied health careers. An introduction to mammalian physiology, particularly the heart, circulation, lungs and kidneys. **Effective Until: Fall 2003**

BME 478 - Introduction to CAD for Biomechanics (2-2-3)

Prerequisites: BME 302 and Mech 320. 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 applicaiton of design principles to standard problems in biomedical design. **Effective From: Spring 2007**

BME 479 - BioMicroElectroMechanical Systems (3-0-3)
Prerequisites: Chem 126 and Phys 121. Knowledge of mechanics, optics, electromagnetism and general chemistry. Micro- and nanosystems used in advanced analytical techniques for microfluidic devices, implantable chips, non-invasive biomedical sensors, DNA chips and microelectronic array systems. Microelectronic processing design for micromaching and piezoelectric materials for biomedical applications. Biomedical sensors and actuators. BioMEMS active ultrasonic transducers for medical imaging, for micro-valves and for implantable medication delivery systems are studied.

BME 488 - Introduction to Nanotechnology (2-2-3)
This course introduces students to nanotechnology through a variety of topics that cover nanoscience and nanotechnology from different points of view including engineering, chemistry, biology, management, ethics, public safety and policy, mathematics, etc. The course is designed in a studio format that complements lectures with hands-on experimental activities. The course will feature on or two lectures per semester given by invited nanotechnology-experts from NJIT or elsewhere. This course is mandatory for any student willing to take the Minor in Nanotechnology. **Effective From: Spring 2014**

BME 489 - Medical Instrumentation (3-0-3)
Prerequisites: BME 373, BME 310 and ECE 251. The hardware and instrumentation needed to measure variables from different physiological systems. Electrodes, sensors and transducers. Bioelectric amplifiers. Hardware for measurement of the ECG, EEG, EMG, respiratory system, nervous system . Clinical laboratory instruments. Medical ultrasound. Electrical safety. Computers in biomedical instrumentation.

BME 491 - Research and Independent Study I (3-0-3)
Needs permission of professor. Senior standing. Planning and execution of engineering projects. Intellectual property: publications and priority documents; invention disclosures and patents. Safety: engineering codes and standards. Engineering ethics. Professional organizations. Professional registration. Preparation of a technical proposal for a senior project and its approval are required.

BME 492 - Research and Independent Study II (1-2-3)
Needs permission of professor. A biomedical engineering design project, selected by the student, which has been approved in BME 491. Involves information from the professional literature, research, design and prototype testing. An oral presentation and a written report are required.

BME 495 - Capstone Design I (2-3-3)
Prerequisites: BME 372 or BME 420 or BME 351. Senior standing or permission of the instructor. To provide students with the guidance to choose a capstone design topic and advisor and to prepare the design proposal. The course introduces the student to the definition of design as well as introducing issues of intellectual property, bioethics and safety, and professional societies. **Effective From: Fall 2008**

BME 496 - Capstone Design 2 (2-5-3)
Prerequisites: BME 495 Implementation of the project approved in BME 491. 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. **Effective From: Fall 2008**

GRADUATE COURSES:

BME 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

BME 601 - Seminar (3 credits)
Required every semester of all master's students in biomedical engineering who receive departmental or research-based support and all doctoral students. To receive a satisfactory grade, students must attend at least five seminars per semester, as approved by the seminar supervisor.

BME 611 - Engineering Aspect of Molecular and Cellular Bio I (1 credit)
Molecular and cellular biology is a foundation of the understanding of the biological sciences and is vital to the study of advanced biomedical engineering. This course is to be taken simultaneously with UMDNJ N551 to enrich the crossover between engieering

and life sciences. Course topics parallel those covered in N551 and both add engineering relevance, and provide engineering students with a stronger understanding of molecular and cellular biology. For students in joint BME PhD program. **Effective From: Fall 2009**

BME 612 - Engineering Aspects of Molecular and Cellular Bio 2 (1 credit)
Molecular and cellular biology is a foundation of the understanding of the biological sciences and is vital to the study of advanced biomedical engineering. This course is to be taken simultaneously with UMDNJ N552 to enrich the crossover between engineering and life sciences. Course topics parallel those covered in N552 and both add engineering relevance, and provide engineering students with a stronger understanding of molecular and cellular biology. For students in joint BME PhD program. **Effective From: Fall 2009**

BME 627 - Introduction to Biomedical Engineering (3 credits)
Prerequisite: undergraduate courses in thermodynamics and differential equations. Introduction to the structure and composition of the body followed by an exploration of the properties of the blood and its flow in the cardiovascular system; 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). Design of artificial kidneys and heart-lung machines is also explored. Same as ChE 627.

BME 651 - Principles of Tissue Engineering (3-0-3)
Tissue Engineering is a therapeutic approach to treating damaged or diseased tissues in the biotechnology industry. In essence, new and functional living tissue can be fabricated using living cells combined with a scaffolding material to guide tissue development. Such scaffolds can be synthetic, natural, or a combination of both. This course will cover the advances in the fields of cell biology, molecular biology, and materials science towards developing novel "tissue engineered" materials. **Effective From: Spring 2005**

BME 652 - Cellular and Molecular Tissue Engineering (3 credits)
This course explores molecular, cellular and tissue level interactions that are an important component of all tissue engineering strategies. Topics include how a cell moves, reacts and maintains viability and function based on its surroundings. We will discuss how to engineer our materials, tissue grafts and implants to integrate with the body. We will also lìearn about bodily reactions and the biocompatibility of tissue engineered devices such as immunoreactivity and blood coagulation. **Effective From: Spring 2010**

BME 653 - Micro/Nanotechnologies for Interfacing Live Cells (3 credits)
In this course, we will study technologies and tools available for interfacing live cells from a sub-cellular, single-cell, and multi-cellular (tissue models) approach. We will introduce key concepts of the biology of cells and tissues and will explore the technologies (micro-/nanotechnologies) and tools (sensors and actuators) available for the investigation of cell and tissue biology. Same as ECE 653. **Effective From: Spring 2010**

BME 654 - Cardiovascular Mechanic (3 credits)
Fundamental biomechanical mechanisms at work in the cardiovascular system. Topics include the fundamental molecular structure of heart muscle, the biomechanical principles that transform the contraction of heart muscle into stress-strain functions of muscle fibers, pressure-volume flow relations in the vasculature when it is considered as a hemodynamic (blood hydraulic) system, growth and disease of the cardiovascular system, resistance, compliance, inertance, and catheter-tip transducers. **Effective From: Fall 2011**

BME 655 - Advanced Characterization of Biomaterials (3-0-3)
Methods used to discover the structures of proteins, enzymes, DNA, and carbohydrates at the molecular level, as well as complex structures such as collagen, the chromosome, and the cell. Topics will include protein and DNA sequencing, separation methods, and spectroscopies such as 2 and 3D NMR, x-ray diffraction, SEM, AFM and microscopic imaging techniques. **Effective From: Spring 2012**

BME 661 - Neural Engineering (3 credits)
Neural Engineering focuses on understanding how the brain functions using engineering principles. The course discusses different instrumentation and signal processing algorithms to study how the brain functions, how to detect different pathologies and new applications for research. Topics include; basic overview of neurology, vector populations, neural networks, vision research, functional MRI, functional electrical stimulation, neural prosthetics, and other advanced research topics studying neurology.

BME 667 - Bio-Control Systems (3 credits)
The course provides an introduction to dynamic and control in biological systems, with particular emphasis on engineering aspects of biological oscillators/waves which govern the basic operations of all living organisms and especially higher order life forms. 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. Same as ECE 667. **Effective From: Spring 2010**

BME 668 - Medical Imaging Systems (3 credits)
This course provides a detailed introduction to medical imaging physics, instrumentation, data acquisition and image processing systems for reconstruction of multi-dimensional anatomical and functional medical images. Three-Dimensional medical imaging modalities including X-ray, Computer Tomography, Magnetic Resonance Imaging, Single Photon Emission Computer Tomography, Positron Emission Tomography, Ultrasound and optical imaging modalities are included. Same as ECE 668. **Effective From: Spring 2010**

BME 669 - Engineering Physiology (3 credits)
To enable students to apply basic tools in engineering analysis, mathematics, computer science, general physics and chemistry courses so that they can develop models that quantitatively predict the functioning of physiological systems in the human body. To enable students to apply engineering systems analysis to systematic physiology and employ the ideas of feedback control, signal procession, mathematical modeling and numerical simulation. Same as ECE 669. **Effective From: Spring 2010**

BME 670 - Introduction to Biomechanical Engineering (3 credits)
Prerequisites: undergraduate thermodynamics, statics, and dynamics. Introduction to biomechanical engineering of physiological systems; fluid flow, structural, motion, transport, and material aspects; energy balance of the body, and the overall interaction of the body with the environment. Same as ME 670.

BME 671 - Biomechanics of Human Structure and Motion (3 credits)
Prerequisites: undergraduate statics, kinematics, and dynamics. Principles of engineering mechanics and materials science applied to human structural and kinematic systems and to the design of prosthetic devices. Topics include anatomy; human force systems; human motion; bioengineering materials; and design of implants, supports, braces, and replacements limbs.

BME 672 - Biomaterials (3 credits)
Prerequisite: Mech 232 (see undergraduate catalog for description) or the equivalent. Materials and processes used to develop devices that are implanted in the human body; clinical aspects of biomechanical engineering; federal government requirements for design and testing of human implant devices; biocompatibility, metal implant devices, material design parameters, plastic and ceramic devices, sterilization techniques, and their effect on biocompatibility.

BME 673 - Biorobotics (3 credits)
Basics of control of a robot and telemanipulation are studied. Computer simulations, MATLAB are used to explore biomimetic autonomous robots. This is a studio-based course with hands-on exercises with small robots and actuators. Topics include understanding how biological robots (humans and animals) differ from designed robots, as well as sensors (touch, stereo and position), actuators (muscles, smart materials), and intelligent (neural and computer controlled systems. **Effective From: Spring 2009**

BME 674 - Principles of Neuromuscular Engineering (3 credits)
Neurophysiology, motor control and robotics are used to study the human motor system. Sensorimotor learning and acquisition of new motor skills are emphasized. Topics include the central nervous system, muscle properties, spinal motor circuitry and dynamics of limb motion. The relation of motor control problems to neurophysiology of the motor system and how motor disorders affect movement control are studied. MATLAB and Simulink are used in simulations and movement date analysis. **Effective From: Fall 2009**

BME 675 - Computer Methods in Biomedical Engineering (3 credits)
This course uses MATLAB to concentrate on methods that allow students to produce original software that can be used to acquire, process, analyze and present data. Topics include advanced graphics and animation, graphical user interfaces, interfacing to and data acquisition from laboratory instrumentation, filtering and processing of acquired data, and interfacing to user interfaces (e.g. joysticks). Applications in speech, bioelectrical signals, images and virtual reality will be included. **Effective From: Fall 2009**

BME 676 - Computational Biomechanics (3 credits)
Prerequisites: BME 670 or equivalent. The use of commercially available software to solve complex engineering problems has become standard practice to reduce time and cost and results in a better product. This is an intro course on computational methods and the use of commercial software such as ANSYS, Fluent, and MATLAB to solve problems related to the BME device industry. Suitable for students interested in Computer Aided Design and Engineering (CAD/CAE). **Effective From: Fall 2010**

BME 677 - CAD for Biomechanics and Biomaterials (3-0-3)
Introduction to Computer Aided Design theory and application using software. Topics include datum planes, extrude, cut, sweep, swept cuts, and parallel, rotational, and general blends. Assemblies and generating, dimensioning, editing, and modifying drawing views and creation of balloons, imaging and scanning techniques of anatomical structures such as bone and arteries and 3D printing are also covered. **Effective From: Fall 2011**

BME 678 - Design of Orthopedic Implants (3-0-3)

Prerequisites: BME 677. First of a two part course on design of orthopedic implants using ProEngineer. Additional topics include machanical properties of implant materials, material selection and introduction to FEA. Methods for prototype development with the use of 3D printing will also be discussed. A critical objective of this course is the preparetion of design reports and project presentations. **Effective From: Spring 2012**

BME 679 - Advanced Design of Orthopedic Implants (3-0-3)
Prerequisites: BME 677, BME 678 or equivalent. Advanced modeling techniques for the design of hip, knee, and spine implants. Mechanical properties of materials, including wear and failure modes associated with typical implants. Kinematics and surgical protocols of implants will be discussed. Course will cover assemblies and FEA analysis of implants. Additional topics include large deformations, fatigue, optimization, review and analysis of results. **Effective From: Fall 2011**

BME 680 - BioMEMS Design and Applications (3 credits)
The advance of bioMEMS (Micro Electrical Mechanical Systems) technology is a key component in making the next generation medical diagnostic tools possible. We will learn how bioMEMS devices are fabricated and combine engineering analysis with knowledge of known biological responses and biomolecule interactions to understand how bioMEMS are designed and function. Topics will include biological, mechanical, electrical, and chemical biosensors, and microfluidics as applied to biotechnology. **Effective From: Fall 2009**

BME 681 - Medical Imaging (3 credits)
The basic principles of medical imaging: physical basis, signal acquisition, image formation and image processing. Image modalities include x-rays, computed tomography CT), magnetic resonance imaging (MRI), ultrasound, positron image tomography (PET), and functional MRI (fMRI).

BME 683 - BioMicroElectroMechanical Systems (3 credits)
Prerequisites: Knowledge of mechanics, optics, electromagnetism and general chemistry. Micro- and nanosystems used in advanced analytical techniques for microfluidic devices, implantable chips, non-invasive biomedical sensors, DNA chips and microelectronic array systems. Microelectronic processing design for micromaching and piezoelectric materials for biomedical applications. Biomedical sensors and actuators. BioMEMS active ultrasonic transducers for medical imaging, for micro-valves and for implantable medication delivery systems are studied.

BME 684 - Medical Device Development (3 credits)
This course will provide a detailed overview of medical device development from a realistic industrial and academic perspective. The processes used in corporations and academic laboratories to conceive and develop devices will be explored from a research, regulatory, clinical, QA/QC, marketing, engineering, and legal perpective under the umbrella of project management techniques. Material will be presented as an aide to students who wish to decide on careers in either industry or academia. **Effective From: Fall 2010**

BME 686 - Intro. to Instrumentation for Physiomeasurements (3-0-3)
Introduction to instrumentation for students without instrumentation background only. This course teaches the hardware and instrumentation needed to measure variables from different physiological systems. Electrodes, sensors and transducers, bioelectric amplifiers safety and digital acquisition will be discussed. Hardware for measurement of the ECG, EEG, EMG, respiratory system, nervous system, clinical laboratory instruments, electrical safety and computers in biomedical instrumentation. **Effective From: Fall 2011**

BME 687 - Design of Medical Instrumentation (3 credits)
Prerequisite: undergraduate course in electronics. Principles and practice of medical instrumentation. Instrument components and medical instrument systems design. Examples taken from electrocardiography, clinical chemistry, medical imaging. Microprocessor-based systems emphasized.

BME 698 - Selected Topics (3 credits)
Selected topics for Biomedical Engineering.

BME 700 - Master's Project (3 credits)
Prerequisite: written approval of project advisor. An extensive paper involving design, construction, and analysis, or theoretical investigation. Joint projects with industry or governmental agencies may be acceptable. Work is carried out under the supervision of a member of the department faculty.

BME 701 - Master's Thesis (6 credits)
Prerequisite: written permission from thesis advisor. Projects include design, construction, experimental or theoretical investigation of the engineering applications to the diagnosis and/or treatment of disease. Research may be in cooperation with industry or medical institutions. Completed work should be of sufficient quality to be acceptable for publication. Oral presentations are required.

BME 710 - Foundations of Biomedical Research (3 credits)
This course provides an overview of biomedical research issues as they relate to biomedical engineering. The course provides students with a working knowledge of the fundamental tools of: 1) a critical literature review, 2) research design, 3) bioethics, 4) statistical analysis of data, 5) protection of animal and human subjects, 6) patent protection and 7) FDA regulations.

BME 725 - Independent Study I (3 credits)
Prerequisite: departmental approval. Program of study prescribed and approved by student's faculty coordinator. This special course covers areas of study in which one or more students may be interested but is not of sufficiently broad interest to warrant a regular course offering. Master's degree students cannot count BME 725 as degree credit but can count these credits to qualify for full-time status.

BME 726 - Independent Study II (3 credits)
Prerequisite: departmental approval. Program of study prescribed and approved by student's faculty coordinator. This special course covers areas of study in which one or more students may be interested but is not of sufficiently broad interest to warrant a regular course offering. Master's degree students cannot count BME 725 as degree credit but can count these credits to qualify for full-time status. This course is not available to master's students.

BME 774 - Principles of Neurorehabilitation (3 credits)
This is a research-focused course providing in-depth review of current studies in the following fields: Pathophysiology of disability; Advanced therapeutic interventions; Emerging neurorehabilitation technologies that are intended to encourage neural reorganization and relearning; Novel interfaces through chronic implementation in the brain, spinal cord and muscles used in deep brain stimulation, brain-machine interfaces, and functional electrical stimulation and Methods of assessing outcomes. **Effective From: Spring 2010**

BME 788 - Selected Topics (3 credits)
Selected topics for Biomedical Engineering.

BME 790 - Doctoral Dissertation (Credits as designated)
Required of all students working toward the Ph.D. in Biomedical Engineering. A minimum of 36 credits is required. The student must register for at least 6 credits of dissertation per semester; registration for additional credits may be permitted beyond the 6, with the approval of the advisor, up to a maximum of 12 credits per semester. If the student is still actively engaged in the research after completion of 36 credits, continued registration of 3 credits per semester is required.

BME 792 - Pre-Doctoral Research (3 credits)
Prerequisite: Permission of the department. For students admitted to the program leading to the Ph.D. in Computer Engineering or Electrical Engineering. Research carried on under the supervision of a designated member of the department faculty. If the student's research activity culminates in doctoral research in the same area, up to a maximum of 6 credits may be applied toward the 36 credits required under BME 790 after the student fulfills requirements of doctoral candidacy.

UMDNJ 313 - Membranes and Transport (null)
For more details go to UMDNJ website.

UMDNJ 501 - General Pathology (null)
For more details go to UMDNJ website.

UMDNJ 5040 - Biostatistics (null)
For more details go to UMDNJ website.

UMDNJ 507 - Introduction to Animal Experiments (null)
For more details go to UMDNJ website.

UMDNJ 602 - Principles of Pharmacology (null)
For more details go to UMDNJ website.

UMDNJ 605 - Advanced Biometrics (null)
For more details go to UMDNJ website.

UMDNJ 610 - Topics in Biochemical Pharmacology (null)
For more details go to UMDNJ website.

UMDNJ 612 - Clinical Pharmacology (null)
For more details go to UMDNJ website.

UMDNJ 701 - Human Physiology (null)
For more details go to UMDNJ website.

UMDNJ 703 - General Endocrinology (null)
For more details go to UMDNJ website.

UMDNJ 704 - Neuroscience (null)
For more details go to UMDNJ website.

UMDNJ 705 - Cardiorespiratory Physiology (null)
For more details go to UMDNJ website.

UMDNJ 715 - Neurophysiology Seminar (null)
For more details go to UMDNJ website.

UMDNJ 716 - Microcirculatory Physiology (null)
For more details go to UMDNJ website.

Career Development Services : Career Development Services

UNDERGRADUATE COURSES:

CDS 201 - Career Development Seminar (1-0-0)
This eight-week course is a requirement for all Career Advancement Program (CAP) sophomore students and is open to all students with higher than first-year standing who have an interest in career exploration and development. Learn effective job search strategies, how to explore and develop career objectives, prepare resumes and cover letters, how to research organizations, and improve interviewing skills. Through discussion, group exercises and actual interview practice sessions, become better prepared to begin the career development and job search process. Guest lecturers from the private and public sectors add a real-world perspective to the classroom experience.

Chemical Engineering : Offered by the Otto H. York Department of Chemical, Biological and Pharmaceutical Engineering.

UNDERGRADUATE COURSES:

ChE 101 - Introduction to Chemical Engineering (1-0-0)
Prerequisites: None. An introduction to the field of chemical engineering and to the Otto H. York Department of Chemical Engineering. Topics include the curriculum, tours of department teaching laboratories and computing facilities, undergraduate research opportunities, cooperative employment, and student professional societies. Also included are visits by alumni who discuss their careers after graduation from the department.

ChE 210 - Chemical Process Calculations I (3-0-2)
Prerequisites: Chem 126 (or Chem 122). Corequisites: Math 112 and CS 101. 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. **Effective From: Fall 2009**

ChE 210W - Chemical Process Calculations I (0-1-0)
Workshop **Effective From: Fall 2008**

ChE 221 - Material Balances (4-0-4)
Prerequisites: Chem 126 or Chem 123, and Math 112. Co-requisites: CIS 101, FED 101. An introduction to the analysis of chemical processes with special emphasis on steady state mass balances. The course introduces mass balances in unsteady state. **Effective Until: Spring 2005**

ChE 230 - Chemical Engineering Thermodynamics I (3-0-3)
Prerequisites: Chem 126, (or Chem 122), 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. **Effective From: Fall 2008**

ChE 230W - Chemical Engineering Thermodynamics I Workshop (0-1-0)
Workshop **Effective From: Fall 2008**

ChE 232 - Chemical Engineering Thermodynamics I (2-2-3)
Prerequisite: ChE 221. Corequisite: Chem 231. A course emphasizing the concepts of energy balances and energy balance calculations. Uses engineering correlations and thermodynamics to estimate properties used in batch and flow systems. **Effective Until: Fall 2005**

ChE 240 - Chemical Process Calculations II (3-0-3)
Prerequisites: ChE 210, ChE 230, Math 211 (or Math 213). Corequisite: Math 222. 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. **Effective From: Fall 2008**

ChE 240W - Chemical Process Calculations II (0-1-0)
Workshop **Effective From: Fall 2008**

ChE 260 - Fluid Flow (3-0-3)
Prerequisite: ChE 230. Corequisite: ChE 240, 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. **Effective From: Fall 2005**

ChE 310 - Co-op Work Experience I (0-0-3)

(3 degree credits). Prerequisites: 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 **Effective From: Spring 2013**

ChE 311 - Co-op Work Experience II (0-0-0)
(0 credits) Prerequisites: ChE 310. Requires permission of undergraduate advisor. Cannot be used for degree credit. **Effective From: Spring 2011**

ChE 312 - Chemical Process Safety (3-0-3)
Prerequisite: Junior standing. 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. **Effective From: Spring 2011**

ChE 342 - Chemical Engineering Thermodynamics II (3-0-3)
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. **Effective From: Fall 2005**

ChE 349 - Kinetics and Reactor Design (3-0-3)
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. **Effective From: Fall 2005**

ChE 360 - Separation Processes I (3-0-2)
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. **Effective From: Fall 2008**

ChE 363 - Transport Operations I (3-0-3)
Prerequisites: ChE 232, Phys 111, CIS 101, and FED 101. Corequisite: Math 222 Considers principles of the molecular and turbulent transport of momentum, particularly as they apply to pressure drop calculations in piping systems, packed columns, and other flow devices. Also considered is flow around submerged objects. **Effective Until: Spring 2007**

ChE 364 - Transport Operations II (3-0-3)
Prerequisites: ChE 232, Math 222. Corequisite: ChE 363. The principles of molecular and turbulent transport of energy are considered, particularly as they apply to design of heat exchangers. Also considered is radiant heat transfer. **Effective Until: Spring 2011**

ChE 365 - Techniques for Process Simulation (3-0-2)
Prerequisites: ChE 370. Corequisite: ChE 360. This course reviews chemical engineering applications of LaPlace transforms, partial fractions, and linear algebra in preparation for the ChE course in process control. It introduces dedicated software for chemical process simulation and control used in the senior capstone courses. **Effective From: Fall 2010**

ChE 367 - Diffusional Systems (3-0-3)
Prerequisites: ChE 363, Math 222. Covers principles of molecular and turbulent transport of mass, particularly as they apply to design of packed columns, and other mass transfer devices. **Effective Until: Spring 2007**

ChE 370 - Heat and Mass Transfer (4-0-4)
Prerequisites: 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. **Effective From: Fall 2005**

ChE 375 - Structure, Properties and Processing of Materials (3-0-3)
Prerequisites: Chem 236, (or Chem 235), Mech 320 (can be taken as co-requisite). Tailoring materials properties by engineering their microscopic/macroscopic structures via processing is central to product design and development in the chemical industry. 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 the chemical process industry. **Effective From: Fall 2004**

ChE 380 - Introduction to Biotechnology (3-0-3)
Prerequisites: Chem 122 or Chem 126. Basic principles of molecular biotechnology with selected examples of applications. **Effective From: Fall 2004**

ChE 396 - Chemical Engineering Laboratory I (0-5-3)
Prerequisites: ChE 370, Eng 352. 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. **Effective From: Fall 2005**

ChE 402 - Applied Optics in Chemical Engineering (3-0-3)
Prerequisites: Junior or senior standing in chemical engineering. Combined laboratory and lecture course emphasizing photonics and laser applications in chemical engineering.

ChE 411 - Work Experience III (0 credits)
Prerequisites: ChE 311. Continuation of ChE 311. Cannot be used for degree credit. **Effective From: Fall 2011**

ChE 427 - Biotransport (3-0-3)
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. **Effective From: Spring 2004**

ChE 444 - Introduction to Polymer Engineering (3-0-3)
Prerequisites: 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 (3-0-2)
Prerequisites: ChE 360. This second course in separations examines non-traditional methods and technologies such as fixed-bed processes, membranes, crystallization, and mechanical separations. **Effective From: Fall 2008**

ChE 461 - Fate and Transport of Pollutants in the Environment (3-0-3)
Prerequisites: Math 222, Chem 235 or Chem 360, ChE 370 or CE 320. The overall objective of this course is to introduce students to concepts, mechanisms, and models used to describe the transport of chemicals in the environment. Two of the most important parameters in mass transport are the driving force or concentration gradient and the transport mechanism. Methods for defining these parameters are discussed during the first six weeks of the class. Concepts and models presented in the first six weeks are applied to air-water, sediment-water, and soil-air interfaces during the rest of the term. The semester ends with a group project, where students are asked to apply material from the course to resolve a comprehensive problem. **Effective Until: Spring 2011**

ChE 466 - Pollution Control in Chemical Processes (3-0-3)
Prerequisites: ChE 349, ChE 360. A course applying chemical engineering principles to the appropriate treatment of gaseous and liquid effluents from manufacturing and utility plants. The course will take into consideration toxicity, safety, and economic constraints. A case study approach is used to evaluate processes and pinpoint pollution sources. Quantitative designs and calculations will be required. **Effective Until: Spring 2011**

ChE 468 - Air Pollution Control Principles (3-0-3)
Prerequisites: ChE 360, ChE 349. A course focusing on the sources and control of air pollution. The course emphasizes design of modern air pollution control equipment and associated economics. **Effective Until: Spring 2011**

ChE 471 - Equilibrium Stage Processes (3-0-3)
Prerequisite: ChE 342, ChE 364. Corequisite: ChE 367. Covers the design of distillation columns, extraction columns, leaching, and other stagewise separation processes. **Effective Until: Fall 2007**

ChE 472 - Process and Plant Design (4-0-4)
Prerequisites: ChE 349, ChE 365, ChE 375, ChE 380, ChE 460, IE 492. A capstone course in the chemical engineering program. This class is divided into three- or four-person groups. Each group must complete an open-ended process design problem,

including equipment specification and economics. **Effective From: Fall 2001**

ChE 472H* - Process and Plant Design Honors (4-0-4)
Same as ChE 472, with special projects for Honors students.

ChE 473 - Mathematical Methods in Chemical Engineering (3-0-3)
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 (3-0-3)
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. **Effective From: Fall 2010**

ChE 477 - Process Dynamics and Control (4-0-4)
Prerequisites: ChE 349, ChE 363, ChE 364. Mathematical description of transient and steady state behavior of chemical engineering processes. Study of the open-loop response of output process variables to varying inputs. Theory and applications of chemical process control. **Effective Until: Fall 2007**

ChE 485 - Chemical Engineering Laboratory I (1-6-4)
Prerequisites: Chem 235A, ChE 363, ChE 364, Math 225. Engineering experimentation and data analysis. Experiments are conducted in the areas of fluid mechanics and heat transfer. Bench and pilot-scale equipment is used. Results are presented in both oral and written reports. **Effective Until: Fall 2007**

ChE 486 - Chemical Engineering Laboratory II (0-8-4)
Prerequisites: ChE 349, ChE 367, ChE 471, ChE 485. Corequisite: ChE 477. Engineering experimentation and data analysis. Experiments are conducted in the areas of distillation, extraction, and chemical/biochemical reactions. Bench and pilot-scale equipment is used. Results are presented in both oral and written reports. **Effective Until: Fall 2007**

ChE 486H - Chemical Engineering Laboratory II Honors (0-8-4)
Same as ChE 486, with special projects for Honors students. **Effective Until: Fall 2007**

ChE 489 - Process Dynamics and Control (2-2-3)
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. **Effective From: Fall 2005**

ChE 490 - Special Topics in Chemical Engineering (3-0-3)
Prerequisites: ChE 349, ChE 360. Topics of current interest in chemical engineering, such as supercritical fluid extraction, combustion research, environmental problems, biotechnology, technologies in hazardous and toxic substance management, etc. As interests develop, other topics will be considered.

ChE 491 - Research and Independent Study I (3-0-3)
Prerequisites: 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 491H - Research and Independent Study I Honors (3-0-3)
Same as ChE 491, with special projects for Honors students.

ChE 492 - Research and Independent Study II (3-0-3)
Prerequisite: ChE 491. A continuation of ChE 491.

ChE 492H - Research and Independent Study II Honors (3-0-3)
Prerequisite: ChE 491H. Same as ChE 492, with special projects for Honors students.

ChE 496 - Chemical Engineering Laboratory II (0-6-3)
Prerequisites: ChE 349, ChE 360, ChE 380, ChE 396, Chem 339, Math 225A. Corequisites: ChE 460, ChE 489. 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. **Effective From: Fall 2005**

GRADUATE COURSES:

ChE 501 - Fundamentals of Chemical Engineering I (6 credits)
Prerequisites: Math 222 or equivalent, Chem 231 or equivalent(see undergraduate catalog descriptions). An intensive course in basic chemical engineering science intended for students in the bridge program. Topics include material and energy balances, thermodynamics, kinetics and reactor design, and staged separation processes. May not be taken for degree credit in any chemical engineering program.

ChE 502 - Fundamentals of Chemical Engineering II (4 credits)
Prerequisites: Math 222 or equivalent (see undergraduate catalog for description), ChE 501 or equivalent. A continuation of ChE 501. An intensive course in basic chemical engineering science intended for students in the bridge program. Topics include fluid mechanics, heat transfer and diffusion-controlled processes. May not be taken for degree credit in any chemical engineering program.

ChE 503 - Introduction to Polymer Science and Engineering (3 credits)
Prerequisite: Undergraduate degree in science or engineering. The course is intended for students whose prior undergraduate degree did not include study of polymer science or engineering. The course provides introductory concepts in four main areas: fundamentals of polymeric material including structural and chemical aspects; synthesis reactions of polymers; polymer properties including an introduction to viscoelastic behavior; and polymer technology including processing and shaping methods for specific products.

ChE 551 - Principles of Mass Transfer (3 credits)
Prerequisites: undergraduate thermodynamics and integral calculus. An introductory course in basic concepts of mass transfer. Special emphasis is placed on mass transfer concepts applicable to stage and continuous operations. Topics covered include evaporation, gas absorption, and distillation. Cannot be used for degree credit in Chemical Engineering. **Effective Until: Spring 2005**

ChE 590 - Graduate Co-op Work Experience I (3 additive credits)
Prerequisite: permission from department and Division of Career Development Services. Cooperative education internship provides on-the-job reinforcement of the academic program by placement in major-related work situations. Work assignment developed or approved by the co-op office and evaluated by the department. Cannot be used for degree credit.

ChE 591 - Graduate Co-op Work Experience II (3 additive credits)
Prerequisite: permission from department and Division of Career Development Services.

ChE 592 - Graduate Co-op Work Experience III (3 additive credits)
Prerequisite: permission from department and Division of Career Development Services.

ChE 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

ChE 599 - Methods for Teaching Assistants and Graduate Assistants (3 credits)
Prerequisite: graduate standing. Required for all chemical engineering teaching assistants and graduate assistants. Covers techniques of teaching, interaction with students, and safety. Does not count as degree credit.

ChE 602 - Selected Topics in Chemical Engineering I (3 credits)
Prerequisite: graduate standing and permission of the instructor. Topics of current interest in chemical engineering.

ChE 603 - Separation Process Principles (3-0-3)
Prerequisites: ChE 342, ChE 349, ChE 363, ChE 364, ChE 367, ChE 471. The course covers the basic principles of separation with or without chemical reaction in phase equilibrium-based, external field-driven and membrane-based separation processes. **Effective From: Fall 2004**

ChE 604 - Membrane Separation Processes (3-0-3)
Prerequisites: ChE 342, ChE 349, ChE 363, ChE 364, ChE 367, ChE 471. This course covers the science, technology, engineering analysis and design of membrane separation processes, membrane reactors, membrane-based equilibrium separation processes and hybrid membrane processes. **Effective From: Spring 2005**

ChE 611 - Thermodynamics (3 credits)
Prerequisites: undergraduate courses in physical chemistry and thermodynamics, or equivalent. Principles of thermodynamics

developed quantitatively to include thermodynamic functions and their application to chemical engineering processes.

ChE 612 - Kinetics of Reactions and Reactor Design (3 credits)
Prerequisite: undergraduate course in chemical engineering kinetics, or equivalent. Elements of optimum design introduced for reactor types, series and parallel reactor systems, multiple reactions, and temperature effects. Introduction to non-ideal reactor design. Study of various models for catalytic and non-catalytic solid-fluid reactions.

ChE 619 - Nano-scale Characterization of Materials (3 credits)
The course presents the basics of nanotechnology and the principles and application of advanced instrumentation for the characterization of nanostructures. Topics include atomic force microscopy; near-field optics, dielectric spectroscopy, and light scattering. The significant component of the course is laboratory work at the W. M. Keck Foundation Laboratory and research project. **Effective From: Fall 2007**

ChE 623 - Heat Transfer (3-0-3)
Prerequisite: undergraduate course in heat transfer. Heat transmission applied to practical problems in design. An introduction will include review of conduction, convection and radiation heat transfer modes. Related topics covered will be heat exchangers, types and design principles (including Kern & Bell?s methods), effectiveness, (NTU Design and Rating methods), Fired Heaters, Design & Rating and Cooling Towers, Design & Rating. **Effective From: Fall 2012**

ChE 624 - Transport Phenomena I (3 credits)
Prerequisites: undergraduate courses in fluid mechanics, heat transfer, and mass transfer. A unified treatment of molecular and turbulent momentum, energy, and mass transport. Emphasis is on the mathematical description of physical mechanisms in momentum and energy transport.

ChE 625 - Microlevel Modeling in Particle Technology (3 credits)
Presents methodologies for analyzing the macroscopic properties of particulate systems in terms of the underlying microlevel processes. Significant components are the mathematical modeling of particulate systems at the microlevel, analytical and numerical methods for predicting macroscopic properties from microlevel models, and comparison of theoretical predictions with experimental results. Demonstrates the importance of the interaction of these three components in the scientific process. The first part concerns the flow of dry particles where any interstitial fluid can be ignored. The second part considers the flow of particles suspended in an interstitial fluid. Also includes a class project involving development of simulations. Same as ME 624.

ChE 626 - Mathematical Methods in Chemical Engineering (3 credits)
Prerequisite: Math 222 or equivalent undergraduate degree in Chemical Engineering. The purpose of the course is to emphasize the importance of mathematics to chemical engineering practice. Applications of ordinary differential equations, Sturm-Liouville problems arising from partial differential equations, regular Perturbation approaches to some nonlinear systems of chemical engineering interests, use of Laplace transfroms expecially the Residue Theorem for inversions and some numerical methods. It is suggested that students take this course before taking ChE 624. **Effective From: Fall 2011**

ChE 627 - Introduction to Biomedical Engineering (3 credits)
Prerequisites: undergraduate courses in thermodynamics and differential equations. Introduction to the structure and composition of the body followed by an exploration of the properties of blood and its flow in the cardiovascular system; the body as a heat source and as a series of compartments involved in mass transfer of materials (such as those in the kidneys and lungs). Design of artificial kidneys and heart-lung machines is also explored. Same as BME 627.

ChE 628 - Biochemical Engineering (3 credits)
Prerequisite: undergraduate degree in chemical engineering. The application of chemical engineering to biological processes, biochemical reaction systems, and their technological use. Special attention given to problems in momentum, energy, and mass transport, as well as chemical reaction kinetics in biological systems.

ChE 629 - Biological Engineering Analysis (3 credits)
Prerequisite: undergraduate degree in chemical engineering. Emphasis is on chemical engineering reactor design employing microbial populations. The dynamics of microbial interactions are described mathematically, as are cell attachment and reactor stability.

ChE 634 - Chemical Process Dynamics and Control (3 credits)
Prerequisite: undergraduate chemical engineering course in process dynamics and control. Mathematical principles of process dynamics and control; derivation and solution of differential equations describing the behavior of typical chemical engineering processing units; and mathematical analysis and design of control systems. Digital and sampled data control systems also discussed.

ChE 645 - Fundamentals of Rheology (3 credits)

Prerequisite: ChE 626 or permission of the instructor. Rheology of polymer melts and polymer solutions. Various types of time-dependent and time-independent non-Newtonian fluids are classified. Experimental techniques used to characterize these materials are discussed. **Effective Until: Spring 2005**

ChE 654 - Corrosion (3-0-3)
Prerequisite: Undergraduate courses in Chemistry. Fundamental principles including thermodynamics and kinetics of corrosion; forms of corrosion (e.g. galvanic, crevice and stress); methods of corrosion measurement; high temperature corrosion; and special case histories. **Effective From: Fall 2004**

ChE 656 - Industrial Catalysis: Fundamentals & Applications (3 credits)
The class provides an introduction to catalytic phenomena as well as catalysts. It provides the background information necessary to understand industrial catalytic processes. Examples which will be discussed are hydrogen, ammonia and methanol synthesis, inorganic and organic oxidation reactions, petrochemical processes as well as pollution abatement and other important processes. The course provides insight into the theory of catalytic phenomena and also provides practical information about these processes from an industrial perspective. **Effective From: Spring 2008**

ChE 662 - Chemical Processing of Electronic Materials (3 credits)
Prerequisite: undergraduate degree in chemical engineering. Processes necessary for manufacturing electronic materials into semiconductor devices and systems including single crystal growth, chemical vapor deposition, ion implantation, dry etching, and other considerations.

ChE 664 - Experiments and Simulations in Particle Technology (3 credits)
Prerequisites: graduate standing and consent of the instructor. Covers particle size analysis using sieves as well as laser diffraction technique, size reduction with ball mill, measurement of powder flow properties and internal angle of friction, measurement of angle of repose, design of mass flow hoppers using Jenike direct shear tester, measurement of minimum sintering temperature of powders, particle sedimentation, powder mixing, dry particle coating, and fluidized beds. Simulations involve various dry and fluid based particle systems, focusing on particle-particle and fluid-particle interactions. Same as ME 664.

ChE 671 - Chemical Process Safety (3 credits)
Prerequisite: graduate standing. Chemical and physical principles in chemical process safety and fire and explosion hazard evaluation. Emphasis is on materials, their reactions, and effect on surroundings. Course intended for students in the master's program in occupational safety and health engineering, and may not be taken for credit by ChE graduate students. **Effective Until: Spring 2005**

ChE 675 - Statistical Thermodynamics (3 credits)
Prerequisite: ChE 611 or permission of instructor. Application of equilibrium statistical mechanics to chemical engineering problems. Basic postulates and relationships of statistical thermodynamics, including the ideal gas, ideal crystal, and virial equation; statistical theories of fluid mixtures and other advanced topics.

ChE 681 - Polymerization-Principles and Practice (3 credits)
Prerequisite: Undergraduate courses in physical or organic chemistry or ChE 503 or equivalent. The course focuses on the structural and synthetic aspects of polymers and examines in detail a number of bench and industrial scale polymerization methods. In addition to kinetics and mechanisms of commercially important polymerization systems, the course examines reactive modification of synthetic and natural polymers and provides an introduction to applicable characterization methods.

ChE 682 - Polymer Structures and Properties (3 credits)
Prerequisite: Undergraduate physical chemistry, a materials related course or ChE 503 or equivalent. The course provides an overview of polymer structures and properties and their relationships from the molecular viewpoint to phenomenological descriptions. Topics include thermodynamics of a single molecule, dynamic theory and viscoelasticity of polymers, polymer solids and mechanical properties, rubbers, polymer blends and composites, biological polymers, and special applications. New areas and innovative applications of polymers will be introduced.

ChE 683 - Polymer Processing (3 credits)
Prerequisite: Undergraduate courses in transport phenomena, fluid flow, or heat transfer or approval of graduate advisor. The course provides a systematic approach to the physical phenomena occurring in polymer processing machinery. The synthesis of the elementary steps of polymer processing are shown in relation to the development of extrusion die flow and extrusion products and injection mold flows and molded products. Structural and residual stresses are examined.

ChE 684 - Materials and Process Selection for Polymer Product Design (3 credits)
Prerequisites or corequisites: ChE 681, ChE 682, ChE 683 or approval of graduate advisor. The course provides methodologies for designing polymer-based products by considering materials and processing methods. Methods for selecting homopolymers, polymer blends and composites for specific appilcations will be presented in terms of properties, processability, manufacturing

methods and economics. Process/structure/property correlations are presented as well as approaches to product design including CAD, prototyping, and strength and failure criteria. Case studies from biomedical, packaging and other applications are discussed.

ChE 685 - Industrial Waste Control I (3 credits)
Prerequisite: undergraduate degree in chemical engineering or permission of the instructor. Physical/chemical treatment of industrial wastewaters: ionic equilibria; surface characterization; thermodynamic applications; transport phenomena; and sludge treatment.

ChE 686 - Industrial Waste Control II (3 credits)
Prerequisite: undergraduate degree in chemical engineering or permission of the instructor. Biological treatment of industrial wastewaters: biological mechanisms; kinetics; vapor-liquid equilibria; and settling phenomena.

ChE 687 - Industrial Gas Cleaning (3 credits)
Prerequisite: undergraduate degree in chemical engineering, or permission of the instructor. Review of available tools for cleaning atmospheric effluents from manufacturing facilities and power plants; use of a systems approach to minimize gas cleaning costs; alternatives involving combinations of process modification and effluent clean-up; methods for estimating key design parameters for cyclones, baghouses, electrostatic precipitators and scrubbers. Applications of design parameters through the solution of extensive problem-sets.

ChE 701 - Master's Thesis (6 credits)
Prerequisite: matriculation for the master's degree in chemical engineering. Approval of thesis advisor is necessary for registration. Original research under the guidance of a departmental advisor. The final product must be a written thesis approved by at least three faculty members: the primary advisor, another from the department, and one other faculty member. A student must continue to register for at least 3 credits per semester until at least 6 credits have been completed and a written thesis is approved. Only a total of 6 credits will count toward the degree.

ChE 702 - Selected Topics in Chemical Engineering II (3 credits)
Prerequisite: graduate standing and permission of the instructor. Topics of current interest in chemical engineering.

ChE 705 - Independent Study (3 credits)
Prerequisites: permission from the graduate advisor (not dissertation advisor) in chemical engineering, as well as courses prescribed by a supervising faculty member (who is not the student's dissertation advisor). This special course covers areas of study in which one or more students may be interested, but which isn't of sufficiently broad interest to warrant a regular course offering. Students may not register for this course more than once with the same supervising faculty member.

ChE 711 - Phase Equilibrium (3 credits)
Prerequisite: ChE 611 or equivalent. Low-pressure and high-pressure vapor-liquid equilibrium and liquid-liquid equilibrium. Among the topics covered are experimental methods, consistency tests of the data, expressions for the dependence of the activity coefficient on composition and temperature, and prediction of multicomponent vapor-liquid and liquid-liquid equilibrium from binary data. Prediction methods of vapor and liquid phase nonidealities, based on equations of state and solution theories, are discussed.

ChE 721 - Combustion Reaction Engineering (3-0-3)
Prerequisites: Undergraduate degree in Chemical or Mechanical Engineering. Topics related to the engineering of combustion systems will be discussed. These include laminar flames, turbulent combustion, ideal reactor modeling of complex combustion systems, combustion chemistry, heterogeneous combustion and incineration. **Effective From: Fall 2004**

ChE 724 - Sustainable Energy (3-0-3)
The course is a project-based advanced graduate course which requires strong background in engineering thermodynamics and transport phenomena. The main goals of this course are to gain an understanding of the cost-benefit ratio of various alternative energy sources and to understand some of the various obstacles associated with current and conventional technologies and industrial applications. Different renewable and conventional energy technologies will be discussed in class. Course materials include biomass energy, fossil fuels, geothermal energy, nuclear power, wind power, solar energy, hydrogen fuel, hydropower, and fuel cells. Students will learn a quantitative framework to aid in evaluation and analysis of energy technology systems in the context of engineering, political, social, economic, and environmental goals. **Effective From: Spring 2013**

ChE 725 - Transport Phenomena II (3 credits)
Prerequisite: ChE 624 or equivalent. Transport in laminar and turbulent flow: in solids, between phases, and macroscopic transport in flow systems.

ChE 740 - Biological Treatment of Hazardous Chemical Wastes (3 credits)
Prerequisite: ChE 686 or the permission of the instructor. A doctoral level seminar on the limitations of biological treatment for hazardous wastes that looks at the fundamental processes taking place.

ChE 790 - Doctoral Dissertation (Credits as designated)
Required of all students for the degree of Doctor of Philosophy. A minimum of 36 credits is required. Approval of dissertation advisor is necessary for registration. Students must register for at least 6 credits of dissertation per semester until 36 credits are reached and then for 3 credits each semester thereafter until a written dissertation is approved.

ChE 791 - Graduate Seminar (Non-credit)
Required of all chemical engineering students receiving departmental or research-based awards and all doctoral students. The student must register each semester until completion of the degree. Outside speakers and department members present their research for general discussion.

ChE 792 - Pre-Doctoral Research (3 credits)
Prerequisite: Permission of Associate Chairperson for Graduate Studies. For students admitted to the Doctor of Philosophy Program in Chemical Engineering who have not yet passed the qualifying examination. Research is carried out under the supervision of designated chemical engineering faculty. If the student's research activity culminates in doctoral research in the same area, up to a maximum of 6 credits may be applied to the 36 credits required under ChE 790. **Effective From: Fall 2007**

ChE 794 - Professional Presentations for Ph.D. Students (0 credits)
Intended to help students make better technical presentations. Each student is required to make a presentation on a research topic; guest lectures will occur during the semester. **Effective From: Fall 2007**

Chemistry: Offered by the Department of Chemistry and Environmental Science

UNDERGRADUATE COURSES:

Chem 105 - Applied Chemical Principles (3-2-4)
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 (3-1-3)
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 (3-1-3)
Prerequisite: Chem 108. A continuation of Chem 108.

Chem 121 - Fundamentals of Chemical Principles I (3-0-3)
Prerequisites: high school math including algebra and trigonometry; chemistry placement examination required. Introduces the basic concepts of chemistry, including chemical reactions, and bonding, electronic and molecular structure, gases and thermochemistry. Alternative course to meet the requirement of Chem 125, 126. Emphasis is on mastering the material at the level of the ACS standardized final. **Effective From: Spring 2011**

Chem 121(Archived - Fundamentals of Chemistry I (3-0-3)
Prerequisites: High School math including algebra and trigonometry; chemistry placement examination required. The first semester of a three-semester sequence in chemistry, designed for undergraduate students. Introduces the basic concepts of chemistry, including chemical reactions, electronic structure, gases and thermochemistry. Enrollment in Chem 121, 122, 123 is determined by a placement exam prior to initial registration. This sequence takes the place of Chem 125, 126. However, 3 credits its of Chem 121, 122, 123 are addictive only. The remaining 6 credits count toward degree requirements. **Effective Until: Fall 2011**

Chem 122 - Fundamentals of Chemical Principles II (3-0-3)
Prerequisite: Chem 121 and Chem 125 with a grade of C or better. Introduces the basic concepts of chemistry, including equilibrium, chemical kinetics, thermodynamics, electrochemistry, and nuclear chemistry. Emphasis is on mastering at the level of the ACS standardized final. Students should also register for Chem 124. **Effective From: Spring 2012**

Chem 122(Archived) - Fundamentals of Chemistry II (3-0-3)
Prerequisite: Chem 121. Continuation of the Chem 121 sequence. This course introduces the student to the basic concepts of Chemistry, including molecular structure, solutions and solids, and equilibrium. **Effective Until: Fall 2011**

Chem 123 - Fundamentals of Chemistry III (3-0-3)
Prerequisite: Chem 122 with a grade of C or better. Continuation of the Chem 121 sequence. Introduces the student to the basic concepts of chemistry, including equilibrium in solution, kinetics and thermo-dynamics. Students should also register for Chem 124. **Effective Until: Spring 2012**

Chem 124 - General Chemistry Laboratory (0-2-1)
Corequisite: Chem 122 or 123 or Chem 126 with a grade of C or better. Chemical principles studied in the Chem 125 and 126 or Chem 121, 122 and 123 sequence are illustrated and reinforced by performance of laboratory experiments. **Effective From: Spring 2009**

Chem 124H - General Chemistry II Honors Laboratory (0-2-1)

Corequisite: Chem 126H with a grade of C or better. The laboratory consists of special research projects and other developmental labs. **Effective From: Spring 2009**

Chem 125 - General Chemistry I (3-0-3)
Prerequisites: At least 620 on the SAT. 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. **Effective From: Fall 2013**

Chem 125H - General Chemistry I Honors (3-0-3)
Prerequisites: High school math including algebra and trigonometry; chemistry placement examination. Admission is by invitation only. An honors chemistry course which parallels Chem 125 but is more comprehensive and rigorous. Field trips, molecular model building, laboratory projects, journal reading assignments and reports, and supplementary problems are required -aspects of the program. **Effective From: Spring 2009**

Chem 126 - General Chemistry II (3-0-3)
Prerequisite: (Chem 125 or Chem 122) with a grade of 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 should also register for Chem 124. **Effective From: Fall 2013**

Chem 126H - General Chemistry II Honors (3-0-3)
Prerequisite: Chem 125H with a grade of C or better. A continuation of Chem 125H, which parallels the course content of Chem 126. An individual research project is completed. Chem 124H must be taken concurrently. **Effective From: Spring 2009**

Chem 221 - Analytical Chemical Methods (0-4-2)
Prerequisite: Chem 222 with grade of C or better. Laboratory introducing quantitative chemical analyses by gravimetry, titration, spectroscopy, chromatography, and potentiometry. **Effective From: Fall 2013**

Chem 222 - Analytical Chemistry (3-0-3)
Prerequisite: Chem 123 or Chem 126, Chem 124 with grade of C or better. Lecture course introducing concepts of chemical analyses by gravimetry, titration, spectroscopy, chromatography, and potentiometry. **Effective From: Spring 2009**

Chem 231 - Physical Chemistry I (3-0-3)
Prerequisites: Chem 122 or Chem 126, Phys 111 with a grade of C or better. Corequisite: Math 211. The topics covered include the properties of ideal and non-ideal gases and liquids, solutions, thermochemistry, thermodynamics, the phase rule, and phase equilibria. **Effective From: Fall 2013**

Chem 235 - Physical Chemistry II (3-0-3)
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. **Effective From: Spring 2009**

Chem 235A - Physical Chemistry II Laboratory (0-4-2)
Prerequisite: 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. **Effective From: Spring 2009**

Chem 236 - Physical Chemistry for Chemical Engineers (4-1-4)
Prerequisites: (Chem 122 or Chem 126)and chem 124 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. **Effective From: Fall 2013**

Chem 238 - Analytical/Organic Chem Lab for Chemical Engineers (0-4-2)
Prerequisite: 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. **Effective From: Spring 2009**

Chem 243 - Organic Chemistry I (3-0-3)
Prerequisite: Chem 123 or Chem 126 with a grade of C or better. The preparation and properties of the various classes of organic compounds are discussed, with attention given to industrial sources such as coal and petroleum. Also covers the commercial utilization of these materials in the synthesis of useful products used in areas such as foods, cosmetics, textiles, plastics, and pharmaceuticals. **Effective From: Spring 2009**

Chem 244 - Organic Chemistry II (3-0-3)
Prerequisite: Chem 243 with a grade of C or better. **Effective From: Spring 2009**

Chem 244A - Organic Chemistry II Laboratory (0-4-2)
Prerequisite: Chem 124 with a grade C or better. Corequisite: Chem 244. Synthesis and characterization of organic compounds are performed in a unique multi-scale manner: micro, macro and a kilo scale. **Effective From: Spring 2009**

Chem 245 - Organic Chemistry for Chemical Engineers (4-1-4)
Prerequisite: 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. **Effective From: Spring 2013**

Chem 246A - Organic Chemistry Laboratory (0-2-1)
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. **Effective From: Spring 2013**

Chem 301 - Chemical Technology (2-2-3)
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. **Effective From: Spring 2009**

Chem 310 - Co-op Work Experience I (3 additive credits)
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. Cannot be used for degree credit.Note: Normal grading applies to this COOP Experience **Effective From: Spring 2013**

Chem 311 - Co-op Work Experience II (3 additive credits)
Prerequisites: ChE 310 with a grade C or better. **Effective From: Spring 2009**

Chem 336 - Physical Chemistry III (3-0-3)
Prerequisite: Chem 235 with a grade of C or better. An introduction to quantum mechanics, statistical mechanics, spectroscopy, and solid state. **Effective From: Spring 2009**

Chem 337 - Physical Chemistry for Biological Science (3-0-3)
Prerequisites: Chem 123 or 126 with a grade of C or better. The course covers fundamental principles of physical chemistry related to biochemical processes such as metabolism and other biochemistry. Descriptions and example applications use DNA, proteins, amino acids, including properties of hydrophobic interactions. Thermochemistry of biochemical systems including chemical energy (enthalpy of reaction) along with chemical activities and non-ideal behavior are illustrated. The importance of entropy in control of biochemical reactions is also covered. Ionic systems and redox reactions and acids and bases in biological systems are presented. The course also illustrates a number of biochemical analytical methods. **Effective From: Spring 2009**

Chem 338 - Analytical/Organic Chem Lab for Chemical Engineers (0-4-2)
Prerequisite: 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. **Effective From: Spring 2009**

Chem 339 - Analytical/Physical Chem Lab for Chemical Engineers (0-4-2)
Prerequisites: Chem 245, or Chem 236 with a grade of 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. **Effective From: Fall 2013**

Chem 340 - Chemistry and Engineering of Materials (3-0-3)
Prerequistes: Chem 235, Chem 244 with a grade of C or better. Emphasizes processing/property relationships for a variety of engineering materials, including polymers, metals, ceramics, composites, semiconductors, optical fibers, and biomaterials. Introduces concepts of chemical structure, bonding and crystallinity. Covers important chemical, physical, electrical, and mechanical properties and corrosion and materials degradation. Also includes materials selection in the chemical process

industries. **Effective From: Spring 2009**

Chem 350 - Industrial Chemistry (3-0-3)
Prerequisite: Chem 244 with a grade of C or better. Applications of chemistry to the development of products from basic research and development through scale-up and marketing. Covers inorganic and organic processes, environmental considerations, industrial catalysis, and cost calculations. **Effective From: Spring 2009**

Chem 360 - Environmental Chemistry I (3-0-3)
Prerequisites: (Chem 126 or Chem 122, or Chem 124) with a grade of C or better. Chem 360 is a prerequisite for Chem 361. Chemistry of the environment is covered with emphasis on water chemistry. The course includes treatment of chemical bonding, basic thermodynamics, chemical equilibrium, kinetics, and the chemistry of ideal and non-ideal solutions. Water chemistry is covered, including acid/base equilibria, alkalinity, buffers, precipitation, and the sources of fates of water pollutants. **Effective From: Fall 2013**

Chem 361 - Environmental Chemistry II (3-0-3)
Prerequisites: Chem 360 with a grade of C or better. Chemistry of the environment is covered with emphasis on atmospheric and geo-chemistry. Organic and biochemical processes in the environment are treated. The applications of chemical principles to industrial ecology, green chemistry, pollution prevention and sustainability are discussed. **Effective From: Fall 2013**

Chem 365 - Environmental Organic Chemistry (3-0-3)
Prerequisite: Chem 122 or 126 with a grade of C or better. An introduction to organic chemistry intended for students studying environmental science or environmental engineering. Covers the traditional functional groups, but focuses on their environmental impact and industrial synthesis. Not open to students who have taken organic chemistry. **Effective From: Spring 2009**

Chem 391 - Research and Independent Study (3-0-3)
Prerequisite: Prerequisite: Junior standing in Chem. Provides an opportunity to work on a reserch project under the individual guidance of a member of the department. **Effective From: Spring 2009**

Chem 412 - Inorganic Chemistry (3-0-3)
Prerequisite: Prerequisite: Chem 231 with a grade of C or better. A lecture-recitation-laboratory course in practical inorganic chemistry. Covers the chemistry of most of the elements and their compounds. Preparation in the laboratory is followed by purification and characterization. **Effective From: Spring 2009**

Chem 437 - Applications of Computational Chemistry and Molecular Modeling (3-0-3)
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. **Effective From: Spring 2013**

Chem 440 - Fundamentals of Polymers (3-0-3)
Prerequisites: Chem 235, Chem 244 with a grade of C or better. An introduction to the important fundamental aspects of polymers including preparation, structure, physical states and transitions, molecular weight distributions, viscous flow, and mechanical properties. **Effective From: Spring 2009**

Chem 443 - Introductory Polymer Laboratory (1-4-3)
Prerequisite: Chem 440 with a grade of C or better. Practical methods useful in the preparation and characterization of macromolecules, including radical, ionic, emulsion, and condensation polymerization. Various methods useful in characterizing polymers, such as solution and bulk viscosity, light scattering, osmometry, thermal analysis, and various spectroscopic techniques. Melt spinning and extrusion of polymers along with mechan-ical properties. **Effective From: Spring 2009**

Chem 448 - Preparation and Analysis of Organic Compounds (0-4-2)
Prerequisites: Chem 244 and Chem 244A with a grade of C or better. The application of laboratory techniques learned in Chem 344A laboratory to the synthesis and characterization of organic compounds. **Effective From: Spring 2009**

Chem 473 - Biochemistry (3-0-3)
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. **Effective From: Spring 2009**

Chem 474 - Biochemistry II (3-0-3)
Biochemistry II will focus on transducing and storing energy, synthesizing the molecules of life, and responding to environmental changes. Topics include basic concepts of metabolism, glycolysis and gluconeogenesis, citric acid cycle, oxidative phosphorylation, photosynthesis, fatty acid metabolism, protein turnover and amino acid catabolism, biosynthesis of amino acids, DNA replication and recombination, RNA synthesis and processing, protein synthesis, control of gene expression, the immune system, and drug development. **Effective From: Spring 2013**

Chem 475 - Biochemistry Lab I (0-4-2)
Prerequisites: Chem 244 or 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. **Effective From: Spring 2009**

Chem 480 - Instrumental Analysis (0-4-2)
Prerequisite: 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. **Effective From: Spring 2009**

Chem 484 - Modern Analytical Chemistry (1-4-3)
Prerequisite: Chem 222 or Chem 235 with a grade of C or better. Basic principles and techniques of quantitative analysis, with emphasis on application of modern analytical instrumentation. Atomic and molecular spectroscopy, chromatography, and electrochemical methods are studied and applied in the laboratory. Calibration, sampling methodology and sample preparation are also treated. **Effective From: Spring 2009**

Chem 490 - Special Topics in Chemistry (3-0-3)
Prerequisite: depends upon the nature of the course given. Course is offered in specific areas as interest develops. **Effective From: Spring 2009**

Chem 491 - Research and Independent Study I (3-0-3)
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. **Effective From: Spring 2009**

Chem 491H - Honors Research and Independent Study I (3-0-3)
Same as Chem 491, with special projects for Honors students. **Effective From: Spring 2009**

Chem 492 - Research and Independent Study II (3-0-3)
Prerequisite: Chem 491 with a grade of C or better. A continuation of Chem 491. **Effective From: Spring 2009**

Chem 492H - Research and Independent Study II ? Honors (3-0-3)
Prerequisite: Chem 491H for Honors students. Same as Chem 492, with special projects for Honors students. **Effective From: Spring 2009**

R160:108 - Organic Biochemistry (3)
For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R160:207 - Structure And Bonding (3)
For more details go to Rutgers Catalog.

R160:227 - Experimental Analytical Chemistry (3)
For more details go to Rutgers Catalog.

R160:333 - Organic Chemistry Laboratory (2)
For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R160:345/346 - Physical Chemistry (3,3)
For more details go to Rutgers Catalog. **Effective From: Spring 2009**

R160:413 - Inorganic Chemistry (3)
For more details go to Rutgers Catalog. **Effective From: Spring 2009**

GRADUATE COURSES:

Chem 552 - Laser Chemistry and Technology (3 credits)
Prerequisites: one year of chemistry, one year of physics, and calculus. An introduction to the underlying chemical and physical principles of lasers, their operation and uses and the related optoelectronic technology. Analysis of classes of laser; pumping mechanisms; detection of light; absorption and emission of radiation and current industrial and state-of-the-art uses.

Chem 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

Chem 599 - Methods for Teaching Assistants and Graduate Assistants (3 credits)
Prerequisite: graduate standing. Required for all chemistry teaching assistants and graduate assistants. Covers techniques of teaching, interaction with students, and safety. Does not count as degree credit.

Chem 601 - Special Topics in Chemistry I (3 credits)
Prerequisite: graduate standing and permission of the instructor. Topics of current interest in chemistry.

Chem 602 - Advanced Organic Chemistry II: Reactions (3 credits)
Prerequisite: undergraduate organic chemistry. The study of organic syntheses including principles underlying chemical reactions; chemical thermodynamics, structural theory, rates of reaction, mechanisms and stereochemistry; IR, UV, and NMR spectroscopy; organic synthesis; formation of aliphatic carbon-carbon bonds; pericyclic reactions; carbon-nitrogen bonds; electrophilic and nucleophilic aromatic substitution, molecular rearrangements; photochemical and free-radical reactions; oxidation and reduction; and organometallic reagents containing phosphorous, boron, sulfur, and silicon.

Chem 603 - Advanced Organic Chemistry Laboratory (3 credits)
Prerequisite: undergraduate organic chemistry. More advanced syntheses than those normally carried out in the undergraduate laboratory are emphasized including current analytical techniques and methods of separation. Both small and large scale preparations are assigned.

Chem 605 - Advanced Organic Chemistry I: Structure (3 credits)
Prerequisite: undergraduate organic chemistry. Structure of organic molecules. Topics include atomic and molecular structure, stereochemistry, reactive intermediates (cations, anions, radicals, and carbenes), orbital symmetry, and spectroscopy.

Chem 606 - Physical Organic Chemistry (3 credits)
Prerequisite: Chem 502 or equivalent. Emphasis is placed on the physical aspects of the subject. Determination of reaction mechanisms, equilibria, and kinetics using simple molecular orbital theory and absolute reaction rate theory.

Chem 610 - Advanced Inorganic Chemistry (3 credits)
Prerequisite: undergraduate physical chemistry or permission of the instructor. Theories of observed chemical and physical properties of the elements and their compounds; prediction of reactivity and properties of proposed new compounds.

Chem 611 - Solid-State Inorganic Chemistry (3 credits)
Prerequisite: undergraduate physical chemistry or physics. Structure, physical and chemical properties of solid-state materials, and their formation.

Chem 617 - Mass Spectrometry and Interpretation of Mass Spectra (3 credits)
Prerequisite: CHEM125 and CHEM126 or equivalent. Historical background, fundamentals and mechanics of operation for components incorporated into modern Mass Spectrometers: vacuum system, ion sources, mass filter, ion detection, plus computer operation and data collection. Explanation and interpretation of mass spectra and fragmentation patterns are a fundamental theme throughout the course. Lecture material includes principles of operation and appropriate applications for modern types of mass spectrometers: magnetic sector, quadrupole, time of flight, ion trap, FT-ICR. Theory and applications of electron impact, chemical, electrospray, and other ionization techniques including atmospheric sampling are covered. High resolution analysis using magnetic sector and FT - ion cyclotron instruments. Analytical applications in environmental, petroleum and biochemical analysis and applications and coupling of mass spectrometry with other instruments (GC, LC, AES,) are illustrated.

Chem 626 - Chemistry of Contemporary Materials (3 credits)
Prerequisite: one year of general chemistry. An introduction to the structure and chemical, electrical, and mechanical properties of metallic, ceramic, and polymeric materials and their use in science and engineering.

Chem 629 - Heterogeneous Catalysis (3 credits)
Prerequisites: Undergraduate course in Organic Chemistry or Physical Chemistry or the equivalent. Basic principles of catalysis, catalyst preparation, and catalyst action; mechanisms and applications. Methods of catalyst preparation; effect on absorption,

transport phenomenon, and reaction mechanisms and review of industrial examples.

Chem 640 - Polymer Chemistry (3 credits)
Prerequisites: undergraduate organic and physical chemistry. Kinetics of polymerization; properties of polymer solutions; characterization of molecular size and shape.

Chem 641 - Polymer Properties (3 credits)
Prerequisite: undergraduate organic and physical chemistry. Forces between polymer molecules and their relation to crystal structure; fundamentals of rheology and viscoelastic properties of polymers; polymer crosslinking, reinforcement, and aging from a chemical viewpoint.

Chem 643 - Polymer Laboratory I (3 credits)
Prerequisites: Chem 440

Chem 644 - Fundamentals of Adhesion (3 credits)
Prerequisite: Undergraduate organic and physical chemistry. Adhesion phenomena; intermolecular and interatomic forces; surface chemistry; absorption of polymers on surfaces; mechanisms of adhesion; bulk properties of adhesives; and rheology of polymers used as adhesives.

Chem 645 - Polymer Laboratory II (3 credits)
Prerequisite: Chem 643. Experiments illustrating contemporary methods of polymer characterization including osmometry, viscometry, laser light scattering, vapor pressure osmometry, differential thermal analysis, dilatometry, x-ray diffraction, birefrigence, polymer factionation/gel permeation chromatography, extrusion, swelling crosslinking, molding, viscoelasticity, and infrared, ultraviolet, and NMR spectroscopy.

Chem 654 - Corrosion (3 credits)
Prerequisite: one year of general chemistry. Fundamental principles including thermodynamics and kinetics of corrosion; forms of corrosion (e.g., galvanic crevice and stress); methods of corrosion measurement; high temperature corrosion; and special case histories.

Chem 655 - Electrochemistry: Principles and Applications (3 credits)
Prerequisites: one year of general chemistry and a course in physical chemistry or equivalent. Principles governing electrochemical methods such as conductance, emf, polarography, cyclic voltammetry, chronopotentiometry, coulometry, and their application to electric energy storage and conversion, corrosion, electroplating, pollution monitoring, electrochemical sensors, and electrochemical synthesis.

Chem 658 - Advanced Physical Chemistry (3 credits)
Prerequisite: one year of undergraduate physical chemistry. Principles and applications of quantum chemistry; the wave equation, its properties and mathematics; the Schrodinger equation and wave functions; the harmonic oscillator; variational and perturbational methods; atomic theory, structure, and properties; simple molecules, LCAO and valence bond theories; semi-empirical methods; time dependence, and introduction to electronic and vibration-rotation spectroscopy.

Chem 659 - Atomic and Molecular Structure (3 credits)
Prerequisite: Chem 658 or equivalent. Application of quantum chemistry and molecular structure; techniques for calculation of physical properties of molecules; and use of state-of-the-art computer graphics.

Chem 661 - Instrumental Analysis Laboratory (3 credits)
Prerequisites: one year of undergraduate physical chemistry. Instruments for chemical analysis are discussed in class and used in the laboratory; basic theory; sample preparation; use of instruments and interpretation of data are covered for spectroscopy including UV0VIS, FTIR, AA, and NMR; HPLC, GC, ion chromatography, mass spectrometry. Applications to food science, pharmaceuticals, polymers, and other chemical areas. 1 hr. lecture, 3 hrs. lab.

Chem 662 - Air Pollution Analysis (3 credits)
Prerequisite: undergraduate physical chemistry. Chemical and physical principles of gaseous species and trace level measurement techniques for airborne vapors and particulates. Emphasis on analyzing real air samples at the parts-per-billion level, meteorological dispersion and life times of pollutants are covered. Laboratory work in air pollution sampling methods for vapor and particulate species. Determination of primary air pollutants using wet chemical and instrumental techniques.

Chem 664 - Advanced Analytical Chemistry (3 credits)
Prerequisite: undergraduate physical chemistry. The principles of chemical analysis as they apply to chromatography, electrochemistry, and spectroscopy. Sampling considerations, separations, and sample preparation steps. This course is a useful adjunct to Chem 661, where these analytical techniques are considered in a more practical way. **Effective From: Spring 2009**

Chem 670 - Environmental Toxicology for Engineers and Scientists (3 credits)
Prerequisite: Chem 673 or equivalent. Toxicology at the molecular level, including methods of evaluation and quantification, as well as mechanisms of absorption, distribution, metabolism, and excretion of toxicants. Discussions of systemic toxicology (e.g., liver, kidneys, nervous system) and survey of toxic agents. Particular emphasis placed on environmental toxicology including air, water and soil pollutants, food additives, and contaminants.

Chem 671 - Industrial Toxicology Workshop (3 credits)
Prerequisite: Chem 670 or equivalent. A case study approach that applies basic theory and methods of toxicology to real-life problems related to hazardous materials transport, toxic commercial products and by-products, chemical industrial fires, unsafe landfills and illegal dumping.

Chem 673 - Biochemistry (3 credits)
Prerequisites: undergraduate organic and physical chemistry, or suitable background in these subjects. Fundamentals of biochemistry related to physical organic chemistry for students who have an interest in biomedical engineering, chemistry, chemical engineering, or environmental science.

Chem 677 - Introduction to Medicinal Chemistry (3-0-3)
The course introduces Medicinal Chemistry with mechanisms of drug action and the classification of drugs into the various categories of activity from a pharmaceutical viewpoint that encompasses chemical, biological and pharmacological parameters. Course includes material on: Chemistry, Structure Activity, Structure-Activity Relationships, Synthetic Pathways and Metabolic Pathways. **Effective From: Fall 2004 Until: Fall 2008**

Chem 700 - Master's Project (3 credits)
Prerequisite: matriculation for the master's degree. An extensive report involving an experimental, theoretical, or literature investigation is required. The literature investigation should result in a critical review of a specific area. Approval to register for the master's project must be obtained from the project advisor. Students must continue to register for at least 3 credits each semester until the project is completed and a written report is accepted. Only a total of 3 credits will count toward the degree.

Chem 701 - Master's Thesis (6 credits)
Prerequisite: matriculation for the master's degree in applied chemistry. Approval of thesis advisor is necessary for registration. Original research under the guidance of a departmental advisor. The final product must be a written thesis approved by at least three faculty members: the primary advisor, another from the department, and one other faculty member. Once registration for thesis has begun, a student must continue to register for a minimum of 3 credits per semester until at least 6 credits have been completed and a written thesis is approved. Only a total of 6 credits will count toward the degree.

Chem 702 - Special Topics in Chemistry II (3 credits)
Prerequisite: Graduate standing. Topics of current interest in chemistry.

Chem 714 - Pharmaceutical Analysis (3 credits)
The objective of this course is to provide an overview of instrumental techniques used in the analysis of different pharmaceutical products. Many different types of analysis are carried out in the pharmaceutical industry pertaining to active ingredients, formulations as well as impurities and dgradants. The focus will be on instrumentation such as chromatography, mass spectroscopy, different types of spectroscopy, quality assurance and GMP. **Effective From: Spring 2009**

Chem 717 - Mass Spectrometry and Mass Spectral Interpretation (3 credits)
Prerequisites: CHEM125 and CHEM126 or equivalent. Chem 717 and Evsc 617 are comprised of Chem/Evsc 617 plus a research project: Research projects usually comprise experimental and mass spectrometry interpretation studies. These can be performed at NJIT or in the students corporate mass spectrometry facility. Projects may also include theory, data interpretation or literature reviews pertinent to a current active area in mass spectrometry research. Projects should be approved or in consult with the instructors.

Chem 718 - Organic Synthesis (3-0-3)
Organic Synthesis is widely used in the production of organic materials and pharmaceutical drugs. The course introduces modern synthetic methods to the graduate students of NJIT. The first part of the course teaches organic reactions categorized by their roles in synthesis. Topics include substitution and addition of carbon nucleophiles, functional group conversion, oxidation, reduction, concerted cycloadditions, aromatic substitutions, and organometallic catalysis. The second part of the course teaches general strategies to develop synthetic plans, special considerations for difficult synthetic targets, and examples of natural product synthesis. **Effective From: Fall 2012**

Chem 725 - Independent Study I (3 credits)
Prerequisites: permission from the graduate advisor (not thesis advisor) in chemistry, as well as courses prescribed by a supervising faculty member (who is not the student's thesis advisor). This special course covers areas of study in which one or

more students may be interested, but which isn't of sufficiently broad interest to warrant a regular course offering. Students may not register for this course more than once with the same supervising faculty member.

Chem 726 - Independent Study II (3 credits)
Prerequisite: written permission from the Associate Chairperson for Environmental Science plus courses prescribed by the supervising faculty member (who is not the student's thesis advisor). This special course covers areas of study in which one or more students may be interested, but which are not sufficiently broad to warrant a regular course offering. Students may not register for this course more than once with the same supervising faculty member.

Chem 727 - Independent Study III (3 credits)
Prerequisite: written permission from the Associate Chairperson for Environmental Science plus courses prescribed by the supervising faculty member (who is not the student's thesis advisor). This special course covers areas of study in which one or more students may be interested, but which are not sufficiently broad to warrant a regular course offering. Students may not register for this course more than once with the same supervising faculty member.

Chem 734 - Thermochemical Kinetics-Detailed Mechanistic Modeling (3 credits)
Prerequisite: graduate level course in either kinetics or reactor design, or permission of instructor. Quantitative estimation of thermochemical data and chemical reactions in the vapor phase, and to some extent in the liquid phase; theories of transition state, RRKM, and Quantum RRK; and detailed chemical modeling concepts for reactor design. Applied computer project is required.

Chem 735 - Combustion (3 credits)
Prerequisite: thermodynamics and kinetics or equivalent, or permission of instructor. Thermodynamic properties of stable molecules and free radical species in combustion and oxidation of aliphatic hydrocarbons; reactions occurring in high temperature combustion systems; and related kinetic principles.

Chem 736 - Inorganic Biological Chemistry (3-0-3)
This class introduces fundamental aspects of metals' roles at the interface of inorganic/organic and biological worlds. Both the "why" and "how" questions of the role of metals in materials and biological sciences will be answered based on the concept of symmetry and its consequences. Special attention will be paid to understanding the electronic structure, spectroscopic signatures and reactivity of metal ions in coordination environments related to chemical and biological catalysis. **Effective From: Fall 2008**

Chem 737 - Applications of Computational Chemistry and Molecular Modeling (3-1-3)
Students are exposed to hands-on applications and fundamental aspects of computational chemistry and molecular modeling in organic, inorganic, bio- and physical chemistry. The course provides methods to determine the thermochemistry of a reaction, and strength (energy)of interactions by organic drug-like molecules with proteins. The course teaches the student to evaluate relative energy of different structures plus chemical species stability, reactivity and equilibrium ratios in chemical environments. **Effective From: Spring 2009**

Chem 748 - Nanomaterials (3)
Prerequisites: New feature of the 700 level course will be hands-on small projects carried out by groups of two students in Professor Iqbal's laboratories during the second half of the semester. The projects will be selected from the topics covered in the course. A second feature will involve a lecture on a specialized nanomaterial topic given by an invited outside lecturer. This 3 credit interdisciplinary course is designed to teach and provide hands-on project experience to M.S. and Ph.D. graduate students in chemistry, physics/materials science, and chemical/biomedical/electrical engineering on the fundamentals, synthesis, characterization and applications of nanomaterials. 75% of the course will comprise of lectures-one or two of which will be given by invited outside lecturers. 25% of the course will involve small projects based on the syllabus and conducted in the research laboratories of the instructor. **Effective From: Spring 2009**

Chem 777 - Principles of Medicinal Chemistry (3)
Teaches about drug design, and the molecular mechanisms by which drugs act in the body. Covers pharmacodynamics, pharmacokinetics, molecular targets used by drugs, the interaction of a drug with a target, and the consequences of this interaction. Covers strategies used in discovering and designing new drugs, and surveys the "tools of the trade" involved, e.g., QSAR, combichem and computer aided design. Covers special topics like chlorinergics, analgesics, opiates, antibacterials, antivirals, and antiulcer agents. **Effective From: Spring 2009**

Chem 791 - Graduate Seminar (Non-credit)
Required of all chemistry graduate students receiving departmental or research-based awards and all doctoral students. The student must register each semester until completion of the degree. Outside speakers and department members present their research for general discussion.

Civil Engineering : Offered by the Department of Civil and Environmental Engineering

UNDERGRADUATE COURSES:

CE 200 - Surveying (3-0-3)
Prerequisite: Math 111. 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 (0-3-1)
Corequisite: CE 200. Field exercises in conjunction with the classroom exercises in CE 200 utilizing classical and electronic instruments and COGO/CAD software.

CE 200B - Surveying Laboratory (0-3-1)
For geoscience engineering majors. Field exercises using survey instruments including tapes, levels, theodolites, and total stations. Covers principles of topographic mapping, traverses, triangulation, and computer data reduction.

CE 210 - Construction Materials and Procedures (3-0-3)
Prerequisites: HSS 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 (2-2-3)
Prerequisite: HSS 101 and FED 101. Provides students with in-depth experience in computer applications in civil engineering and with written and oral communication. **Effective From: Spring 2013**

CE 307 - Geometric Design for Highways (3-0-3)
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 (zero)
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.

CE 320 - Fluid Mechanics (4-0-4)
Prerequisites: Mech 235 with a grade of C or better. 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 (0-3-1)
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 (3-0-3)
Prerequisite: CE 200, CE 200A, Math 225. 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 (3-0-3)
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 (3-0-3)
Prerequisites: 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 (3-0-3)
Prerequisites: 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 (3-0-3)
Prerequisite: Mech 237 with a grade of C or better or equivalent. Corequisite: CE341A. 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 (0-3-1)
Corequisite: CE 341. Students perform basic experiments in soil mechanics.

CE 342 - Geology (3-0-3)
Prerequisite: consult the advisor. 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 343 - Geology with Laboratory (3-3-4)
Covers the material given in CE 342 with the addition of a laboratory component. It provides a more in-depth understanding of geology through rock and mineral identification, laboratory experiments, field trips, and selected case studies.

CE 350 - Transportation Engineering (3-0-3)
Prerequisite: 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 381 - Geomorphology (3-0-3)
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. **Effective From: Fall 2010**

CE 406 - Remote Sensing (3-0-3)
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 (3-0-3)
Prerequisites: 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 (3-0-3)
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 degree credits)
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 **Effective From: Spring 2013**

CE 414 - Engineered Construction (3-0-3)
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 (0-3-1)
Prerequisites: 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 (3-0-3)
Prerequisites: 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 (3-0-3)
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 (3-0-3)
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 (3-0-3)
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. **Effective From: Fall 2006**

CE 465 - Green and Sustainable Civil Engineering (3-0-3)
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. **Effective From: Spring 2011**

CE 485 - Special Topics in Civil Engineering (3-0-3)
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. **Effective From: Spring 2010**

CE 490 - Civil Engineering Projects (3-0-3)
Prerequisites: 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 490H - Honors Civil Engineering Projects (3-0-3)
Prerequisites: senior standing, enrolled in Honors College, and approval of the department. Same as CE 490.

CE 491H - Honors Research Experience in Civil Engineering (3-0-3)
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 (3-0-3)
Prerequisite: CE 210, CE 260, CE 320, CE 321, CE 350, CE 341 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. **Effective From: Fall 2011**

CE 494H - Honors Civil Engineering Design I (3-0-3)

Prerequisites: senior standing, enrolled in Honors College. Same as CE 494.

CE 495 - Civil Engineering Design II (3-0-3)
Prerequisite: CE 494. Provides students with the type of design experience they would receive if engaged in civil and environmental engineering design practice. Course will focus on one or more of these design areas: structural, geotechnical, transportation and planning, and sanitary and environmental engineering. **Effective From: Spring 2012**

CE 495H - Honors Civil Engineering Design II (3-0-3)
Prerequisites: senior standing, enrolled in Honors College. Same as CE 495.

GRADUATE COURSES:

CE 501 - Introduction to Soil Behavior (3 credits)
Prerequisites: Mech 320, Mech 235 with a grade of C or better and Mech 236 with a grade of C or better(see undergraduate catalog for descriptions). Open only to the students in bridge program. Permission from CEE department graduate advisor is required. Covers the necessary concepts in strength of materials, geology and soil mechanics required for the bridge program in M.S. in Environmental Engineering and Geoenvironmental Engineering option. **Effective From: Fall 2013**

CE 506 - Remote Sensing of Environment (3 credits)
Prerequisite: Phys 234 (see undergraduate catalog for description). Covers the principles of remote sensing, general concepts, data acquisition procedures, data analysis and role of remote sensing in terrain investigations for civil engineering practices. Data collection from airborne and satellite platforms will be emphasized. Photographic and non-photographic sensing methodologies will be covered as well as manual and computer assisted data analysis techniques for site investigations and examination of ground conditions.

CE 531 - Design of Masonry and Timber Structures (3 credits)
Prerequisite: CE 332 (see undergraduate catalog for description). Study of basic properties of clay and concrete masonry units and wood. The masonry segment includes discussion of unreinforced bearing walls subjected to concentric as well as eccentric loads. Lateral-force resistance of unreinforced and reinforced masonry systems are introduced and new developments to strengthen and retrofit unreinforced masonry walls are discussed. The timber design portion includes design and behavior of wood fasteners, beams, columns, and beam-columns as well as introduction to plywood and glued laminated members.

CE 545 - Rock Mechanics I (3 credits)
Prerequisite: approved undergraduate course in soil mechanics within last five years or permission of instructor. Rock mechanics including geological aspects, mechanical properties, testing, and in-situ measurements of rock properties, and a brief introduction to design of structures in rock.

CE 552 - Geometric Design of Transportation Facilities (3 credits)
Prerequisite: CE 350 or equivalent (see undergraduate catalog for description). Design principles and criteria related to highways and railroads resulting from requirements of safety, vehicle performance, driver behavior, topography, traffic, design speed, and levels of service. Elements of the horizontal and vertical alignments and facility cross-section, and their coordination in the design. Computer-aided design procedures including COGO, CADAM, Digital Terrain Modeling. Same as Tran 552.

CE 553 - Design and Construction of Asphalt Pavements (3 credits)
Importance of designing proper asphalt pavements. Topics include the origin of crude, refining crude, types of asphalts, desired properties of asphalt cement, specification and tests for asphalt cement, aggregates for asphalt mixtures, aggregate analysis, gradation and blending, hot-mix asphalt (HMA) mix design, manufacture of HMA and HMA-paving, hot and cold recycling. Same as Tran 553.

CE 590 - Graduate Co-op Work Experience I (3 additive credits)
Prerequisites: permission from the civil engineering department and the Division of Career Development Services. Cooperative education/internship providing on-the-job reinforcement of academic programs in civil engineering. Work assignments and projects are developed by the co-op office in consultation with the civil engineering department; and evaluated by civil engineering faculty co-op advisors.

CE 591 - Graduate Co-op Work Experience II (3 additive credits)
Prerequisites: permission from the civil engineering department and the Division of Career Development Services.

CE 592 - Graduate Co-op Work Experience III (3 additive credits)
Prerequisites: permission from the civil engineering department and the Division of Career Development Services.

CE 593 - Graduate Co-op Work Experience IV (0 credits)

Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

CE 601 - Advanced Remote Sensing (3 credits)
Prerequisite: a first course in remote sensing. Principles of computer processing of satellite and aircraft remote sensing data as well as image enhancement, image transformation and image classification techniques using advanced image analysis system ERDAS in the interactive mode. Multiple applications on land use/land cover, water quality assessment and terrain evaluation will be emphasized. During final weeks of the semester students will apply the acquired techniques to specific projects. **Effective Until: Fall 2011**

CE 602 - Geographic Information System (3 credits)
Prerequisite: course or working knowledge of CADD or permission of instructor. Geographical/Land Information System (GIS/LIS) is a computerized system capable of storing, manipulating and using spatial data describing location and significant properties of the earth's surface. GIS is an interdisciplinary technology used for studying and managing land uses, land resource assessment, environmental monitoring and hazard/toxic waste control. Introduces this emerging technology and its applications. Same as MIP 652 and Tran 602.

CE 603 - Introduction to Urban Transportation Planning (3 credits)
Urban travel patterns and trends; community and land activity related to transportation study techniques including survey methods, network analysis, assignment and distribution techniques. Case studies of statewide and urban areas are examined. Same as Tran 603. **Effective Until: Fall 2011**

CE 604 - Environmental Modeling in Remote Sensing (3 credits)
Prerequisites: CE 602 and CE 605. Advanced course consisting of three main components: review of current research and literature dealing with environmental RS/GIS, applied and computer modeling of land and oceans; case studies in RS/GIS applications, emphasizing real world environmental problems presented by outside experts; and presentation of student projects. **Effective Until: Fall 2011**

CE 605 - Research Methods in Remote Sensing (3 credits)
Prerequisites: CE 601 and Math 661. Major components of RS data acquisition systems, overview of image processing techniques with emphasis on neural network and traditional pattern recognition, principal component transformations, and data reduction. Emphasizes geometric and mapping aspects of RS/GIS techniques for linking RS images with spatial data, sources of error, and accuracy assessment techniques. Hands-on experience with existing hardware/software (ERDAS & GENESIS).

CE 606 - Geospatial Data Applications (3 credits)
Prerequisite: CE 602. The course focuses on geospatial data processing, information extraction and analysis tools. It provides visualization and decision support applications using desktop GIS software. Examples of the student projects include: Applications of integrated geospatial date in environmental, infrastructure, urban planning and homeland security. **Effective From: Spring 2010**

CE 610 - Construction Management (3 credits)
Prerequisite: B.S. degree in CE, technology, architecture, or related field. Managerial aspects of contracting. Study of an individual firm in relation to the entire construction industry. Topics include contractor organization and management, legal aspects of construction, and financial planning.

CE 611 - Project Planning and Control (3 credits)
Prerequisite: CE 610. Management tools as related to construction projects are analyzed and applied to individual projects. Emphasis is on network scheduling techniques, time-cost analysis, resource allocation and leveling, cost estimating, bidding strategy, and risk analysis.

CE 614 - Underground Construction (3 credits)
Prerequisite: undergraduate course in soil mechanics. Various aspects of underground construction, including rock and soft ground tunneling; open cut construction; underpinning; control of water; drilling and blasting rock; instrumentation; and estimating underground construction costs. Case studies and a field trip to an underground construction site will be included.

CE 615 - Infrastructure and Facilities Remediation (3 credits)
Prerequisites: graduate standing in civil engineering and basic knowledge of structures, and material science. Examines the methodology of inspection, field testing, evaluation and remediation of existing infrastructure and facilities, which include pipelines, tunnels, bridges, roadways, dams, and buildings. Typical materials distress and failure scenarios will be covered with remediation options through the use of case studies.

CE 616 - Construction Cost Estimating (3 credits)
Prerequisite: CE 610. Full range of construction cost-estimating methods including final bid estimates for domestic building and heavy/highway projects; computerized takeoff and estimating techniques; international construction; financial and cost reporting; databases; indices; risk; competition; performance; and profit factors.

CE 617 - Historic Preservation (3-0-3)
This course addresses the many aspects of structural preservation from both an engineering and aesthetic perspective. Course topics include: permits and regulations, an overview of architectural styles, designation of historic structures, past methods of construction, current methods of preservation and the availability of grants and funding. Knowledge gained from the course will be applied directly to course projects involving the evaluation and recommendations needed for the proposed preservation of an existing structure. **Effective From: Fall 2012**

CE 618 - Applied Hydrogeology (3 credits)
Prerequisites: undergraduate courses in earth science/geology, fluid mechanics, and calculus or permission of instructor. Examines ground water and contaminant movement through the subsurface environment. A basic understanding of the aquifer geology is emphasized. Hydrogeologic applications including well design, pumping tests, and computer modeling of subsurface flow, and methods to monitor and remediate contaminated groundwater are introduced.

CE 620 - Open Channel Flow (3 credits)
Prerequisite: undergraduate fluid mechanics. The principles developed in fluid mechanics are applied to flow in open channels. Steady and unsteady flow, channel controls, and transitions are considered. Application is made to natural rivers and estuaries.

CE 621 - Hydrology (3 credits)
Prerequisite: undergraduate fluid mechanics. The statistical nature of precipitation and runoff data is considered with emphasis on floods and droughts. The flow of groundwater is analyzed for various aquifers and conditions. Flood routing, watershed yield, and drainage problems are considered.

CE 622 - Coastal Engineering (3 credits)
Prerequisites: fluid mechanics and calculus. An introductory course covering basic wave theory, sediment transport and ocean circulation. The application of these principles to various coastal engineering problems will be discussed, including beach erosion, pollution transport in coastal waters, and the design of shore protection structures.

CE 623 - Groundwater Hydrology (3 credits)
Prerequisites: undergraduate fluid mechanics and computer programming, or consent of instructor. Basic principles of groundwater hydraulics; Darcian analysis of various aquifer systems; unsaturated flow into porous mediums; transport of contaminants in soil media; and mathematical models for fluid and contaminant transport. **Effective From: Fall 2012**

CE 625 - Public Transportation Operations and Technology (3 credits)
Prerequisite: graduate standing in a cross-listed department or instructor approval. Presentation of the technological and engineering aspects of public transportation systems. Historical development of public transportation technologies. Vehicle and right-of-way characteristics, capacity and operating strategies. Public transportation system performance. Advanced public transportation systems. Same as Tran 625. **Effective Until: Fall 2011**

CE 626 - Sediment Transport (3 credits)
Prerequisites: CE 341or CE 501; CE 620 or consent of the instructor. Unified treatment of sediment transport over a wide range of conditions; basic theory and application to engineering problems. Sediment transport problems associated with the analysis and design aspects of hydraulic and environmental structures, including channel stability, scouring, dredging, reservoir sedimentation, and wastewater solids are presented. **Effective Until: Fall 2011**

CE 631 - Advanced Reinforced Concrete Design (3 credits)
Prerequisite: an undergraduate course in theory and design of reinforced concrete. A review of basic concepts of elastic and ultimate strength theories and a study of the present design codes. Topics include: design of concrete building frames, two-way slabs, flat slabs, deep beams, and other structural elements using the above two theories.

CE 632 - Prestressed Concrete Design (3 credits)
Prerequisite: undergraduate course in theory and design of reinforced concrete. Analysis and design of pre-tensioned and post-tensioned prestressed concrete elements for both determinate and indeterminate structures will be studied. Examples of prestressed elements used in buildings and bridges will be discussed, as well as the source and magnitude of prestress losses.

CE 634 - Structural Dynamics (3 credits)
Prerequisite: undergraduate course in structural analysis. Dynamic analysis of beams, frames, and other types of structures. Practical methods developed are applied to problems such as the analysis of the effects of earthquakes on buildings and moving

loads on bridges.

CE 635 - Fracture Mechanics of Engineering Materials (3 credits)
Prerequisites: graduate standing in civil and/or mechanical engineering and basic knowledge of structures and mechanics of materials. Basic principles of fracture mechanics to increase understanding of cracking and fracture behavior of materials and structures. Emphasis on practical applications of fracture mechanics.

CE 636 - Stability of Structures (3 credits)
Prerequisite: undergraduate course in theory of structural analysis. Topics include structural design concept; stability criteria; elastic and inelastic buckling; column buckling; lateral buckling of beams; stability of frames; stability of plates and shell; local buckling and post-buckling.

CE 637 - Short Span Bridge Design (3 credits)
Prerequisite: undergraduate courses in steel design and concrete design, and some knowledge of prestressed concrete fundamentals. Design and performance of highway and railroad bridges, particularly steel and prestressed concrete structures since they are most common in the northeast; and computer applications including bridge geometry, abutment design and composite beam design.

CE 638 - Nondestructive Testing Methods in Civil Engineering (3 credits)
Familiarizes the civil engineering student with nondestructive testing (NDT) techniques currently employed for evaluation and condition monitoring of civil structures and construction materials. Major emphasis in the application of NDT methodologies to steel, concrete, and timber as the construction material. Covers theories, principles, and testing methodologies associated with individual technologies from specific material point of view. Discusses advantages and limitations pertaining to the application of individual NDT technologies to construction materials.

CE 639 - Applied Finite Element Methods (3 credits)
Prerequisites: CE 332 and CIS 101. Introduction to application of finite element method to problems of structural analysis and design. Review of matrix algebra and the stiffness method of structural analysis. Applications include trusses, frames, plates, shells, and problems of plane stress/strain. Application of finite element method to design.

CE 641 - Engineering Properties of Soils (3 credits)
Prerequisite: approved undergraduate course in soil mechanics within last five years. An in-depth study of physical and mechanical properties of soils. Topics include clay mineralogy, shear behavior and compressibility of fine and coarse grained soil; and in-situ measuring techniques such as vane shear, core penetration and pressure meter. Laboratory work includes consolidation test and triaxial test, with emphasis on analysis, interpretation and application of data to design problems.

CE 642 - Foundation Engineering (3 credits)
Prerequisites: approved undergraduate courses in soil mechanics and foundation engineering. The salient aspects of shallow foundation design such as bearing capacity and settlement analyses. Topics are relevant to the deep foundation, selection of the type and the determi-nation of load bearing capacity from soil properties, load tests, and driving characteristics utilizing wave equation analyses. Earth pressure theory and retaining wall design.

CE 643 - Advanced Foundation Engineering (3 credits)
Prerequisite: CE 642. Lateral and earth pressure computations for the design of retaining walls, bulkheads, cellular cofferdams, and sheetpiles. Also considers the design of internal bracing systems and anchors, soil nailing and reinforced earth. Slope stability of embankments and dams.

CE 644 - Geology in Engineering (3 credits)
Prerequisites: undergraduate course in geology or permission of instructor. Geology has a significant influence on how we plan, design, and construct engineering works. This course examines how the geologic formations underlying a locale will ultimately determine land use, control structure design, and affect construction material availability. Included is a study of the various rock-forming processes and geologic agents that have shaped Earth's surface. The course also explores the role of geologic factors in assessing environmental impacts and natural hazards such as earthquakes, subsiding soils, and landslides. Case study applications and a field trip are included. **Effective From: Fall 2005**

CE 645 - Rock Mechanics II (3 credits)
Prerequisite: CE 545 or equivalent, or permission of instructor. Applications of design problems in underground structures, subways, stability of rock slopes, blasting, and seismic effects. A design project is a course requirement.

CE 646 - Geosynthetics and Soil Improvement (3 credits)
Prerequisite: CE 341 (see undergraduate catalog for description). Includes engineering properties of geosynthetics and their application in civil engineering, such as filtration, seepage, and erosion control; subgrade and slope stabilization. Soil improvement

topics include preloading, electrokinetic stabilization, soil modification, admixtures and grouting. **Effective Until: Fall 2011**

CE 647 - Geotechnical Aspects of Solid Waste (3 credits)
Prerequisites: CE 341, CE 341A or equivalents (see undergraduate catalog for descriptions). Geotechnical aspects of solid waste such as municipal landfill, dredged materials, coal and incinerator ashes, identification and classification of waste materials, geological criteria for siting, laboratory and field testing, design for impoundment and isolation of waste, methods of stability analyses of landfill sites, techniques for stabilizing waste sites, leachate and gas collection and venting systems. Primary emphasis is on municipal wastes.

CE 648 - Flow Through Soils (3 credits)
Prerequisite: CE 641. Explains the fundamentals of fluid flow through saturated and unsaturated soils and the use of computer programs for the solution of boundary value fluid flow problems in soils. The first two-thirds of the course are devoted to flow through saturated soils. The topics are mathematical description of flow through soils, solutions for steady state and transient state fluid flow and geotechnical applications. The last one-third is devoted to flow through unsaturated soils. Topics include steady state of transient state fluid flow and a presentation of how these concepts are applied to geoenvironmental problems.

CE 650 - Urban Systems Engineering (3 credits)
Prerequisites:B.S. degree in engineering or in the physical or social with some computer programming background. Identifies the various urban problems subject to engineering analysis, and modern techinques for their solution, including inductive and deductive mathematical models, mathematical modeling and simulation, and decision making under uncertainty. Same as Tran 650. **Effective Until: Fall 2011**

CE 653 - Traffic Safety (3 credits)
Prerequisite: CE 660. System behavioral principles are applied to safety aspects of highway operation and design, and improvements of existing facilities. Solutions are evaluated on the basis of cost effectiveness. Same as Tran 653. **Effective Until: Fall 2011**

CE 655 - Land Use Planning (3 credits)
Spatial relations of human behavior patterns to land use; methods of employment and population studies are evaluated; location and spatial requirements are related to land use plans; and concepts of urban renewal and recreational planning are investigated by case studies. Same as MIP 655 and Tran 655. **Effective Until: Fall 2011**

CE 659 - Flexible and Rigid Pavements (3 credits)
Prerequisite: CE 341 or equivalent (see undergraduate catalog for description). Types of rigid (Portland cement) and flexible (bituminous) pavements. Properties of materials, including mineral aggregates. Design methods as functions of traffic load and expected life. Importance and consequences of construction methods. Maintenance and rehabilitation of deteriorated pavements. Same as Tran 659.

CE 660 - Traffic Studies and Capacity (3 credits)
Prerequisite: elementary probability and statistics. Presentation of the characteristics of the traffic stream, road users, and of vehicles, and a review of traffic flow relationships. Students are exposed to the principal methodologies followed by transportation practices to perform volume, speed, travel time, delay, accident, parking, pedestrian, transit and goods movement studies. Presentation of the principal methodologies used to perform transportation facility capacity analyses for: basic freeway sections, weaving areas, ramps and ramp junctions, multi-lane and two lane roadways, signalized and unsignalized intersections. Students get hands on experience using the highway capacity software (HCS) and SIDRA. Same as Tran 615. **Effective Until: Fall 2011**

CE 661 - Analysis and Design of Shell Structures (3 credits)
Prerequisite: undergraduate course in structural analysis. Methods of analysis and design of shell structures for building. Topics include: domes, hyperbolic paraboloids, folded plates, and cylindrical shells. Materials considered include reinforced and prestressed concrete. **Effective Until: Fall 2011**

CE 671 - Performance and Risk Analysis of Infrastructure Systems (3 credits)
This course presents a comprehensive systems approach to infrastructure asset management across areas of public and private infrastructure. Topics include the framework of integrated asset management illustrated in transportation, water and wastewater systems, the economic evaluation of infrastructure options, using life cycle cost analysis (LCCA) and cost-benefit analysis (CBA). The elements of performance measurement and modeling, including condition assessment and information management, failure and impact analysis are covered. Decision and risk analysis are covered to enable students to develop a holistic economic, performance and risk analysis approach to infrastructure management illustrated in a term project. **Effective From: Fall 2007**

CE 672 - Security Management of Critical Infrastructure (3 credits)
This course focuses on the areas of vulnerability assessment and security management of critical infrastructure systems. A review of techniques for facility and network modeling and performance simulation, leads to sector-specific approaches to vulnerability

analysis and critical infrastructure protection strategies using a Model-Based Vulnerability Analysis (MBVA). Covered critical infrastructure systems include water supply/environmental, transportation, power and energy systems, SCADA systems, cyber-infrastructure and telecommunications. The course ends with a review of the combined use of multi-criteria analysis techniques, expert heuristic response to scenarios and network analysis techniques in a general framework for vulnerability and security management of infrastructure systems in its key aspects: prevention, warning/detection and event mitigation and response planning and execution. **Effective From: Spring 2008**

CE 700 - Civil Engineering Project (3 credits)
Prerequisite: student must have sufficient experience and/or graduate courses in major field to work on the project. Subject matter to be approved by the department. Permission to register must be obtained from the project advisor. Extensive investigation, analysis, or design of civil engineering problems not covered by regular graduate course work is required. A student with an exceptional project in CE 700 may, upon his/her own initiative and with the approval of his/her advisor, substitute the work of this course as the equivalent of the first 3 credits for CE 701 Master's Thesis. Students must register for 3 credits every semester until the project is completed.

CE 701 - Master's Thesis (6 credits)
The thesis is to be prepared on a subject in the student's major field approved by the department. Approval to register for thesis must be obtained from the thesis advisor. A student must register for a minimum of 3 credits per semester until completion and submittal of an approved document. Credit will be limited, however, to the 6 credits indicated for the thesis.

CE 702 - Special Topics in Civil Engineering (3 credits)
Prerequisite: advisor's approval. Topics of special current interest in civil engineering.

CE 705 - Mass Transportation Systems (3 credits)
Prerequisites: CE 625 and Tran 610 or IE 610. An investigation of bus, rapid transit, commuter railroad, and airplane transportation systems. Existing equipment, economics, capacity, and terminal characteristics are discussed, as well as new systems and concepts. Long- and short-range transportation systems are compared. Same as Tran 705.

CE 710 - Systems in Building Construction (3 credits)
Requirements and benefits of various building construction systems. Preliminary examination of the interrelation between design and construction. Topics include lift slab and tilt-up construction, slipforming, precasting, joist systems, modular construction, and mechanical and electrical systems. **Effective Until: Fall 2011**

CE 711 - Methods Improvement in Construction (3 credits)
Prerequisite: CE 610. Improved methods in construction; various techniques of work sampling and productivity measurement; and current innovations in the construction industry for increasing efficiency.

CE 720 - Water Resource Systems (3 credits)
Prerequisites: CE 620, CE 621. A system methodology is applied to the analysis of water resource development and operation. Topics include operational hydrology, water quality criteria, streamflow requirements, resource allocation, and economics. Mathematical models are developed and employed in the evaluation of a case study.

CE 725 - Independent Study I (3 credits)
Prerequisites: written permission from department chairperson plus courses to be prescribed by the supervising faculty member. Covers areas of study in which one or more students may be interested but which is not of sufficiently broad interest to warrant a regular course offering.

CE 726 - Independent Study II (3 credits)
Prerequisites: written permission from department chairperson plus courses to be prescribed by the supervising faculty member. Covers areas of study in which one or more students may be interested but which is not of sufficiently broad interest to warrant a regular course offering.

CE 727 - Independent Study III (3 credits)
Prerequisites: written permission from department chairperson plus courses to be prescribed by the supervising faculty member. Covers areas of study in which one or more students may be interested but which is not of sufficiently broad interest to warrant a regular course offering.

CE 730 - Plastic Analysis and Design (3 credits)
Prerequisite: CE 639. Theory of plasticity applied to structural design. Study of methods of predicting strength and deformation of single and multi-story steel frames in the plastic range. Comparison of plastic and prestressed concrete.

CE 733 - Design of Metal Structures (3 credits)
Prerequisites: CE 639 and CE 636. Methods of design of metal structural systems. Topics include combined action of

unsymmetrical sections, torsion of open and closed sections, buckling of columns and plates with various end conditions, and design of curved and boxed girders.

CE 734 - Design of Tall Buildings and Space Structures (3 credits)
Prerequisites: CE 639 and CE 636. Design of tall buildings and space structures emphasizing framing systems, and recent developments and current research related to the design of such structures.

CE 736 - Finite Element Methods in Structural and Continuum Mechanics (3 credits)
Prerequisites: a working knowledge of computer programming, and Mech 630 and CE 630. Finite element approaches for analysis of plane stress problems, plates in flexure, shells, and three-dimensional solids; and choice of interpolation functions, convergence, and the capabilities of the methods.

CE 737 - Earthquake Engineering (3 credits)
Prerequisite: CE 634. Practical design solutions for resisting the damaging effects of earthquake ground motions and other severe dynamic excitations. Factors which control dynamic response in elastic and inelastic ranges, and the nature of severe dynamic excitations. Theories of structural analysis and dynamics, and modern design methodologies on the behavior of structures.

CE 738 - Advanced Matrix Analysis of Structures (3 credits)
Prerequisite: CE 639. Advanced topics from structural analysis, including nonlinear analysis of trusses, frames and membrane finite elements, collapse by buckling, analysis and design of fabric structures. **Effective Until: Fall 2011**

CE 739 - Structural Optimization (3 credits)
Prerequisite: CE 639. Application of methods of mathematical programming to problems of optimal structural design. Optimal criteria methods, discrete and continuous systems, and code design will be covered.

CE 741 - Theoretical Soil Mechanics (3 credits)
Prerequisite: CE 641. An advanced graduate course for Ph.D. students and interested M.S. students in Civil Engineering. Explains the fundamentals of constitutive models for soils and their use in the solution of boundary value problems. Covers the theory of elasticity and theory of plasticity as tools in developing constitutive models for soils. Introduces critical state concept for soils. The triaxial experimental behavior of soils is discussed to introduce the concept of soil flow and strength. Critical state concept and elastoplastic material concepts are incorporated in the constitutive models, models predictions will be compared with experimental results for sands and for clays. Constitutive models will incorporated into finite element codes to analyze boundary value problems such as stability of slopes and performance of footings. **Effective Until: Fall 2011**

CE 742 - Geotechnology of Earthquake Engineering (3 credits)
Prerequisite: CE 641. Explains the fundamentals of propagation of the earthquakes through soils to supporting structures and the use of computer programs in the solution of boundary value problems in soils. The first half is devoted to synthesis of earthquakes, mathematical formulation of the problem, measurement of applicable soil parameters, use of computer programs to solve 1-D wave propagation problems in soils with structures. The second half is devoted to soil liquefaction, soil-structure interaction, and design of machine foundations.

CE 743 - Contaminant Transport in Soils (3 credits)
Prerequisites: CE 618, CE 623 and CE 648. An advanced graduate course for Ph.D. students and interested M.S. students in civil, environmental, and chemical engineering. Explains the fundamental mechanisms involved in the organic chemical flow and transport in soils. Includes new concepts and recent findings associated with leaking underground storage tanks. First half deals with flow of nonaqueous phase liquids (NAPL) through a soil-water-air system. The second half discusses the sorption and dissolution of organics in the soil-water-air system, and transport of organics in the dissolved phase. **Effective Until: Fall 2011**

CE 751 - Transportation Design (3 credits)
Prerequisite: CE 603. Design problems for airports, terminals, and highway intersections and interchanges are undertaken. Same as Tran 751. **Effective Until: Fall 2011**

CE 752 - Traffic Control (3 credits)
Prerequisite: CE 660. Traffic laws and ordinances; regulatory measures; traffic control devices; markings, signs and signals; timing of isolated signals; timing and coordination of arterial signal systems; operational controls; flow, speed, parking; principles of transportation system management/administration; highway lighting; and state-of-the-art surveillance and detection devices and techniques. Hands-on experience with TRAF/NETSIM and FREESIM. Same as Tran 752. **Effective Until: Fall 2011**

CE 753 - Airport Design and Planning (3 credits)
Prerequisites: Tran 610 or EM 693 and CE 660. Planning of individual airports and statewide airport systems. Functional decision of air and landside facilities. Orientation, number and length of runways. Concepts of airport capacity. Passenger and freight terminal facility requirements. Airport access systems. FAA operating requirements. Financial, safety and security issues. Same as

IE 753 and Tran 753.

CE 754 - Port Design and Planning (3 credits)
Prerequisites: Tran 610 or EM 693 and CE 660. Functional design of the water and landsides for general cargo, liquid and dry bulk, and container operations. Yard and storage systems. Port capacity in an intermodal network. Economic, regulatory, and environmental issues. Same as IE 754 and Tran 754. **Effective Until: Fall 2011**

CE 765 - Multi-modal Freight Transportation Systems Analysis (3 credits)
Prerequisites: Tran 610 or equivalent and CE 650 or EM 602 or equivalent. Quantitative methods for the analysis and planning of freight transportation services. The supply-performance-demand paradigm for freight transportation systems. Cost and performance as determined by system design and operations. Relationship of traffic and revenue to service levels and pricing. Optimal service design and redesign for transportation enterprises and operations planning. Fleet and facility investment planning. Applications to various modes. Same as EM 765 and Tran 765.

CE 790 - Doctoral Dissertation (3 credits)
Required of all candidates for the degree of Doctor of Philosophy. A minimum of 36 credits is required. Students must register for at least 6 credits of dissertation per semester until 36 credits are reached. Registration for additional credits may be permitted beyond the 6, with the approval of the advisor, to a maximum of 12 credits per semester. If the dissertation is not completed after 36 credits, registration for an additional 3 credits per semester is required thereafter. Registration for 3 credits is permitted during the summer session, hours to be arranged.

CE 791 - Graduate Seminar (Non-credit)
A seminar in which faculty or others present summaries of advanced topics suitable for research. Students and faculty discuss research procedures, thesis organization, and content. Students present their own research for discussion and criticism. Required of all doctoral students registered for CE 790 unless requirement is waived, in writing, by the dean of graduate studies.

Classics: Offered by the Department of Classical and Modern Languages and Literatures at Rutgers-Newark

UNDERGRADUATE COURSES:

R190:310 - Ancient Technology (3)
For more details go to Rutgers Catalog.

Communication and Media:

UNDERGRADUATE COURSES:

COM 266 - Foundations of Game Production (2-1-3)
Prerequisites: Hum 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. IT 201 and IT 265, all with a grade of C or better. This class introduces students to many of the tools and production methodologies needed for electron games. This class will focus heavily on content control and story handling through the use of scripting and game development tools. Students will learn a few scripting languages that are used in the games industry, such as Unreal Script and LUA and use them to create a new game experience. **Effective From: Spring 2009**

COM 303 - Video Narrative (3-0-3)
Prerequisite: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

COM 325 - Special Topics in Communication (3-0-3)
Prerequisite: Varies according to topic. The study of new and/or advanced topics in an area of Communication, not regularly covered in any other Humanities course at the 300-level. The precise topics to be covered, along with prerequisites, are announced in the semester prior to the offering of the course. **Effective From: Spring 2009**

COM 335 - 3-D Modeling and Animation (2-1-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. IT 201 with a grade of C or better or permission of program advisor. 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. **Effective From: Spring 2009**

COM 345 - Character Modeling and Animation (2-1-3)
Prerequisite: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. COM 335 with a grade of C or better. This class builds on the concepts of 3D modeling and animation, applying those techniques to character creation and animation. This class focuses on the considerations and techniques involved in the creation and animation of character in 3D. **Effective From: Spring 2009**

COM 350 - Digital Video Production (2-2-3)
Prerequisite: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Instruction in the creation and editing of non-linear digital video; emphasis on tream 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. **Effective From: Spring 2009**

COM 351 - Documentary Studies (3-0-3)
Prerequisite: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

COM 352 - Photojournalism (2-2-3)
Prerequisite: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2007**

COM 369 - Digital Poetry (3-0-3)
Prerequisite: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

COM 376 - Game Design Studio (2-1-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. COM 266, COM 335 and COM 345, all with a grade of C or better. This class challenges students to apply what they have learned in previous courses about game design. Students work in groups to design and create games for various platforms. Groups will work closely with the instructor to get constant feedback and criticism on their work. Students will complete case studies of various game genres. Students will work on one large project and complete it in stages, as a project would in the industry. **Effective From: Spring 2009**

COM 390 - Electronic Writing Workshop (1-2-3)
Prerequisite: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Computer Science:

UNDERGRADUATE COURSES:

CS 100 - Roadmap to Computing (3-0-3)
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. **Effective From: Fall 2010**

CS 101 - Computer Programming and Problem Solving (3-0-3)
An introductory course in computer science and programming (using MATLAB, or other languages) and its use in solving engineering and scientific problems. 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. Designed for students not specializing in computer science. **Effective From: Fall 2009**

CS 102* - Computer Science with Problem Solving (3-1-3)**
An introductory course in computer science, with applications to engineering and technology problems. Emphasis on programming methodology using a high level language (such as FORTRAN) as the vehicle to illustrate concepts. Topics include basic concepts of computer systems, software engineering, algorithm design, programming languages and data abstraction, with applications. **Effective From: Fall 2006**

CS 103* - Computer Science with Business Problems (3-0-3)**
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. **Effective From: Fall 2012**

CS 104 - Computer Programming and Graphics Problems (3-0-3)
Corequisite: Math 138. 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. **Effective From: Spring 2010**

CS 106 - Roadmap to Computing Engineers (3-0-3)
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. **Effective From: Spring 2012**

CS 107 - Computing as a Career (1-0-1)
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. **Effective From: Fall 2010**

CS 110 - Introduction to Computer Science IA (3-0-3)
First semester of a two course sequence, equivalent to CS 113. Introduces fundamentals of computer science, with emphasis on programming methodology and problem solving. Topics include basic concepts of computer systems, software engineering, algorithm design, programming languages and data abstraction, including the development environment, native types, expressions, objects, classes, decisions, iteration, and methods. A high level language (Java) is fully discussed and serves as the vehicle to illustrate many of the concepts. **Effective From: Fall 2006 Until: Spring 2012**

CS 110A - CS 110A Computer Science Lab for CS 111 ((0-1.5-0))

Laboratory module for the first course of the sequence equivalent to CS 113. **Effective From: Fall 2006 Until: Spring 2012**

CS 111 - Introduction to Computer Science IB (3-0-3)
Second semester of a two course sequence, equivalent to CS 113. Introduces fundamentals of computer science, with emphasis on programming methodology and problem solving. Topics include basic concepts of computer systems, software engineering, algorithm design, programming languages and data abstraction, including methods and classes, arrays, collections, inheritance and polymorphism, exceptions, recursion, testing and debugging. A high level language (Java) is fully discussed and serves as the vehicle to illustrate many of the concepts. **Effective From: Fall 2006 Until: Spring 2012**

CS 111A - CS111A Computer Science Lab for CS 111 ((0-1.5-0))
Laboratory module for the second course of the sequence equivalent to CS 113. **Effective From: Fall 2006 Until: Spring 2012**

CS 113 - Introduction to Computer Science (3-0-3)
Prerequisites: CS 100 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. **Effective From: Fall 2012**

CS 113A - Lab (0-1.5-0)
Lab for CS 113. **Effective From: Fall 2006 Until: Spring 2012**

CS 113H - Honors Introduction to Computer Science I (3-0-3)
Prerequisite: Satisfactory performance on placement exam and/or departmental approval. A course similar to CS 113, but material is covered in greater depth. Honors students contemplating a major in computer science, or who plan to take advanced electives in computer science, should take CS 113H instead of CS 101H. Students who receive degree credit for CS 113H cannot receive degree credit for CS 213. **Effective From: Fall 2006**

CS 114 - Introduction to Computer Science II (3-0-3)
Prerequisites:; CS 113 or completion of a required 100 level GUR course in CIS, plus an approved CIS 105. 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 114 cannot receive degree credit for CIS 335 or CIS 505. **Effective From: Fall 2006**

CS 114A - Lab (0-1.5-0)
Lab for CS 114. **Effective From: Fall 2006 Until: Spring 2012**

CS 114H - Honors Introduction to Computer Science II (3-0-3)
Prerequisites: CS 113H or department approval; A course similar to CS 114, but material is covered in greater depth. Students receiving degree credit for CS 114H cannot receive degree credit for CS 335 or CS 505. **Effective Until: Fall 2006**

CS 115 - Intro. to CS I in C++ (3-0-3)
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. CIS majors should enroll in CS 113. **Effective From: Fall 2006**

CS 115A - Computer Science I Lab/C++ (0-1.5-0)
Laboratory for CS 115. **Effective From: Fall 2006 Until: Spring 2012**

CS 116 - Intro. to Computer Science II/C++ (3-0-3)
Prerequisites: CS 115 or completion of a required 100 level GUR course in CS, plus an approved CS 105. 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. **Effective From: Fall 2006**

CS 116A - Computer Science II Lab/C++ (0-1.5-0)
Laboratory for CS 116. **Effective From: Fall 2006 Until: Spring 2012**

CS 207 - Computing and Effective Communication (1-0-1)

Prerequisites: CS 107. 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. **Effective From: Fall 2010**

CS 241 - Foundations of Computer Science I (3-0-3)
Prerequisites: CS 114 AND Math 112 OR CS 114 AND Math 133. 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. **Effective From: Fall 2006**

CS 251 - Computer Organization (3-0-3)
Prerequisite: CS 113. An introduction to computer system structure and organization. Topics include representation of information, circuit analysis and design, register-transfer level, processor architecture and input/output. **Effective From: Fall 2006**

CS 252 - Computer Organization and Architecture (3-0-3)
Prerequisite: CS 113. 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. **Effective From: Spring 2006**

CS 265 - Game Architecture and Design (3-0-3)
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. **Effective From: Spring 2007**

CS 266 - Game Modification Development (3-0-3)
Prerequisites: IT 102 OR IT 114 OR CS 116, OR CS 114. 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. **Effective From: Fall 2007**

CS 276 - 2D Game Development (3-0-3)
Prerequisites: CS 265 and CS 266 or IT 265 and 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. **Effective From: Spring 2007**

CS 280 - Programming Language Concepts (3-0-3)
Prerequisite: CS 114 OR CS 116 OR IT 114 OR IT 102. 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. **Effective From: Fall 2006**

CS 288 - Intensive Programming in Linux (3-0-3)
Prerequisite: CS 114. 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. **Effective From: Spring 2013**

CS 310 - Co-op Work Experience I (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 **Effective From: Spring 2013**

CS 332 - Principles of Operating Systems (3-0-3)
Prerequisite: CS 114 OR CS 116 OR IT 114 OR IT 102. 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. **Effective From: Fall 2006**

CS 332H - Honors Principles of Operating Systems (3-1-3)
Prerequisite: CS 114 or equivalent. A course similar to CS 332, with a project of greater depth and scope. **Effective From: Fall 2006**

CS 333 - Introduction to UNIX Operating Systems (3-0-3)
Prerequisite: 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. **Effective From: Fall 2006**

CS 337 - Performance Modeling in Computing (3-0-3)
Prerequisites: CS 114 and (Math 333 or Math 341). Introduction to probability models and techniques useful in computer science. Performance evaluation, discrete-event simulation, classification and optimization. **Effective From: Fall 2012**

CS 341 - Foundations of Computer Science II (3-0-3)
Prerequisites: (CS 241 or MATH 226) and CS 280. 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 theory, including the classes P and NP. **Effective From: Fall 2006**

CS 341H - Honors Introduction to Logic and Automata (3-0-3)
Prerequisites: completion of a 100-level GUR course in CS; CS 280, Math 226 or Math 326. A course similar to CS 341, with a project of greater depth and scope. **Effective From: Fall 2006**

CS 345 - Web Search (3-0-3)
Prerequisites: CS 280 and CS 241 or CS 252. An introductory course on the 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). **Effective From: Spring 2012**

CS 352 - Parallel Computers and Programming (3-1-3)
Prerequisites: CS 252, CS 332. A course introducing parallel computers and parallel programming. General structures and design techniques of parallel computers are described. Programming paradigms and algorithm design considerations for parallel processors will be discussed. **Effective From: Fall 2006**

CS 353 - Advanced Computer Organization (3-0-3)
Prerequisite: CS 252 or instructor approved equivalent. This course emphasizes the basic design principles of various components in a computer, as well as how the components are organized to build a computer. Topics include: design methodology, arithmetic and logic unit design, control unit design, memory hierarchy, memory system design, input and output devices, peripheral devices, and interfacing computers using software. A software simulation package is used to help the learning process. By the end of the semester, students will have built simulated computer. **Effective From: Fall 2006**

CS 356 - Introduction to Computer Networks (3-0-3)
Computer Science students should take CS 288 before taking CS 356. This course provides an introduction to computer networks, with a special focus on the 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 aquire practical experience by programming reduced versions of real Internet protocols. **Effective From: Fall 2011**

CS 357 - Fundamentals of Network Security (3-0-3)
Prerequisite: CS 356 or IT 120. 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 120 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. **Effective From: Fall 2010**

CS 366 - 3D Game Development (3-0-3)
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. **Effective From: Fall 2009**

CS 370 - Introduction to Artificial Intelligence (3-1-3)
Prerequisites: CS 114 and (Math 226 or CS 241). 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 used extensively. Students are required to do programming assignments, complete a programming term project and review case studies. **Effective From: Fall 2006**

CS 370H - Honors Introduction to Artificial Intelligence (3-1-3)
Prerequisites: CS 114, Math 226. A course similar to CS 370, with a project of greater depth and scope. **Effective From: Fall 2006**

CS 371 - Logic with Applications to Computer Science (3-0-3)
Prerequisites: CS 114, Math 211 and (Math 226 or CS 241). An introduction to both the syntax and semantics (basic model theory) of first-order logic, covering one set of inference rules, sequent calculus or a tableau system and prove the completeness theorem for the proof system. You will also cover a relatively modern (and simpler) form of Incompleteness theorems and relate it to computational issues such as the halting problem, as well as issues related to automating logical reasoning. These will include Herbrand's theorem, resolution, and logic programming. **Effective From: Fall 2006**

CS 371H - Honors Logic with Applications to Computer Science (3-0-3)
Prerequisites: CS 114; Math 211 and 226. A course similar to CS 371, with a project of greater depth and scope. **Effective From: Fall 2006**

CS 375 - Application Development for WWW (3-0-3)
Prerequisite: CIS 114. A state-of-the-art computer programming language/environment, such as Java and related tools, is studied and used as a vehicle to build applications that involve graphical user-interfaces, simple graphics, multithreading, images, animation, audio, database connectivity, remote objects, and networking. **Effective From: Fall 2006**

CS 407 - Professional Development in Computing (1-0-1)
Prerequisites: CS 107 and CS 207.This course is designed for final 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 experiences. Through collaborative communication, students will reflect on global issues, explore how to best use new communication technologies and effectively communicate in the workplace. **Effective From: Fall 2010**

CS 408 - Cryptography and Internet Security (3-0-3)
Prerequisite: Math 226 or CS 241. Covers security require-ments 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 CIS 608. **Effective From: Fall 2006**

CS 410 - Co-op Work Experience II (3 additive credits)
Prerequisites: CS 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 **Effective From: Spring 2013**

CS 421 - Numerical Algorithms (3-0-3)
Prerequisite: completion of a 100-level GUR course in CIS. Corequisite: Math 222. This course deals with fundamentals of numerical methods, including discussion of errors, interpolation and approximation, linear systems of equations, solution of nonlinear equations, and numerical solution of ordinary differential equations. The algorithmic approach and the efficient use of the computer are emphasized. **Effective From: Fall 2006**

CS 431 - Database System Design and Management (3-0-3)
Prerequisite: CS 114 or equivalent. 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. **Effective From: Fall 2006**

CS 431H - Honors Database System Design and Management (3-0-3)
Prerequisite: CS 114 or equivalent. A course similar to CS 431, with a project of greater depth and scope. **Effective From: Fall 2006**

CS 432 - Advanced Operating Systems (3-0-3)
Prerequisites: CS 252, CS 332. A survey of the design and implementation of distributed operating systems, both by introducing basic concepts and considering examples of current systems. Topics include: communication, synchronization, processor allocation, and distributed file systems. **Effective From: Fall 2006**

CS 433 - Introduction to Linux Kernel Programming (3-0-3)
An introductory study of how the Linux operating system is built from scratch. As a hands-on course, students will perform intensive programming using 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, etc. At the end of the course, students will be able to modify the Linux operating system to create their own. **Effective From: Spring 2010**

CS 434 - Advanced Database Systems (3-0-3)
Prerequisites: CS 431. 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. **Effective From: Fall 2006**

CS 434H - Honors Advanced Database Systems (3-0-3)
Prerequisites: CS 431. A course similar to CS 434, with a project of greater depth and scope. **Effective From: Fall 2006**

CS 435 - Advanced Data Structures and Algorithm Design (3-0-3)
Prerequisite: CS 241 and CS 288. 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. **Effective From: Fall 2010**

CS 435H - Honors Advanced Data Structures and Algorithm Design (3-0-3)
Prerequisite: CS 241 and CS 288. A course similar to CS 435, with a project of greater depth and scope. **Effective From: Fall 2012**

CS 438 - Interactive Computer Graphics (3-0-3)
Prerequisites: completion of a 100-level course in CIS, plus knowledge of a higher level language. 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. **Effective From: Fall 2006**

CS 439 - Image Processing and Analysis (3-0-3)
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. **Effective From: Fall 2006**

CS 440 - Computer Vision (3-0-3)
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. **Effective From: Fall 2006**

CS 441 - Database Programming (3-0-3)
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 proposed course will focus on accessing databases through the web but also mention new developments in the field. **Effective From: Fall 2006**

CS 451 - Network Technologies (3-0-3)
This course provides an in-depth study of the different transmission and network technologies that make up the Internet

infrastructure. Topics include: physical layer technologies, multiplexing and switching, Wired and Wireless LANS, cellular networks, ATM networks, Multimedia formats and protocols, multicasting, traffic characteristics and measurements, QoS. **Effective From: Spring 2009**

CS 456 - Open Systems Networking (3-0-3)
Prerequisite: CS 114. An introduction to internetworking, including an in-depth study of the architecture of network interconnections, the internet services, and the protocols needed to provide these services. Topics include: architecture of interconnected networks, internet addresses and the address resolution problem, internet protocols, the domain name system, the socket interface, the client-server model of interaction, the OSI transport and application support protocols, and the TCP/IP application protocols. **Effective From: Fall 2006 Until: Fall 2008**

CS 458 - Technologies-Network Security (3-0-3)
Prerequisite: CS 356 or CS 456 or IT 420. This course provides both an in depth theoretical study and a practical exposure to technologies which 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. **Effective From: Spring 2009**

CS 467H - Honors Efficient Algorithm Design (3-0-3)
Prerequisite: CS 435 or CS 335; Math 333. The course focuses on presenting techniques for efficient sequential and parallel algorithm design. Algorithms for numerical and combinatorial problems will be discussed. The use of randomization in the solution of algorithmic problems will be explored. Applications to be considered include string matching, polynomials and FFT algorithms, sorting networks, algebraic computations and primality testing and factoring, matrix operations, randomized algorithms for sorting and selection, and data compression. **Effective From: Fall 2006**

CS 478 - Software Tools for Solving Problems (3-0-3)
Prerequisites: junior or senior standing, permission of instructor. Provides students with an opportunity to interact directly with industry and solve actual problems using various -information-systems software tools. At the beginning of the semester, company representatives present actual problems they are facing, and the students work in groups to develop a solution, which they present at the end of the term. Presentation skills, working in groups, and using software tools for problem solving are stressed. **Effective From: Fall 2006**

CS 482 - Data Mining (3-0-3)
Prerequisite: CS 431. 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. **Effective From: Fall 2006**

CS 485 - Special Topics in Computer Science/Information Systems (3-0-3)
Prerequisites: 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 CIS 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. **Effective From: Fall 2006**

CS 486 - Topics in Computer Science/Information Systems (3-0-3)
Prerequisites: Same as for CS 485. A continuation of CS 485. **Effective From: Fall 2006**

CS 488 - Independent Study in Computer Science (3-0-3)
Prerequisites: open only to students in the Honors Program who are computer science majors and who have the prior approval of the department and the CIS 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. **Effective From: Fall 2006**

CS 488H - Honors Independent Study in Computer Science/Information Systems (3-0-3)
Prerequisites: honors college computer science or information systems majors who have the prior approval of the department and the CS faculty member who will guide the independent study. Independent studies, investi-gations, 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 **Effective From: Fall 2006**

CS 490 - Guided Design in Software Engineering (3-0-3)
Prerequisite: senior standing or departmental approval. 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. **Effective From: Fall 2006**

CS 491 - Senior Project (3-0-3)
Prerequisites: CS 490, 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. **Effective From: Fall 2006**

CS 491H - Honors Computer Science Project (3-0-3)
Prerequisites: CS 490, senior standing in the Honors College and project proposal approval. A course similar to CS 491, with a project of greater depth and scope. **Effective From: Fall 2006**

CS 493 - Computing and Business Senior Project (3-0-3)
The Computing and Business Senior Project is intended to provide a real-world project-based learning experience for seniors in the Computing and Business and Business and Information Systems BS degrees. The overall objectives of this course are to investigate the nature and techniques of a business and computing development project. Projects are either provided by industry partners or proposed by students who wish to become entrepreneurs. **Effective From: Fall 2008**

GRADUATE COURSES:

CS 505 - Programming, Data Structures, and Algorithms (3 credits)
Prerequisite: knowledge of at least one procedure-oriented language such as PASCAL or C. Computer science students cannot use this course for graduate degree credit. Intensive introduction to computer science principles: a procedure-oriented language such as C++; program design techniques; introductory data structures (linked lists, stacks, sets, trees, graphs); and algorithms (sorting, searching, etc.) and their analysis. Programming assignments are included. **Effective From: Fall 2006**

CS 506 - Foundations of Computer Science (3 credits)
Prerequisite: knowledge of C/PASCAL. Corequisite: CS 505. Cannot be used for graduate credit towards the M.S. in Computer Science. Introduction to the concepts of iteration, asymptotic performance analysis of algorithms, recursion, recurrence relations, graphs, automata and logic, and also surveys the main data models used in computer science including trees, lists, sets, and relations. Programming assignments are given. **Effective From: Fall 2006**

CS 510 - Assembly Language Programming and Principles (3 credits)
Prerequisite: knowledge of at least one procedure-oriented language such as PASCAL, C, or C++. Computer Science students cannot use this course for graduate degree credit. An intensive course in assembly language programming including basic machine organization, the structure of instruction sets, program linkage, macros and macro libraries. Extensive programming assignments are included. **Effective From: Fall 2006 Until: Spring 2009**

CS 515 - Advanced Computer Programming for Engineers (3 credits)
Prerequisite: knowledge of at least one procedure-oriented language such as PASCAL, C, or FORTRAN. Students specializing in computer science may not take this course for credit. This course is designed for engineering students who require an extensive knowledge of programming for their project or thesis work. Topics include review of basic programming techniques, treatment of algorithm design, error analysis and debugging. As time permits, problem-oriented languages are examined. **Effective From: Fall 2006**

CS 540 - Fundamentals of Logic and Automata (3 credits)
Prerequisite: Math 226 or equivalent (see undergraduate catalog for description). Theory of logic and automata and their influence on the design of computer systems, languages, and algorithms. Covers the application of Boolean algebra to design of finite state machines; formal systems, symbolic logic, computability, halting problem, Church's thesis, and the main ideas of the theory of computation. **Effective From: Fall 2006 Until: Spring 2009**

CS 590 - Graduate Co-op Work Experience I (3 additive credits)
Prerequisite: students must have the approval of the co-op advisor for the CIS department. Provides on-the-job reinforcement and application of concepts presented in the undergraduate computer science curriculum. Work assignments are identified by the co-op office and developed and approved by the CIS department in conjunction with the student and employer. Students must submit, for CIS department approval, a proposal detailing the nature of the intended work. A report at the conclusion of each semester's work experience is required. Credits for this course may not be applied toward degree requirements for either the bachelor's or master's in computer science. **Effective From: Fall 2006**

CS 591 - Graduate Co-op Work Experience II (3 additive credits)
Prerequisite: students must have the approval of the co-op advisor for the CIS department. Provides on-the-job reinforcement and

application of concepts presented in the undergraduate computer science curriculum. Work assignments are identified by the co-op office and developed and approved by the CIS department in conjunction with the student and employer. Students must submit, for CIS department approval, a proposal detailing the nature of the intended work. A report at the conclusion of the semester work experience is required. Credits for this course may not be applied toward degree requirements for either the bachelor's or master's in computer science. **Effective From: Fall 2006**

CS 592 - Graduate Co-op Work Experience III (3 additive credits)
Prerequisites: graduate standing, and acceptance by the CIS department and the Division of Career Development Services. Students must have the approval of the co-op advisor for the CIS department. Provides on-the-job reinforcement and application of concepts presented in the undergraduate or graduate computer science curriculum. Work assignments are identified by the co-op office and developed and approved by the CIS department in conjunction with the student and employer. Students must submit, for CIS department approval, a proposal detailing the nature of the intended work. A report at the conclusion of the semester work experience is required. Credits for this course may not be applied toward degree requirements for either the bachelor's or master's in computer science. **Effective From: Fall 2006**

CS 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

CS 601 - Object-Oriented Programming (3 credits)
Prerequisite: basic knowledge of C++. Covers the fundamentals of object-oriented programming. Includes object-oriented concepts such as data abstractions, encapsulation, inheritance, dynamic binding, and polymorphism, and uses C++ as the vehicle for illustrating and implementing these concepts. The object-oriented paradigm is systematically employed in the design of all concepts. Effects of this methodology on software maintenance, extensibility, and reuse. Significant programming/design projects. **Effective From: Fall 2006 Until: Spring 2009**

CS 602 - Java Programming (3 credits)
Prerequisite: advanced Web-based programming with an emphasis on the Java language and platform. No prior knowledge of Java is required but students are expected to have a good understanding of object-oriented programming concepts such as encapsulation, inheritance, and polymorphism, experience with C++. Basic constructs and syntax and then the core advanced features. Topics include: networking and sockets, remote method invocation (RMI), database connectivity (JDBC), Java Beans, multi-threading and lighweight components (Swing). Common gateway interface (CGI) languages and browser scripting (JavaScript and VBScript) are discussed when used as a complement to the functionality of the Java language. Emphasis is on the Java Development Kit version 1.1 (JDK1.1), both deprecated methods and newly introduced features are discussed. **Effective From: Fall 2006**

CS 603 - Advanced Programming Environments and Tools (3 credits)
Prerequisite: CS 601. Introduction to Graphical User Interface (GUI) Programming in the X Windows System environment. Design and implementation of the GUI at various levels of abstraction using industry standard software tools. Trade-offs between flexibility and ease of use inherent in GUI building tools. Best suited for the advanced programmer. **Effective From: Fall 2006 Until: Spring 2009**

CS 604 - Client/Server Computing (3 credits)
Prerequisites: CS 333 and CS 432 or instructor approval (see undergraduate catalog for descriptions). Fundamentals of client/server architecture as applied to the development of software systems. Concepts of distributed systems such as open systems, middleware, software reengineering, and distributed computing environments. Components of distributed client/server technologies such as X Windows Systems, DCE, CORBA, NFS, and ODBC. Case studies are used to illustrate how client/server techniques can be used in a variety of applications. The importance of standards and their role in client/server architecture, such as Posix, DCE, and COS. Requires creation of distributed applications. **Effective From: Fall 2006 Until: Spring 2009**

CS 605 - Discrete Event Dynamic Systems (3 credits)
Prerequisite: Math 630 or EE 601 or MnE 603 or equivalent. Covers discrete event dynamic system theory and its applications in modeling, control, analysis, validation, simulation, and performance evaluation of computer systems, flexible manufacturing systems, robotic systems, intelligent supervisory control systems, and communication networks. Emphasis on Petri net and automation based approaches. **Effective From: Fall 2006 Until: Spring 2009**

CS 608 - Cryptography and Security (3-1-3)
This course involves computational methods providing secure Internet communication. Among the topics covered are: Security threats in communication systems; conventional cryptography: substitution and transposition codes; distribution of secret key over the Internet; principles of public-key cryptography; RSA and other public-key cryptographic methods; and digital signature protocol. **Effective From: Fall 2006**

CS 610 - Data Structures and Algorithms (3 credits)
Prerequisite: CS 505 or CIS 335 or equivalents (see undergraduate catalog for description). Intensive study of the fundamentals of data structures and algorithms. Presents the definitions, representations, processing algorithms for data structures, general design and analysis techniques for algorithms. Covers a broad variety of data structures, algorithms and their applications including linked lists, various tree organizations, hash tables, strings, storage allocation, algorithms for searching and sorting, and a selected collection of other algorithms. Programs are assigned to give students experience in algorithms, data structure design and implementation. **Effective From: Fall 2006**

CS 611 - Introduction to Computability and Complexity (3 credits)
Prerequisites: mathematics bridge requirements. Introduces the theoretical fundamentals of computing, and provides an understanding of both the inherent capabilities and limitations of computation. The main models of computation are deterministic and non-deterministic Turing machines. Auxiliary models include partial and total recursive functions, first order logic, recursive and recursively enumerable sets, and symbol systems. Covers the essentials of computational theory: first order logic, Russel's Paradox, completeness and consistency, Goedel's Theorem, Church's Thesis, countable and uncountable sets, simulation and computation, diagonalization, dove-tailing, decidable and undecidable problems, reduction, recursion theory, Rice's Theorem, Recursion Theorem, execution time measures, P and NP, polynomial-time reduction, NP-completeness and NP-hardness and formal correctness semantics of programs. **Effective From: Fall 2006**

CS 621 - Numerical Analysis I (3 credits)
Prerequisite: Math 511 (see undergraduate catalog for description) or an introductory course in numerical methods. An introduction to computational aspects of scientific and engineering problems. Time-dependent phenomena and corresponding quantitative models. Numerical stability and conditioning. Approximation of functions. Interpolation, integration. Solution of nonlinear equations. Ordinary differential equations of the first order. Finite and iterative algorithms for solution of systems of linear equations. Emphasis on computer implementation of algorithms and application to variety of engineering problems. **Effective From: Fall 2006**

CS 622 - Numerical Analysis II (3 credits)
Prerequisite: Math 511 (see undergraduate catalog for description) or an introductory course in numerical methods. This course covers the theory and design of computer solutions to mathematical equations. Included are iterative methods for solving systems of linear and nonlinear equations, the numerical eigenvalue-eigenvector problem, and methods for solving ordinary and partial differential equations. Emphasis is on the control of errors generated by the computer. **Effective From: Fall 2006 Until: Spring 2009**

CS 630 - Operating System Design (3 credits)
Prerequisites: CS 332, CS 432 (see undergraduate catalog for descriptions) and CS 505. An intensive study of computer operating system design including multiprogramming, time-sharing, real-time processing, job and task control, synchronization of concurrent processes and processors, resource scheduling, protection, and management of hierarchical storage. **Effective From: Fall 2006**

CS 631 - Data Management System Design (3 credits)
Prerequisites: knowledge of C and data structures. Acquaintance with fundamental notions of relational database technology. Mathematical properties and usage of database programming languages. Methods of database design and conceptual modeling. Methods of physical storage for database information. Fundamental notions of concurrency control and recovery in database systems. **Effective From: Fall 2006**

CS 632 - Advanced Database System Design (3 credits)
Prerequisites: CS 631 and knowledge of C++. Covers the concepts and principles of object-oriented data modeling and database systems, parallel and distributed database systems, database machines, real time (database) systems, multimedia and text databases, and imprecise information retrieval systems. Emphasis is on advanced data modeling, query optimization, indexing techniques, concurrency control, crash recovery, distributed deadlock detection, real-time scheduling, vague retrieval and system performance. **Effective From: Fall 2006**

CS 633 - Distributed Systems (3 credits)
Prerequisites: completion of bridge requirements. Fundamental topics concerning the design and implementation of distributed computing systems are covered, including interprocess communication, remote procedure calls, authentication, protection, distributed file systems, distributed transactions, replicated data, reliable broadcast protocols, and specifications for distributed programs. All topics will be illustrated with case studies. Optional topics may include synchronization, deadlocks, virtual time, and load balancing. **Effective From: Fall 2006**

CS 634 - Data Mining (3 credits)
This course covers the principles of data mining system design and implementation. It presents methods for association and dependency analysis as well as classification, prediction, and clustering. Optional topics may include time series and graph mining,

current trends in data mining, and data mining for scientific, medical and engineering applications. **Effective From: Spring 2011**

CS 635 - Computer Programming Languages (3 credits)
Prerequisites: CS 505 and CS 510. The theory and design of computer language systems; the formal theory of syntax and language classification; a survey of procedure and problem-oriented computer programming languages, their syntax rules, data structures, and operations; control structures and the appropriate environments and methods of their use; a survey of translator types. **Effective From: Fall 2006**

CS 636 - Compiling System Design (3 credits)
Prerequisite: CS 635. Compiler organization; interaction of language and compiler design. The front end scanning, parsing, and syntax-directed translation: theory, standard approaches, and techniques; front-end tools such as Lex and Yacc. Attribute grammars. Code generation, register allocation, and scheduling; interaction with the run-time environment. Introduction to static analysis and optimization. As time permits, topics in modern compilers: compiling for object-oriented languages such as C++ or Java, memory hierarchies, pipelining, parallelism. Includes a significant programming component. **Effective From: Fall 2006 Until: Spring 2009**

CS 637 - Real-Time Systems (3 credits)
Prerequisites: completion of bridge requirements. Theory and principles that govern real-time systems design, and mechanisms and methodologies that enable their construction and operation. All aspects of such systems will be covered, including scheduling, device and resource management, communications, machine architecture, kernel software, language design and implementation, specification and user interfaces, and performance analysis and verification techniques. **Effective From: Fall 2006 Until: Spring 2009**

CS 639 - Elec. Medical Records: Med Terminologies & Comp. Imp. (3 credits)
This course presents a graduate introduction to Medical Informatics for Computer Science students covering (1) the design, use and auditing of medical terminologies, such as the Unified Medical Language System (UMLS) and the Systematized Nomenclature of Medicine (SNOMED); and (2) principles of Electronic Medical Records (EMR), Electronic Health Records (EHR) and Personal Health Records (PHR), including issues of privacy and security. **Effective From: Fall 2011**

CS 640 - Recursive Function Theory (3 credits)
Prerequisite: CS 540 or equivalent. Review of basic computability theory. Topics include Church's thesis; unsolvability results; creative, productive, and simple sets; computational complexity; P=NP problem; and classification of solvable problems according to their complexity. **Effective From: Fall 2006**

CS 641 - Formal Languages and Automata (3 credits)
Prerequisite: Math 226 or equivalent (see undergraduate catalog for description). Fundamentals of automata and formal languages: hierarchy of abstract machines and languages; nondeterministic finite state machines; tape and pushdown automata; context-free and context-sensitive grammars. **Effective From: Fall 2006**

CS 643 - Cloud Computing (3 credits)
Prerequisites: CS 633 or CS 656. This course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its main focus is on parallel programming techniques for cloud computing and large scale distributed systems which form the cloud infrastructure. The topics include: overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, secure distributed computing, and multicore programming. **Effective From: Fall 2011**

CS 645 - Security and Privacy in Computer Systems (3-0-3)
Prerequisites: Students are expected to enter this course with a basic knowledge of operating systems, networking, algorithms, and data structures. Also, students should be able to program in Java and C/C++. The course covers fundamental principles of building secure systems and techniques to ensure data security and privacy. Topics include access control mechanisms, operating systems security, malicious code threats and software security, trusted computing, content protection, and database security . The course will also study existing technical approaches to protecting privacy, including Web anonymizers and ant-censorship tools, as well as policy and legal aspects of privacy. **Effective From: Fall 2012**

CS 650 - Computer Architecture (3 credits)
Prerequisites: CS 251 (see undergraduate catalog for description) and CIS 510. Exploiting instruction level parallelism (ILP) is central to designing modern computers. Presents design techniques used for such computers as IBM Power architectures, DEC Alpha, MIPS R4600, Intel P6, etc. Introduction of Instruction Set Architecture (ISA), various functional units, basic principles of pipelined computers. Modern techniques to ILP including superscalar, super-pipelining, software pipelining, loop unrolling, and VLIW. Memory hierarchy, including instruction cache, data cache, second level cache, and memory interleaving. Advanced computer architectures, including vector, array processors, interconnection technology, and ATM network of workstations. Hands-on experience designing a simple pipelined computer on screen and using CAD tools such as Cadence or ViewLogic. **Effective**

From: Fall 2006

CS 651 - Data Communications (3 credits)
Prerequisite: Math 333 (see undergraduate catalog for description). Intensive study of the analytic tools required for the analysis and design of data communication systems. Topics include: birth-death queuing systems, Erlang's distribution, bulk-arrival and bulk-service systems, design and analysis of concentrators and multiplexers, elements of Renewal Theory, M/G/1 system, analysis of Time Division Multiplexing, priority queues, analysis of random access systems, time reversibility, open and closed queuing networks, mean value analysis, flow and congestion, control mechanisms, routing algorithms, flow models, and network topological design. **Effective From: Fall 2006**

CS 652 - Computer Networks-Architectures, Protocols and Standards (3 Credits)
Prerequisite: A high level programming language, Math 333 (see undergraduate catalog for description), or instructor approved equivalents. Intensive study of various network architecture and protocol standards; with emphasis on the Open Systems Interconnetion (OSI) model. Topics include: analog and digital transmission, circuit and packet switching, the Integrated Services Digital Network (ISDN), Frame Relay, Broadband ISDN, Cell Relay, SONET, Local Area Networks (CSMA/CD, Token Bus, Token Ring, switched and isochronous Ethernets), Metropolitan Area Networks (FDDI, FDDI-II, DQDB), wireless and satellite networks, synchronization and error control, routing and congestion control, X.25 standard. **Effective From: Fall 2006**

CS 653 - Microcomputers and Applications (3 credits)
Prerequisite: familiarity with an assembly level and higher-level language. An investigation of the personal computer based on the WinTEl architecture. Programming and use of the various input/output devices via operating system constructs. Use of computer in stand-alone (control) applications and networked applications. Investigation of non-Intel architectures and non-Windows systems as time permits. **Effective From: Fall 2006 Until: Spring 2009**

CS 654 - Telecommunication Networks Performance Analysis (3 credits)
Prerequisites: CS 651, CS 652, or instructor approved equivalents. Modeling and analysis of telecommunication networks; with emphasis on Local Area Networks (LANs) and Metropolitan Area Networks (MANs). Case studies will be presented and discussed, and the need for modeling and analysis will be established. Various types of LANs, and MANs will be modeled and analyzed. Problem sets and case studies will be assigned to facilitate understanding of the covered material. **Effective From: Fall 2006 Until: Spring 2009**

CS 656 - Internet and Higher-Layer Protocols (3 credits)
The course introduces the protocols and standards of the TCP/IP suite that govern the functioning of the Internet. The material covered in class is a top-down approach on introduction, discussion, and analysis of protocols from the data-link layer to the application layer. Alternative protocols to the TCP/IP suite and new protocols adopted by this suite are discussed. Numerical examples related to network planning and proocol functioning are analyzed. **Effective From: Spring 2010**

CS 657 - Principles of Interactive Computer Graphics (3 credits)
Prerequisites: CS 505 or familiarity with the organization of at least one computer system, and knowledge of a structured programming language such as C. Graduate-level introduction to computer graphics concepts, algorithms, and systems. Includes 2-D raster graphics, algorithms, 2-D and 3-D geometric transformations, 3-D viewing, curves and surfaces. Emphasis on PC-based graphics programming projects. Principles of interactive graphics systems in terms of the hardware, software and mathematics required for interactive image production. **Effective From: Fall 2006**

CS 659 - Image Processing and Analysis (3 credits)
Prerequisite: CS 505. Fundamentals of image processing, analysis and understanding. Topics include image representation, image data compression, image enhancement and restoration, feature extraction and shape analysis, region analysis, image sequence analysis and computer vision. **Effective From: Fall 2006**

CS 660 - Digital Watermarking (3)
Digital watermarking and steganography is important to ensure data security because of widely used digital multimedia and rapid growth of the Internet. Digital watermarking is a suitable tool to identify the source, creator, owner, distributor, or authorized consumer of a document or an image. Digital steganography aims at hiding digital information into covert channels, so one can conceal the information and prevent detection. This course intends to provide students an overview on different aspects of mechanisms and techniques for digital watermarking and steganography. **Effective From: Spring 2009**

CS 661 - Systems Simulation (3 credits)
Prerequisites: an undergraduate or graduate course in probability theory and statistics, and working knowledge of at least one higher-level language. An introduction to the simulation of systems, with emphasis on underlying probabilistic and statistical methodologies for discrete-event simulations. Design of simulation applications, and simulation programming in a high-level language. Algorithms for the generation of pseudorandom numbers. Algorithmic methodologies for the simulation of discrete and continuous probabilistic processes. Use of statistical tools. Simulation of queuing systems. Applications of simulation to a variety of

system studies. The special purpose simulation language GPSS is studied in detail. **Effective From: Fall 2006**

CS 662 - Model Analysis and Simulation (3 credits)
Prerequisite: introductory course in simulation. Advanced topics in simulation methodology, including design of simulation experiments, variance reduction techniques, estimation procedures, validation, and analysis of simulation results. Queueing systems. Implementing a simulation with the SIMSCRIPT language. Models of continuous systems with applications to elementary socio-economic and industrial systems. Utilization of the DYNAMO II language. **Effective From: Fall 2006 Until: Spring 2009**

CS 665 - Algorithmic Graph Theory (3 credits)
Prerequisite: CS 610. The elements of the theory of graphs and directed graphs with motivating examples from communication networks, data structures, etc; shortest paths, depth first search, matching algorithms, parallel algorithms, minimum spanning trees, basic complexity theory, planarity, and other topics. Programming assignments are included. **Effective From: Fall 2006**

CS 666 - Simulation for Finance (3 credits)
Covers the use of Monte Carlo stochastic simulation for finance applications. Topics include generation of various random variables and stochastic processes (e.g., point processes, Brownian motion, diffusions), simulation methods for estimating quantities of interest (e.g., option prices, probabilities, expected values, quantiles), input modeling, and variance-reduction techniques. Students will write computer programs in C++. Students cannot receive credit for both CS 661 and CS/Math 666. **Effective From: Spring 2010**

CS 667 - Design Techniques for Algorithms (3 credits)
Prerequisite: CS 610. An introduction to the principles of major design techniques in algorithms. Examples from a variety of topics and problems in computer science are used to demonstrate these design techniques and their appropriate application. **Effective From: Fall 2006**

CS 668 - Parallel Algorithms (3 credits)
Prerequisites: CS 610 and CS 650. This course examines a variety of parallel algorithms and architectures. Shared memory algorithms and algorithms for special architectures (tree processors, grids, systolic arrays, butterflies) are considered. The basic theory of algorithm/architecture performance will be described. **Effective From: Fall 2006**

CS 669 - Computational Geometry (3 credits)
Prerequisite: CS 610 or permission of the instructor. Intensive study of the fundamentals of computational geometry data structures and algorithms. Emphasis is on the design of efficient algorithms and data structures, proofs of their correctness and complexity analysis. Fundamental topics including geometric searching, convex hull computation, nearest/farthest searching, Voronoi diagrams, Euclidean minimum spanning trees, planar triangulation, planar point location, arrangement of lines. **Effective From: Fall 2006 Until: Spring 2009**

CS 670 - Artificial Intelligence (3 credits)
Prerequisite: CS 610 and CS 631. Fundamental concepts and general techniques in artificial intelligence. Main topics include goal tree search, logic and deduction, adduction, uncertainty, fuzzy logic, knowledge representations, machine learning, vision, and action planning. The LISP programming language is used extensively. Students are required to do programming assignments, complete a programming term project, and review case studies. **Effective From: Fall 2006**

CS 671 - Knowledge-Based Systems (3 credits)
Prerequisite: CS 670 or equivalent. Deals with the underlying architectures of ?classical? knowledge-based systems, i.e., systems based on a knowledge representation formalism that are built by knowledge acquisition from a domain expert; and advanced database systems, especially object-oriented and deductive databases. **Effective From: Fall 2006 Until: Spring 2009**

CS 672 - Expert System Methods and Design (3 credits)
Prerequisite: CS 670. Deals with expert systems, expert system shells, programming of rule-based systems, selection of shells, verification and validation of expert systems, and knowledge acquisition techniques for extracting knowledge from domain experts. **Effective From: Fall 2006 Until: Spring 2009**

CS 673 - Software Design and Production Methodology (3 credits)
Prerequisite: CS 631. Modern techniques and methods employed in the development of large software systems, including a study of each of the major activities occurring during the lifetime of a software system, from conception to obsolescence and replacement. Topics include cost/performance evaluation, documentation requirements, system design and production techniques, system verification techniques, automated aids to system development, and project organization and management. **Effective From: Fall 2006**

CS 674 - Natural Language Processing (3 credits)
Prerequisite: CS 670. Deals with techniques of natural language understanding. Topics are syntax and parsing (top down and

bottom up), semantics, pragmatics and use of world knowledge in language understanding. Augmented Transition Networks will be used as programming tool set. Good knowledge of LISP or PROLOG. **Effective From: Fall 2006 Until: Spring 2009**

CS 680 - Linux Kernel Programming (3)
An in-depth study of how the Linux operating system is built from scratch. As a hands-on course, students will perform intensive programming using Linux Kernel. The contents include machine booting, segmentation and paging memory management, creating and destroying processes, process switching and scheduling, handling exceptions and hardware interrupts, software interrupts, creating system calls, creating file systems, networking with TCP/IP, device driver writing and module programming, etc. At the end of the course, students will be able to modify Linux operating system to create their own. **Effective From: Spring 2009**

CS 681 - Computer Vision (3-0-3)
This course introduces computational models of computer vision and their implementation on computers, and focuses on material that is fundamental and has a broad scope of application. Topics include comtemporary developments in all mainstream areas of computer vision e.g., Image Formation, Feature Detection/Representation, Classification and Recognition, Motion Analysis, Camera Calibration, 3D/Stero Vision, Shape From X (motion, shading, texture, etc.), and typical applications such as Biometrics. **Effective From: Fall 2010**

CS 682 - Geometric Modeling (3 credits)
Prerequisite: CS 610. The techniques required to describe the shape of an object and to simulate dynamic processes; parametric geometry of curves, surfaces, and solids; and particular formulations for facilitating calculating geometric properties. Fundamentals of solid model construction and analysis are discussed extensively. Some applications in computer graphics, CAD, and CAM are also mentioned. **Effective From: Fall 2006 Until: Spring 2009**

CS 683 - Software Project Management (3-0-3)
This course gives the student the necessary background to allow her/him to manage software projects; this includes economic, managerial and organizational aspects. The essence of software engineering is not only to introduce a valuable software product, but to do so economically and competitively. Like any engineering discipline, software engineering depends critically on managerial, economic and organizational considerations. Students will learn software management technique, various software costing techniques including COCOMO and ROI, team organization and management, and various methods of software development including Cleanroom and Agile. **Effective From: Spring 2012**

CS 684 - Software Testing and Quality Assurance (3-0-3)
This course discusses software faults and techniques to reduce faults and improve software quality. Software systems are some of the most complex human artifacts ever built and also some of the most critical means to ensure our safety, well being, and prosperity. This course teaches techniques to ensure software systems perform their function correctly. Topics include software specifications, goals of testing, techniques of test data selection, test oracle design, test data analysis, test lifecycle and quality impacts of testing. **Effective From: Spring 2012**

CS 685 - Software Architecture (3-0-3)
The software architecture defines the structure and interactions of software modules. This course provides a working knowledge of the terms, principles and methods of software architecture and module design. It explains the constraints on the design and the properties of capacity, response time, and consistency. The "4+1" architecture model is taught with architectural styles, interface isolation, decoupling, reuse, agile design with software patterns, data structures, queuing effects, design simplification and refactoring. The non-functional requirements of reliability, performance and power consumption, component based design and good industry practices for documenting and managing the architectural process are taught. **Effective From: Spring 2012**

CS 688 - Programming for Interactive Environments (3 credits)
Prerequisite: knowledge of C++. A thorough study of the fundamental concepts and techniques of programming for modern interactive support environments, better known as graphical user interfaces (GUIs). A balanced blend of principle and practice, incorporating a general paradigm of interactive program development and numerous examples from, and projects in, the major GUI environments. **Effective From: Fall 2006 Until: Spring 2009**

CS 696 - Network Management and Security (3 credits)
Prerequisites: CS 652 or ECE 683, and CS 656. Thorough introduction to current network management technology and techniques, and emerging network management standards. In-depth study of the existing network security technology and the various practical techniques that have been implemented for protecting data from disclosure, for guaranteeing authenticity of messages, and for protecting systems from network-based attacks. SNMP family of standards including SNMP, SNMPv2, and RMON (Remote Monitoring), OSI systems management. Various types of security attacks (such as intruders, viruses, and worms). Conventional Encryption and Public Key Cryptology. Various security services and standards (such as Kerberos, Digital Signature Standard, Pretty Good Privacy, SNMPv2 security facility). Same as ECE 638. **Effective From: Fall 2006**

CS 697 - Principles of Broadband ISDN and ATM (3 credits)

Prerequisite: CS 652 or ECE 683 or equivalent. Study of the Broadband Integrated Services Digital Network (B-ISDN) architecture and services. In-depth study of the Asynchronous Transfer Mode (ATM), ATM Adaptation Layer (AAL), ATM switching architectures, SONET/SDH, ATM traffic control, broadband integrated traffic models, Operation Administration and Management (OAM) functions, TCP/IP over ATM, and ATM market. Same as ECE 639. **Effective From: Fall 2006 Until: Spring 2009**

CS 704 - Sequencing and Scheduling (3-0-3)
Advanced sequencing and scheduling for job shops, flow lines, and other general manufacturing and production systems are discussed in this course. Both deterministic and stochastic scheduling models are covered in detail. Heuristics and worst case analysis for "unsolvable" hard scheduling problems (NP-C problems) are introduced. **Effective From: Fall 2006**

CS 708 - Advanced Data Security and Privacy (3 credits)
Prerequisites: CS 608,CS 645, CS 696, or instructor approval. In-depth study of the security and privacy issues associated with the massive amount of data that is collected, stored, shared and distributed in today's society. New paradigms are needed to address the security/privacy challenges when data is outsourced at untrusted servers (such as in cloud computing), when data is anonymized in order to be shared among untrusted parties, or when copyrighted data needs to be protected from unauthorized use. **Effective From: Fall 2013**

CS 725 - Independent Study in Computer Science I, II (3 credits)
Prerequisites: graduate standing and department consent. **Effective From: Fall 2006**

CS 730 - Seminar in Database Management Topics (3 credits)
Prerequisite: CS 631. A seminar in which students pursue intensive study of specialized topics in the current literature of database management. Each topic is supported by an initial reading list covering current problems in theory and practice. Students present the results of their studies in class with faculty and invited specialists participating. Topics include, but are not limited to, advanced data modeling, object oriented databases, query languages, semantic optimization, database mapping and integration, physical database architecture, database/knowledge-base integration, distributed databases, database machines, database version control, logical and deductive databases. **Effective From: Fall 2006**

CS 731 - Applications of Database Systems (3 credits)
Prerequisites: IS 675 and CS 631. Restricted to students who are specializing in computer and information systems management. Comparative study of different models of database management systems and their applications. Emphasis on the functions of the database administrator. Includes a survey of physical and logical organization of data, methods of accessing data, characteristics of different models of generalized database management systems, and case studies using these systems from various applications. Student teams design database systems for class projects. **Effective From: Fall 2006**

CS 734 - Data Mining (3 credits)
Prerequisites: Permission from instructor. Covers the concepts and principles of advanced data mining systems design. Presents methods for association and dependency analysis, classification and predication, and clustering analysis. Optional topics may include Web and scientific data mining, knowledge discovery applications, and current trends in data mining. **Effective From: Fall 2006 Until: Fall 2010**

CS 741 - Communication Network Design (3 credits)
Prerequisites: CS 651 and CS 652. Basic problems of communication network design: analyzes their complexity and provides algorithms, heuristics and other techniques for their solution. **Effective From: Fall 2006 Until: Spring 2009**

CS 744 - Data Mining and Management in Bioinformatics (3 credits)
Prerequisites: CS 610 or permission of the instructor. Concepts and principles of bioinformatic data mining and management with focus on efficiency and scalability. Methods for indexing and querying biological databases, biological data mining, and algorithmic development for bimolecular and phlyogenetic data analysis. Trends and advances in areas such as functional genomics and proteomics, genetic engineering, and large-scale gene expression data analysis. **Effective From: Fall 2006**

CS 750 - High Performance Computing (3 credits)
Prerequisite: CS 650. An in-depth study of the state of the art in high performance computing. Topics parallel computer architectures, programming paradigms, and their applications. Parallel architectures include PC clusters, shared-memory multiprocessors, distributed-memory multiprocessors, and multithreaded architectures. Parallel programming paradigms include message passing interface (MPI), its second-generation MPI-2, and multithreaded programming. Applications include computational science and high performance Web and database servers for Internet-based electronic commerce. Students program a parallel machine in class projects. First-hand experience in stable, scalable, high performance computing for Internet-based electronic commerce. **Effective From: Fall 2006**

CS 752 - Communication Protocol Synthesis and Analysis (3 credits)
Prerequisite: CS 652 or basic familiarity with communication protocols. An in-depth study of the state of the art of protocol

engineering. Enables students to apply the techniques of protocol design to real problems in communication protocols. **Effective From: Fall 2006 Until: Spring 2009**

CS 755 - Security and Privacy in Wireless Networks (3 credits)
This course covers selected topics on security and privacy in wireless networks and is intended for graduate students who are interested in network security. This course can help the students learn the state of the art and open challenges in wireless network security and privacy, thus enhancing their potential to perform research or pursue a career in this emerging area. **Effective From: Spring 2011**

CS 756 - Mobile Computing and Sensor Networks (3 credits)
This course provides an in-depth study of mobile computing and sensor networks, which are becoming major components of the transition from today's world of desktop computers to a world where computing is ubiquitous. The main topics include: techniques to handle mobility in the Internet and ad hoc networks; operating systems, programming languages, and protocols for sensor networks; applications, middleware, programming models, and security ubiquitous computing environments. **Effective From: Spring 2008**

CS 759 - Advanced Image Processing and Analysis (3 credits)
Prerequisite: CS 659. Advanced study of recent research in image processing, analysis, and understanding. Topics include all image processing techniques, high-level recognition approaches, and automated expert vision systems. **Effective From: Fall 2006**

CS 775 - Seminar in Software Engineering (3 credits)
Prerequisite: CS 673. A seminar in which students pursue intensive study of specialized topics in the current literature of software engineering. Each topic is supported by an initial reading list on current problems in theory and practice. The results of the studies are discussed in class with students, faculty and invited specialists. **Effective From: Fall 2006**

CS 777 - Seminar in Software Management and Production (3 credits)
Prerequisites: Ph.D. core courses. A seminar in which students pursue intensive study of specialized topics in the current literature of software management and production. Each topic is supported by an initial reading list covering current problems in theory and practice. The results of the studies are discussed in class with students, faculty, and invited specialists participating. Topics include, but are not limited to, theory of algorithm structure, analysis of algorithms and programs, hardware technology assessment, automated tools for software production, software measurements and quality, peripheral device interfaces, data communications, computer networks, distributed processing, software verification, implementation standards, documentation standards, system security, software copyright, and project control and organization. **Effective From: Fall 2006**

CS 780 - Computer Vision (3 credits)
Prerequisite: CS 505. This course introduces computational models of computer vision and their implementation on computers, and focuses on material that is fundamental and has a broad scope of application. Topics include contemporary development in all mainstream areas of computer vision e.g., Image Formation, Feature Representation, Classification and Recognition , Motion Analysis, Camera Calibration, 3D Vision, Shape From X, and typical applications such as Biometrics. **Effective From: Fall 2006 Until: Fall 2010**

CS 782 - Pattern Recognition and Applications (3 credits)
Prerequisite: CS 610. Study of recent advances in development of (statistical and syntactic) pattern algorithm, approximation, and estimation techniques. Topics include statistical estimation theory, classifier design, parameter estimation and unsupervised learning, bias vs. variance, nonparametric techniques, linear discriminant functions, tree classifiers, feature extraction, and clustering. Additional topics include Support Vector machines (SVM), Bayesian Learning, Hidden Markov Models (HMM), evolutionary computation, neural networks, with applications to signal interpretation, time-series prediction, and Biometrics. **Effective From: Fall 2006**

CS 785 - Seminar in Computer and Information Science I (3 credits)
Prerequisites: determined by nature of topic area. Advance notice of the topics to be covered is given. These seminars examine in depth a special interest area of computer and information science. It emphasizes recent work in area selected for the offering of the course. This course is for master's students and cannot apply toward master's degree credit. **Effective From: Fall 2006**

CS 786 - Special Topics (3 credits)
Prerequisites: same as for CS 785. A continuation of CS 785. **Effective From: Fall 2006**

CS 791 - Graduate Seminar (Non-credit)
Corequisite (for doctoral students only): CIS 790. A seminar in which faculty, students, and invited speakers will present summaries of advanced topics in computer and information systems management. In the course students and faculty will discuss research procedures, dissertation organization, and content. Students engaged in research will present their own problems and research progress for discussion and criticism. **Effective From: Fall 2006**

CS 792 - Pre-Doctoral Research (3 credits)
Prerequisite: permission from department chairperson. For students admitted to the doctoral program in computer and information science who have passed the field exam or the qualifying examination. Research is carried out under the supervision of a designated faculty member. Students identify a research problem and prepare a plan to solve the problem. A maximum of 6 credits of CS 792 may be applied to the CIS 790 requirement. **Effective From: Fall 2006**

CS 794 - Computer Science/Information Systems Colloquium (Non-credit)
Prerequisite: graduate standing with major in computer science. Colloquium in which national and international experts in the various fields of computer science are invited to present and discuss the results of their recent research. **Effective From: Fall 2006**

Co-op: Co-op

UNDERGRADUATE COURSES:

CDS 201 - Career Development Seminar (1-0-0)
This eight-week course is a requirement for all Career Advancement Program (CAP) sophomore students and is open to all students with higher than first-year standing who have an interest in career exploration and development. Learn effective job search strategies, how to explore and develop career objectives, prepare resumes and cover letters, how to research organizations, and improve interviewing skills. Through discussion, group exercises and actual interview practice sessions, become better prepared to begin the career development and job search process. Guest lecturers from the private and public sectors add a real-world perspective to the classroom experience.

Criminal Justice: Offered by the School of Criminal Justice at Rutgers-Newark

UNDERGRADUATE COURSES:

R202:307 - Culture and Crime (3)
For more details go to Rutgers Catalog.

Digital Design: Offered by the School of Art + Design

UNDERGRADUATE COURSES:

DD 275 - History of Games (2-3-3)
Prerequisites: AD 111, 112 and AD 162 or Arch 163, Arch 263 and Arch 251. 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. **Effective From: Fall 2013**

DD 284 - Video and Animation (3-0-3)
Prerequisites: AD 112 and AD 150 or equivalent with instructor's and program permission. 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. **Effective From: Spring 2011**

DD 301 - Acting Fundamentals for Animators (3-0-3)
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. **Effective From: Spring 2010**

DD 303 - Foundations of Sound and Music (3-0-3)
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. Digital Design majors only, others by permit. **Effective From: Fall 2013**

DD 320 - Computational Design (3-0-3)
Prerequisite: AD 112, AD 150; or ARCH 155, ARCH 156; or instructor approved equivalents. The course explores methods for algorithmically modeling spatial structures. Through a sequence of scripting exercises in application-specific programming environments, the course further explores rule-based generation of spatial forms and the underlying mathematical principles. Applications of digital fabrication and physical computing are also explored. **Effective From: Fall 2012**

DD 321 - Interactive and Reactive Environments (3-0-3)
Prerequisites: AD 112, AD 150 and DD 284, or ARCH 155, 156, 263 and 264, 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. **Effective From: Fall 2012**

DD 363 - Digital Design Studio I (1-12-5)
Prerequisites: AD 111, 112, 150,161, 162; DD 284. CO/Prerequisites: 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. **Effective From: Fall 2010**

DD 364 - Digital Design Studio II (1-12-5)
Prerequisites: Arch 251, 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.

Effective From: Fall 2010

DD 403 - Digital Sound and Music (3-0-3)
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. **Effective From: Spring 2014**

DD 415 - Web/Exhibit Development (3-0-3)
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. **Effective From: Spring 2012**

DD 442 - Visual & Special Effects in Movies (3-0-3)
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. **Effective From: Spring 2014**

DD 449 - Imaginary Worlds: Architecture in Motion Pictures (3-0-3)
Prerequisites: AD 112, AD 161, AD 162 & ARCH 382. 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. **Effective From: Fall 2013**

DD 464 - Digital Design Studio III (1-12-5)
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. **Effective From: Spring 2012**

Economics: Offered by the School of Management. See Management course list for faculty.

UNDERGRADUATE COURSES:

Econ 201 - Economics (3-0-3)
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. **Effective From: Fall 2009**

Econ 265 - Microeconomics (3-0-3)
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 (3-0-3)
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 SS 201 may not subsequently receive credit for Econ 266.

Econ 485 - Special Topics in Economics (3-0-3)
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. **Effective From: Fall 2009**

R220:102 - Introduction to Economics, Macro (3)
For more details go to Rutgers Catalog.

R220:304 - Economics of Labor (3)
For more details go to Rutgers Catalog.

R220:322 - Introduction to Econometrics (3)
For more details go to Rutgers Catalog.

R220:323 - Intermediate Microeconomic Theory (3)
For more details go to Rutgers Catalog.

R220:324 - Intermediate Macroeconomic Theory (3)
For more details go to Rutgers Catalog.

R220:339 - Economic Development (3)
For more details go to Rutgers Catalog.

R220:402 - Advanced Econometrics (3)
For more details go to Rutgers Catalog.

GRADUATE COURSES:

Econ 565 - Managerial Economics (3 credits)
Managerial decision-making for different markets: structure of industry, vertical integration, conglomerate firms, multinational firms,

theory of contestable markets, entry deterrence, estimating demand and cost functions, price discrimination, agency trade, theory of regulation, market signaling and hiring, and theory of share economy.

Econ 610 - Managerial Economics (3-0-3)
Managerial Economics covers the role of economic theory in management analysis and decisions. The study of demand, cost, and supply theories from a business viewpoint are also covered. This course is about economic principles and their relevance to business decision-making. The course examines the interaction of information, economic incentives and market competition and how these interact to determine prices, products available, profits, and patterns of trade and organization. **Effective From: Fall 2013**

Education, Science, Technology and Society: Offered by the Department of Humanities

UNDERGRADUATE COURSES:

ESTS 298 - Teaching in Urban Schools (3-0-3)
Prerequisite: Intended for students in Teaching Certificate program or by permission of the STS Director. This course introduces students to critical issues of teaching in urban schools. Readings and seminar discussions will focus on: the urban setting, children's lives in the inner city, urban schools, teachers' experiences in urban schools, the classroom, the curriculum, culturally responsive pedagogy, special education in the urban context, bilingual education, immigrant children in American schools, and Newark as an example of some of the topics studied in the course. **Effective From: Spring 2013**

ESTS 331 - Teaching in Urban Schools (3-0-3)
Prerequisite: Intended for students in Teaching Certificate program or by permission of the STS Director. This course introduces students to critical issues of teaching in urban schools. Readings and seminar discussions will focus on: the urban setting, children's lives in the inner city, urban schools, teachers' experiences in urban schools, the classroom, the curriculum, culturally responsive pedagogy, special education in the urban context, bilingual education, immigrant children in American schools, and Newark as an example of some of the topics studied in the course. **Effective From: Spring 2009 Until: Fall 2012**

ESTS 332 - Understanding Educational Eval. (3-0-3)
Prerequisites: R300:292 & STS 331 or R300:298, with a grade of C or better. This course examines educational evaluation-methods of data gathering, interpretations of data, as well as understanding and use of findings to inform and improve classroom practice. It provides knowledge and tools of evaluation to be proactive gatherers and users of data to plan and improve instruction. Students will define and understand various types of evaluations, how they are developed, administered, and analyzed, and their appropriate uses for the classroom. **Effective From: Spring 2011 Until: Fall 2012**

ESTS 333 - Science LIteracy and Pedagogy (3-0-3)
Prerequisite: Intended for students in Teaching Certificate program or by permission of the STS Director. This course investigates the principles of scientific literacy for the general public and how it can be achieved. Particular attention is paid to identifying a personal pedagogy, method of teaching, and how this can be capitalized upon to assist others to become more scientifically literate and aware. **Effective From: Spring 2009 Until: Fall 2012**

ESTS 335 - ICT in Secondary Schools (3-0-3)
Prerequisite: Intended for students in Teaching Certificate program or by permission of the STS Director. This course examines the integration of Information and Communication Technology (ICT) into instruction to foster community, collaboration, conceptual development, and exceptional academic performance. The course pays particular attention to present and potential access and academic uses of ICT in under-resourced urban schools with racially, ethnically, and linguistically diverse students whose families tend not to be participants in the US society's culture of power. **Effective From: Spring 2009 Until: Fall 2012**

ESTS 336 - Curriculum & Instruction for Secondary Schools (3-0-3)
Prerequisite: R300:292 and STS 331 or R300:298. This course introduces curriculum, its development, and how it influences classroom practice. Guidance documents (national, state & local), tensions between the overt, covert and hidden curricula, use of resources to enact and augment the curriculum, the need for interdisciplinary instruction, differentiated instruction, special education, and the integration of assessment into curriculum planning and implementation are examined general and for each subject-matter discipline. **Effective From: Spring 2011 Until: Fall 2012**

ESTS 337 - Obstacle to Understanding Science and Technology (3-0-3)
Prerequisite: Intended for students in Teaching Certificate program or by permission of the STS Director. This course examines the scientific disciplines typically taught to primary and secondary school children as part of standards-based education in America. It seeks to identify those factual inaccuracies, misconceptions, and other incorrect notions held by students-up-to and through college. Methods for identifying and overcoming incorrect notions will be presented. **Effective From: Spring 2009**

ESTS 338 - Paradigm Shifts in Science, Technology and Society (3-0-3)

Prerequisite: Intended for students in Teaching Certificate program or by permission of the STS Director. This course examines how to approach, discuss and debate controversial issues in science and technology in order to facilitate civil discourse and policy-formation in a democratic society. Various types of controversies will be addressed illustrating various aspects of debate and discourse needed to arrive at compromise, understanding, and consensus. Students will learn how to moderate group discussion dealing with current science and technology issues facing society and learn to moderate discussions for themselves and for others. **Effective From: Spring 2009**

ESTS 386 - Methods of Teaching (3-0-3)
Prerequisite: Intended for students in Teaching Certificate program or by permission of the STS Director. This course investigates the principles of scientific literacy for the general public and how it can be achieved. Particular attention is paid to identifying a personal pedagogy, method of teaching, and how this can be capitalized upon to assist others to become more scientifically literate and aware. **Effective From: Spring 2013**

ESTS 388 - Curriculum and Instruction for Secondary Schools (3-0-3)
Prerequisite: R300:292 and ESTS 298 or R300:298. This course introduces curriculum, its development, and how it influences classroom practice. Guidance documents (national, state & local), tensions between the overt, covert and hidden curricula, use of resources to enact and augment the curriculum, the need for interdisciplinary instruction, differentiated instruction, special education, and the integration of assessment into curriculum planning and implementation are examined general and for each subject-matter discipline. **Effective From: Spring 2013**

ESTS 390 - Understanding Educational Evaluation (3-0-3)
Prerequisites: R300:292 & STS 331 or R300:298, with a grade of C or better. This course examines educational evaluation-methods of data gathering, interpretations of data, as well as understanding and use of findings to inform and improve classroom practice. It provides knowledge and tools of evaluation to be proactive gatherers and users of data to plan and improve instruction. Students will define and understand various types of evaluations, how they are developed, administered, and analyzed, and their appropriate uses for the classroom **Effective From: Spring 2013**

ESTS 410 - ICT in Secondary Schools (3-0-3)
Prerequisite: Intended for students in Teaching Certificate program or by permission of the STS Director. This course examines the integration of Information and Communication Technology (ICT) into instruction to foster community, collaboration, conceptual development, and exceptional academic performance. The course pays particular attention to present and potential access and academic uses of ICT in under-resourced urban schools with racially, ethnically, and linguistically diverse students whose families tend not to be participants in the US society's culture of power. **Effective From: Spring 2013**

Electrical and Computer Engineering: Offered by the Department of Electrical and Computer Engineering.

UNDERGRADUATE COURSES:

ECE 101 - Introduction to Electrical and Computer Engineering (1-0-0)
Prerequisite: None. Familiarize students with various disciplines, career opportunities and curricula in electrical and computer enginneering. Invited speakers include faculty and industrial representatives. **Effective From: Fall 2003**

ECE 231 - Circuits and Systems I (3-1-3)
Prerequisites: Phys 121 and Math 112 or Math 133. 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 (3-1-3)
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 (3-1-3)
Prerequisites: Phys 121. 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 (3-0-3)
Prerequisites: 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 (3-1-3)
Prerequisite: ECE 231. 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 (0-3-1)
Prerequisites: ECE 231, HSS 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. **Effective From: Spring 2011**

ECE 310 - Co-op Work Experience I (0 credits)
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. **Effective From: Fall 2011**

ECE 321 - Random Signals and Noise (3-0-3)
Prerequisite: ECE 232 and 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 (3-0-3)

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 341 - Energy Conversion (3-0-3)
Prerequisite: ECE 231. Magnetic materials and their applications including the design of singly- and multiply-excited magnetic circuits and transformers, and the steady-state performance of dc and ac electromechanical energy converters.

ECE 353 - Computer Organization and Architecture (3-0-3)
Prerequisites: 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. **Effective From: Fall 2003**

ECE 354 - Digital Test (2-0-2)
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. **Effective From: Fall 2003**

ECE 361 - Electromagnetic Fields I (3-0-3)
Prerequisites: ECE 231, Math 213. Vector analysis and calculus, static electric and magnetic fields, capacitance and inductance, electric currents, resistance, time dependent fields and introduction to Maxwell's equations. **Effective From: Fall 2013**

ECE 362 - Electromagnetic Fields II (3-0-3)
Prerequisites: 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 (2-0-2)
Prerequisites: ECE 232, ECE 251. Familiarization with 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. **Effective From: Fall 2003**

ECE 372 - Electronic Circuits II (3-0-3)
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 373 - Electronic Circuits III (3-0-3)
Prerequisites: ECE 372. Topics include operational amplifier fundamentals, linear op-amp circuits, instrumentation amplifiers, feedback theory, active filters, practical op-amp limitations, Schmitt triggers, oscillators, multivibrators, timers, and waveform generators. **Effective Until: Spring 2012**

ECE 374 - Electronic Device I (3-0-3)
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. **Effective From: Fall 2010**

ECE 392 - Electrical Engineering Laboratory II (1-2-2)
Prerequisite: ECE 271, and ECE 291. Laboratory work in some of the areas covered in ECE 251, ECE 333 and ECE 372. Design, testing and performance analysis of analog and digital electronic circuits. Simulations of the designed circuit's performance on the personal computer. **Effective From: Fall 2013**

ECE 394 - Digital Systems Lab (0-3-1)
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. **Effective From: Fall 2003**

ECE 395 - Microprocessor Laboratory (0-4-2)
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 (3-0-3)
Prerequisites: Phys 121. (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 degree credits)
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 **Effective From: Spring 2013**

ECE 413 - Introduction to Electrical Engineering Practice (1-0-1)
Prerequisite: senior standing or permission of the instructor. Planning and execution of engineering projects. Intellectual property: publications and proprietary documents, invention disclosures and patents. Safety: the role of engineering codes and standards. Engineering ethics. Professional organizations. Professional registration. Preparation of a technical proposal for a senior project and its approval required. **Effective Until: Summer 2005**

ECE 414 - Electrical and Computer Engineering Project I (1-0-1)
Prerequisite: Senior standing. 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. **Effective From: Fall 2005**

ECE 415 - Electrical Engineering Project (1-2-2)
Prerequisites: ECE 373, ECE 413, ECE 494. A synthesis and focusing of previous experience, in and out of college, upon one or more electrical engineering projects selected by the student. Involves library research, design, cost analysis, construction and testing. Projects are shared in final project presentations. **Effective Until: Summer 2005**

ECE 416 - Electrical and Computer Engineering Project II (3-0-3)
Prerequisites: 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. **Effective From: Fall 2007**

ECE 417 - Independent Study (3-0-3)
Prerequisites: ECE 414. Students work on various individually selected projects guided by the individual faculty or faculty and industrial mentors. There are no scheduled course meetings but the project progress is continuously monitored 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 Workshop in the present of students, faculty and industry representatives. **Effective From: Fall 2007**

ECE 421 - Digital Data Communications (3-0-3)
Prerequisites: ECE 232, Math 333, or ECE 321. Covers communications basics and some topics in digital communications most germane to data communication. Topics include signal classification, correlation, spectral analysis, energy and power spectral density, white noise, signal transmission through linear systems, sampling and quantization, and principles of digital data transmission. **Effective From: Fall 2007**

ECE 422 - Computer Communications Networks (3-0-3)
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. **Effective From: Fall 2003**

ECE 423 - Data Communications Networking Devices (3-0-3)
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. **Effective From: Fall 2003**

ECE 424 - Optical Communication Network (3-0-3)
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. **Effective From: Fall 2003**

ECE 425 - Wireless Communication Systems (3-0-3)
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 blockssuch as modulation, synchronization, coding, diversity, equalization, and spreading. **Effective From: Fall 2003**

ECE 429 - Computer Communications Lab (0-4-2)
Prerequisites: 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. **Effective From: Spring 2013**

ECE 431 - Introduction to Feedback Control Systems (3-0-3)
Prerequisite: ECE 232. 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. **Effective From: Spring 2013**

ECE 432 - Control Systems Elective (3-0-3)
Prerequisites: ECE 431. A continuation of the study of automatic control systems with emphasis on computer-aided design and problem solving. Topics covered include state feedback control, observers, industrial regulators, linear quadratic regulators, and the analysis of various common system nonlinearities. Implementation techniques on both analog and digital platforms will be addressed. **Effective From: Fall 2003**

ECE 435 - Medical Imaging Instrumentation & Data Acquisition Systems (3-0-3)
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. **Effective From: Fall 2007**

ECE 436 - Bio Control Systems (3-0-3)
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. **Effective From: Fall 2007**

ECE 438 - Bio Electronic Systems Laboratory (0-4-2)
This laboratory provides the laboratory experience for students interested in medical applications from the perspective of electrical and computer engineering. It consists of 3 modules: Bio-electronics, Bio-control and Bio-imaging. **Effective From: Fall 2006**

ECE 439 - Control Systems Laboratory (0-4-2)
Prerequisites: ECE 431. Laboratory work in the design and synthesis of control systems, closely coordinated with the control systems elective. **Effective From: Fall 2007**

ECE 441 - Power Electronics (3-0-3)
Prerequisites: 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. **Effective From: Fall 2003**

ECE 442 - Power Systems Elective (3-0-3)
Prerequisite: ECE 341. 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. **Effective From: Fall 2003**

ECE 443 - Renewable Energy Systems (3-0-3)
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, politics and social policy are integral components of the course. **Effective From: Fall 2009**

ECE 449 - Power Systems Laboratory (0-4-2)
Prerequisites: ECE 494. Corequisite: ECE 442. Laboratory work in the design and synthesis of power systems, closely

coordinated with the power systems elective. **Effective From: Fall 2007**

ECE 451 - Advanced Computer Architecture (3-0-3)
Prerequisites: ECE 353. Focues on dvanced concepts in computer systems design, and the interaction between hardware and software components at various levels (i.e., hardware/_software codesign). Introduces common performance measures used by hardware and software designers to facilitate comparative analysis. Main topics are: advanced pipelining, good instruction sets, CISC and RISC microprocessors, introduction to parallel computing, and a brief historical survey of computer designs. **Effective From: Fall 2003**

ECE 452 - Advanced Computer Architecture II (3-0-3)
Prerequisite: ECE 451. Topics include memory allocation, single-instruction stream parallelism, parallelism by message passing, shared-resource systems, protection and security, stack-oriented systems, systolic array systems, and data-flow systems. Discusses the relationships between software and hardware levels of system implementation and -operation. **Effective From: Fall 2003**

ECE 453 - Introduction to Discrete Event Systems (3-0-3)
Prerequisites: ECE 251 or CIS 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. **Effective From: Fall 2003**

ECE 457 - Digital Image Processing (3-0-3)
Prerequisites: 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. **Effective From: Fall 2007**

ECE 459 - Advanced Computer Systems Design Lab (0-4-2)
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. **Effective From: Fall 2007**

ECE 461 - Microwave and Integrated Optics (3-0-3)
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. **Effective From: Fall 2007**

ECE 462 - RF/Fiber Optics Systems Elective (3-0-3)
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. **Effective From: Fall 2003**

ECE 463 - Optoelectronics (3-0-3)
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. **Effective From: Fall 2007**

ECE 469 - RF/Microwave and Fiber Optics Systems Laboratory (0-4-2)
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. **Effective From: Fall 2003**

ECE 471 - Active Network Design (3-0-3)
Prerequisite: ECE 373. Topics include the basic theorems of network synthesis; the design of LC and RC networks; the design of second-order active RC low-pass, high-pass, band-pass and notch filters; and the design of high-order filters with Butterworth, Chebyshev, Elliptic, and Bessel response. Also, switched-capacitor circuit designs and other selected topics. **Effective From: Fall 2003**

ECE 472 - Pulse Techniques (3-0-3)
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. **Effective From: Fall 2003**

ECE 475 - VLSI Circuits (3-0-3)

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 476 - Electronic Device II (3-0-3)
Prerequisite: ECE 374. Thorough study of basic principles of semiconductor electrical behavior (particularly as applied to junction, the MOS field effect, and optoelectronic devices) in order to understand their operation and characteristics. Devices include Schottky barrier and PN junction diodes, bipolar and FET transistors, solar cells, photoconductive and photovoltaic detectors, LEDs, and semiconductor lasers. Emphasis on characteristics important for circuit design, e.g., dynamic switching behavior. **Effective From: Fall 2007**

ECE 477 - Semiconductor Sensors and Bio Electronics (3-0-3)
Prerequisite: ECE 374. The course outlines electronic systems geared for bio-sensors from fabrication to realization point of view. Topics include MEMS, device fabrication, BioMEMS and detection methods, Signal Conditioning Circuits, Signal Amplification, Microarrays & Nanoscale Arrays, Nanotechnology. **Effective From: Fall 2007**

ECE 478 - VLSI Circuits (3-0-3)
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. **Effective Until: Summer 2003**

ECE 479 - Optoelectronics and Electronic Laboratory (0-4-2)
Co-requisites: ECE 463 and ECE 476. The Laboratory course outlines experiments on electronic and optoelectronics device concepts. Topics include Optical waveguide, Solar Cell, LED Modulation of Light, capacitance-voltage of MOS structure. **Effective From: Fall 2007**

ECE 481 - Digital Communications Systems (3-0-3)
Prerequisites: 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. **Effective From: Spring 2013**

ECE 482 - Communications Systems Elective (3-0-3)
Prerequisites: 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. **Effective From: Fall 2003**

ECE 489 - Communications Systems Laboratory (0-4-2)
Prerequisites: ECE 481. The laboratory experiments include time and frequency domain analysis of AM and FM signals, generation and detection of digitally modulated waveforms (ASK, FSK,BPSK), line coding and synchronization. Through the experiments, students learn how to assess and combat the impairments due to noise, and become familiar with instruments such as spectrum analyzers, audio analyzers and noise generators. **Effective From: Fall 2003**

ECE 494 - Electrical Engineering Laboratory III (1-2-2)
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. **Effective From: Spring 2013**

ECE 495 - Computer Engineering Design Lab (1-4-3)
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. **Effective From: Fall 2003**

ECE 497 - Computer Systems Laboratory (0-4-2)
Prerequisite: ECE 494. Corequisite: ECE 487. Laboratory work in the design and synthesis of computer systems, closely coordinated with the computer systems elective.

ECE 498 - Special Topics in Electrical and Computer Engineering (3-0-3)

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. **Effective From: Fall 2007**

GRADUATE COURSES:

ECE 501 - Linear Systems and Random Signals (3 credits)
This course, serving as a bridge course for non-electrical and computer engineering department graduate students, provides fundamental coverage of signal and system analysis, including probabilistic methods. Topics include signal models, system properties, Fourier Transform, introduction to probability, random variables, random processes, correlation functions, and spectral density.

ECE 550 - Circuit Analysis (3 credits)
Introduction to analysis of linear circuits and systems. Techniques used include mesh and nodal analysis, network theorems, steady-state and transient methods, analogs, Fourier series and transforms, and LaPlace transforms. Pole-zero diagrams are developed as an aid in the study of low-order systems. Credits for this course may not be used to fulfill any electrical engineering degree requirement. **Effective Until: Fall 2004**

ECE 590 - Graduate Co-op Work Experience I (3 credits)
Prerequisites: permission from Department of Electrical and Computer Engineering and Division of Career Development Services. Cooperative education/internship providing on-the-job reinforcement of academic programs in electrical and computer engineering. Assignments and projects are developed by the co-op office in consultation with the electrical and computer engineering department. Work assignments are related to student's major and are evaluated by faculty coordinators in the ECE department. Credits for this course may not be used to fulfill any electrical or computer engineering degree requirement.

ECE 591 - Graduate Co-op Work Experience II (3 additive credits)
Prerequisites: ECE 590 and permission from Department of Electrical and Computer Engineering and Division of Career Development Services. See ECE 590 course description. Credits for this course may not be used to fulfill any electrical or computer engineering degree requirement.

ECE 592 - Graduate Co-op Work Experience III (3 additive credits)
Prerequisites: graduate standing and permission from Department of Electrical and Computer Engineering and Division of Career Development Services. See ECE 590 course description. Credits for this course may not be used to fulfill any electrical or computer engineering degree requirement.

ECE 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

ECE 599 - Electrical Engineering Laboratory (3 credits)
Prerequisites: B.S. in engineering or science, and permission from ECE department. Workshop on fundamental measurements involving instrumentation commonly used in testing electronic and power circuits. Credits for this course may not be used to fulfill any electrical engineering degree requirement.

ECE 601 - Linear Systems (3 credits)
Methods of linear-system analysis, in both time and frequency domains, are studied. Techniques used in the study of continuous and discrete systems include state-variable representation, matrices, Fourier transforms, LaPlace transforms, inversion theorems, sampling theory, discrete and fast Fourier transforms, and Z-transforms. Computer simulation of linear systems is used, and, where feasible, computer solutions are obtained. **Effective Until: Fall 2011**

ECE 605 - Discrete Event Dynamic Systems (3 credits)
Corequisite: Math 630 or ECE 601 or MnE 603 or equivalent. Covers the theory of discrete event dynamic systems with applications in modeling, control, analysis, validation, simulation, and performance evaluation of computer systems, flexible manufacturing systems, robotic systems, intelligent supervisory control systems, and communication networks. Emphasis on Petri net and automation based approaches.

ECE 609 - Artificial Neural Networks (3 credits)
Prerequisites: ECE 601 and ECE 673 or consent of instructor. Artificial Neural Networks (ANN) are networks consisting of massively parallel connected simple processing elements arranged in various topology, usually in layers. Various ANN models, learning paradigms, and applications are covered. The course evolves from a simple single-neuron structure to more complex networks.

ECE 610 - Power System Steady-State Analysis (3 credits)
Prerequisite: B.S. in EE or ME. Steady-state analysis of power system networks, particularly real and reactive power flows under normal conditions and current flows under faulty conditions. Symmetrical components and digital solutions are emphasized.

ECE 611 - Transients in Power Systems (3 credits)
Prerequisite: ECE 610. Transient performance of power systems with lumped properties, interruption of arcs, restriking voltage, re-ignition inertia effects, switching of rotational systems, magnetic saturation in stationary networks, harmonic oscillations, saturated systems, transient performance of synchronous machines.

ECE 612 - Computer Methods Applied to Power Systems (3 credits)
Prerequisite: undergraduate computer programming. Digital computer techniques proven successful in the solution of power system problems, particularly in the electric utility industry. Emphasis on short-circuit, load flow, and transient stability problems. Matrix sparsity is considered.

ECE 613 - Protection of Power Systems (3 credits)
Prerequisite: ECE 610 or equivalent Coils, condensers, and resistors as protective devices; fundamental principles of protective relaying; relay operating characteristics; power and current directional relays; differential relays; distance and wire pilot relays; heating and harmonic effects; and Computer-based protective device coordination. **Effective From: Fall 2009**

ECE 614 - Dynamics of Electromechanical Energy Conversion (3 credits)
Prerequisites: ECE 620 and undergraduate electric machines. Dynamic behavior of lumped parameter systems; study of a continuum electromechanics, such as magnetic diffusion and the stress tensor; and dynamics of electromechanical continua in two- and three-dimensional systems. **Effective Until: Fall 2004**

ECE 615 - Advanced Electromechanical Energy Conversion I (3 credits)
Prerequisite: undergraduate electric machines. Steady-state performance of synchronous machines; time constants, sudden reactive loading; sudden short-circuit conditions; dynamic behavior of synchronous machines; speed torque-current control of induction machines; magnetic noise and voltage ripples; and Kron generalized machine theory. **Effective Until: Fall 2000**

ECE 616 - Power Electronics (3 credits)
Prerequisite: B.S. in electrical engineering. Principles of thyristor devices, dynamic characteristics of choppers, commutation, protection, voltage-fed and current-fed inverter drives, cycloconverters, pulse width modulation, phase control, and microcomputer control, with case studies.

ECE 617 - Economic Control of Interconnected Power Systems (3 credits)
Economic Control of Interconnected Power Systems: Advanced techniques for operating power systems in the most economic manner while meeting various network constraints; economic dispatch, penalty factors, optimal power flow, short-term electricity markets and locational marginal prices will be studied. **Effective From: Fall 2009**

ECE 618 - Renewable Energy Systems (3 credits)
This course introduces renewable energy systems. It covers the fundamental concepts of energy and radiation with specific solar energy applications and photovoltaics, electrical energy storage systems, and thermal energy and storage. The second part covers the basic science of wind energy systems and their electrical sytem designs. The third part covers the bioenergy systems from resources to final products and conversion technologies. It finally introduces other promising energy sources. **Effective From: Spring 2009**

ECE 620 - Electromagnetic Field Theory (3 credits)
Prerequisite: undergraduate electromagnetic field theory or equivalent. Maxwell's equations, boundary conditions and formulation of potentials. LaPlace and Poisson equations for electrostatic and magnetostatic problems and the method of images. Dielectric and magnetic materials, force and energy concepts. Quasi-static and time varying fields, plane, cylindrical and spherical waves. Green's functions, transmission lines.

ECE 622 - Wave Propagation (3 credits)
Prerequisite: ECE 620 or equivalent. Fundamentals of electromagnetics; radiation and scattering; Green's functions; integral equations; numerical methods; ray optics and asymptotics.

ECE 623 - Fourier Optics (3 credits)
Prerequisite: EE 362 (see undergraduate catalog for description) or equivalent. Theoretical background needed to analyze various optical systems: two-dimensional Fourier transforms, vector and scalar diffractions, Fresnel and Fraunhofer approximations, the properties of lenses, coherence theory, frequency analysis of optical imaging systems, spatial filtering, optical information processing, and wavefront-reconstruction imaging.

ECE 624 - Optical Engineering (3 credits)
This course covers basic optical concepts, emphasizing those common to many optical instruments, such as light sources and their characteristics, polarization, coherence, and interferometry. The course introduces CAD tools for lenses, optical filters, and instrument design. The course also focuses on topics concerning optical systems, such as flat panel displays and micromechanical optical systems.

ECE 625 - Fiber and Integrated Optics (3 credits)
Prerequisites: undergraduate electromagnetic field theory and solid-state circuits. Planar dielectric waveguides, step and graded index fibers and dispersion in fibers. The p-n junction and heterostructures, light emitting diodes and semiconductor lasers, p-i-n and avalanche photodetectors, optical transmitter and receiver designs, optical fiber communication system design concepts.

ECE 626 - Optoelectronics (3 credits)
Prerequisites: undergraduate electromagnetic field theory and solid-state circuits. Optical propagation in anisotropic materials, polarization, birefringence and periodic media. Concepts of electro-optics and acousto-optic devices, optical modulators, switches, active filters for optical communication and optical processing.

ECE 630 - Microwave Engineering (3 credits)
Prerequisite: undergraduate course in electromagnetic field theory. Review of transmission line theory and the Smith chart; scattering matrix representation, LC and microstrip matching networks; signal flow graph analysis; micro-wave transistor amplifier design, which includes power gain, stability, noise figure circles; oscillator design.

ECE 632 - Antenna Theory (3 credits)
Prerequisite: undergraduate course in electromagnetic field theory. Fundamentals of electromagnetic field theory; far field approximation, antenna characteristics (gain, impedance, pattern, etc.); elementary antenna types (dipoles, loops, etc.), antenna array theory, wire antennas; broadband antennas.

ECE 635 - Conduction in Plasma (3 credits)
Prerequisite: undergraduate course in direct power generation. Maxwellian velocity distribution function, concentration and diffusion gradients, mean free path, methods of ionization, field intensified ionization, drift velocity, plasma temperature methods of deionization, plasma oscillations and plasma sheath, spark breakdown and mechanism of arcs.

ECE 636 - Computer Networking Laboratory (3 credits)
Prerequisites: ECE 637 or CS 656. This course provides students with hands on training regarding the design, troubleshooting, modeling and evaluation of computer networks. In this course, students are going to experiment in a real test-bed networking environment, and learn about network design and troubleshooting topics and tools such as: network addressing, Address Resolution Protocol (ARP), basic troubleshooting tools (e.g. ping, ICMP), IP routing (e,g, RIP), route discovery (e.g. traceroute), TCP and UDP, IP fragmentation and many others. Student will also be introduced to the network modeling and simulation, and they will have the opportunity to build some simple networking models using the OPNET modeling tool and perform simulations that will help them evaluate their design approaches and expected network performance.

ECE 637 - Internet and Higher-Layer Protocols (3 credits)
The course introduces the protocols and standards of the TCP/IP suite that govern the functioning of the Internet. The material covered in class is a top-down approach on introduction, discussion, and analysis of protocols from the data-link layer to the application layer. Alternative protocols to the TCP/IP suite and new protocols adopted by this suite are discussed. Numerical examples related to network planning and proocol functioning are analyzed. **Effective From: Spring 2010**

ECE 638 - Network Management and Security (3 credits)
Prerequisites: ECE 683 or CIS 652, and ECE 637 or CIS 656. Thorough introduction to current network management technology and techniques, and emerging network management standards. In-depth study of the existing network security technology and the various practical techniques that have been implemented for protecting data from disclosure, for guaranteeing authenticity of messages, and from protecting systems for network-based attacks. SNMP family of standards including SNMP, SNMPv2, and RMON (Remote Monitoring), OSI systems management. Various types of security attacks (such as intruders, viruses, and worms), Conventional Encryption and Public Key Cryptology. Various security services and standards (such as Kerberos, Digital Signature Standard, Pretty Good Privacy, SNMPv2 security facility). Same as CIS 696.

ECE 639 - Principles of Broadband Networks (3 credits)
Prerequisites: ECE 673, 683 or CS 652 or equivalent. This course covers fundamental concepts of broadband networks. Topics include Broadband ISDN, Switching Techniques, ATM, SONET/SDH, Congestion Control, High-Speed Switching Architectures, Traffic Modeling of Broadband Services, Admission Control, Traffic Scheduling, IP/ATM Convergence, QoS Provisioning in IP Networks, and Optical Networks.

ECE 640 - Digital Signal Processing (3 credits)

Prerequisite: ECE 601 or equivalent. The theory of digital signals and basic processing techniques: Discrete Fourier Series, Discrete Fourier Transform and FFT, Linear and Circular Convolution, Digital Filter Design Techniques, Discrete Hilbert Transforms, Discrete Random Signals, Chirp-Z and other advanced transforms. Introduction to multivariate signal processing. The typical applications of signal processing tools are discussed and connected to the theoretical foundations.

ECE 641 - Laboratory for High Performance Digital Signal Processing (3 credits)
This course first introduces today's FPGA and GPU technology, the design tools for the state-of-the-art DSP algorithms and systems. It focuses on computer arithmetic including possible number representations for DSP with FPGA like distributed arithmetic (DA) and CORDIC algorithm. Then, it introduces CUDA development tools for GPUS. Finally, there is a set of DSP implementations spanning from finite impulse response and infinite impulse response filters to wavelet processors with two-channel filter banks and others. Each student is also assigned a term project for the course to be implemented on FPGA or GPU. **Effective From: Fall 2011**

ECE 642 - Communication Systems I (3 credits)
Corequisite: ECE 673. Principles of communication theory applied to the representation and transmission of information. Topics include analysis of deterministic and random signals, amplitude modulation, angle modulation, sampling, quantization, PCM, DM, DPCM, geometric representation of signals, error probability, matched filter and correlation receivers and performance analysis of communication systems signal to noise ratio.

ECE 643 - Digital Image Processing I (3 credits)
Prerequisite: ECE 601. Introductory course in digital image processing. Topics include image models, digitization and quantization, image enhancement in spatial and frequency domains, image restoration, image segmentation and analysis.

ECE 644 - Wireless Communication (3 credits)
Prerequisites ECE 321 or MATH 333. This course is focused on the technical challenges and solutions to physical and link layer design of wireless communication systems. Course topics include characterization of the wireless channel, the cellular concept, digital modulation techniques, spread spectrum, multiple access techniques including CDMA and OFDMA, diversity techniques. Advanced techniques such as MIMO, 3G and 4G wireless technologies are introduced. Matlab is used for examples and assignments. Team projects based on advanced wireless technologies. **Effective From: Fall 2013**

ECE 645 - Wireless Networks (3 credits)
Prerequisites: EE 321 or Math 333, or equivalent (see undergraduate catalog for descriptions). Introduction to wireless network design, management, and planning stages. Topics include demand modeling, radio planning, network optimization, and information handling architecture with emphasis on resource allocation and mobility management aspects. Investigation of signaling load optimizations and internetworking problems.

ECE 646 - Introduction to Data Communications (3 credits)
Prerequisites: ECE 642 and ECE 673, or equivalent. Introduces the theory and technology of data communications over voice-grade and broadband channels. Provides the analytical tools required to understand and design data communication systems. Topics include: an overview of data communication systems, channel capacity, channel coding (block codes, cyclic codes, convolutional codes), data transmission, synchronization, equalization, and an introduction to adaptive equalization.

ECE 648 - Digital Microelectronics (3 credits)
Prerequisite: undergraduate semiconductor circuits. Topics include: linear wave shaping with RC circuits, clipping and clamping circuits; theory of operation of semiconductor diode, bipolar transistor (BJT), and MOSFET; BJT and MOSFET inverters, gate circuits, and regenerative logic circuits.

ECE 649 - Compression in Multimedia Engineering (3 credits)
Prerequisite: ECE 640 or instructor's permission. Foundations of information theory, audio/speech and video compression technologies. Detailed discussion of JPEG, image compression, H.261, MPEG-1 and MPEG-2 international video compression standard algorithms. Current status and future directions of very low bit rate MPEG-4 video compression standards activities.

ECE 650 - Electronic Circuits (3 credits)
Prerequisite: senior undergraduate level semiconductor circuits. Methods of analysis and design of linear and digital semiconductor circuits are studied. Topics include low and high frequency models, passive and active biasing techniques, I-C analysis and design, op-amp circuits, and active filters.

ECE 653 - Micro/Nanotechnologies for Interacing Live Cells (3 credits)
In this course, we will study technologies and tools available for interfacing live cells from a sub-cellular, single-cell, and multi-cellular (tissue models) approach. We will introduce key concepts of the biology of cells and tissues and will explore the technologies (micro-/nanotechnologies) and tools (sensors and actuators) available for the investigation of cell and tissue biology. Same as BME 653. **Effective From: Spring 2010**

ECE 655 - Modeling of Biological Neural Systems (3 credits)
This course introduces biological neural networks and systems as the essential parts of the autonomous, peripheral and central nervous systems in human body to perform physiological functions and determine behavior. The difference in neural architecture and function in different nervous systems will be discussed. Approaches for modeling of neural circuits with examples of simulation of small and large neural networks in human nervous systems for pattern generation, recall and recognition are discussed and studied. **Effective From: Spring 2010**

ECE 657 - Semiconductor Devices (3 credits)
Fundamental principles of solid state materials necessary for understanding semiconductor devices. Topics include crystal structure; energy bands; electron and hole generation, and transport phenomena; generation and recombination processes, and high field effects. P-N junction diode, metal semiconductor contact, and bipolar and metal oxide semiconductor transistors, including switching phenomena and circuit models. Introduction to: photonic devices~light emitting diodes, semiconductor lasers, photodetectors, and solar cells; microwave devices~tunnel and IMPATT diodes, transferred electron devices, and charge-coupled capacitors.

ECE 658 - VLSI Design I (3 credits)
Prerequisite: ECE 657 or equivalent. Analysis and design of digital integrated circuits; basic building blocks and dependence on circuit parameters of propagation delay; noise margin; fan-out; fan-in; and power dissipation for circuits of different logic families, including NMOS, CMOS and BiCMOS; subsystem designs in combinational and sequential logic; Memory Systems; HSPICE circuit simulation is used for digital characteristics evaluation. Mentor Graphics Layout design tools are used for chip design.

ECE 659 - Fabrication Principles of Electronic and Optoelectronic Devices (3 credits)
Prerequisite: ECE 657 or equivalent. Overview of all major processing steps in fabrication of integrated circuits such as crystal growth, epitaxy, oxidation, diffusion, ion implantation and etching. Formation of thin film structures along with techniques for defining submicron structures. Emphasizes silicon device technology but also includes processing of compound semiconductors such as gallium arsenide.

ECE 660 - Control Systems I (3 credits)
Prerequisites: undergraduate course equivalent to EE 333 or ME 305 (see undergraduate catalog for descriptions) and ECE 601 or equivalent or permission from instructor. Introduction to feedback control. Review of state-space analysis. Frequency-domain methods for analysis: Routh-Hurwitz stability algorithms, Root-loci; Nyquist and Bode plots; system ?type.? Controllability and observability. The separation principle and design by pole placement. Linear observers. Optimization of quadratic performance criteria. Elements of random processes. The Kalman filter as an optimum observer. Robustness considerations.

ECE 661 - Control System Components (3 credits)
Prerequisite: ECE 660. The theoretical and practical requirements for analog and digital state-of-the-art control system components are covered. Actuators, amplifiers, sensors, encoders, resolvers and other electromagnetic devices are included. A complete system is designed using current vendor catalog data. Problems affecting the system performance are analyzed using measures of functionality, reliability and cost.

ECE 662 - Large Power Control Systems (3 credits)
Prerequisites: ECE 660, ECE 614, or equivalents. Emphasis on the design and test analysis of servomechanisms and regulation systems involving large power components such as dc machines, induction motors, and alternators. Positioning and velocity servos using rotating amplifiers are covered. A velocity servo for controlling a large induction motor is designed and a typical alternator voltage regulator studied, with regard to its servo characteristics. Methods of determining motor size and gear ratio in large positioning servos are covered.

ECE 664 - Real-time Computer Control Systems (3 credits)
Prerequisite: EE 486 or equivalent (see undergraduate catalog for description). Emphasizes the practical aspects of modern computer control systems. Topics include: Architecture of digital signal processors (DSP) and microcontrollers, real-time data acquisition devices and interface, programming a DSP, review of sampling theorems and properties of discrete-time systems, introduction of control systems theory, design and implementation of parameter optimized controllers, state variable controllers, and cancellation controllers. An experimental project using a TMS320C2x DSP-based data acquisition system is an integral part of this course.

ECE 666 - Control Systems II (3 credits)
Prerequisites: ECE 601 and ECE 660. Properties of nonlinear systems and basic concepts of stability including small-signal linearization. State plane methods are introduced, with emphasis on controller design for systems that can be represented by second-order approximations. Concepts of equivalent gain, describing function, and dual-input describing function as applied to a large class of nonlinear systems. Representation of linear sampled-data systems in discrete state variable form, stability and performance of discrete-event systems. Full-state feedback, pole placement and observer design. Linear quadratic control and Kalman filtering.

ECE 667 - Bio-Control Systems (3 credits)
The course provides an introduction to dynamic and control in biological systems, with particular emphasis on engineering aspects of biological oscillators/waves which govern the basic operations of all living organisms and especially higher order life forms. 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. Same as BME 667. **Effective From: Spring 2010**

ECE 668 - Mecial Imaging Systems (3 credits)
This course provides a detailed introduction to medical imaging physics, instrumentation, data acquisition and image processing systems for reconstruction of multi-dimensional anatomical and functional medical images. Three-Dimensional medical imaging modalities including X-ray, Computer Tomography, Magnetic Resonance Imaging, Single Photon Emission Computer Tomography, Positron Emission Tomography, Ultrasound and optical imaging modalities are included. Same as BME 668. **Effective From: Spring 2010**

ECE 669 - Engineering Physiology (3 credits)
To enable students to apply basic tools in engineering analysis, mathematics, computer science, general physics and chemistry courses so that they can develop models that quantitatively predict the functioning of physiological systems in the human body. To enable students to apply engineering systems analysis to systematic physiology and employ the ideas of feedback control, signal procession, mathematical modeling and numerical simulation. Same as BME 669. **Effective From: Spring 2010**

ECE 673 - Random Signal Analysis I (3 credits)
Fundamentals of the theory of random variables. Introduction to the theory of random processes. Topics include functions of random variables, sequences of random variables, central limit theorem, properties of random processes, correlation, spectral analysis and linear systems with random inputs.

ECE 677 - Optimization Techniques (3 credits)
Prerequisite: undergraduate course in differential equations. Analytical and numerical methods for finding an extremum emphasizing how and when to apply them. Classical differentiation, Lagrange multipliers, the calculus of variations, penalty functions, slack variables, search techniques, and stochastic approximation are covered.

ECE 681 - High Performance Routers and Switches (3 credits)
The course introduces the different system comprising and Internet routing including the processors for networking function and protocol compliance, switching functions and packet classification for deep-layer inspection capable routers or network appliances. This course material describe the different functions that Internet routers perform and discusses the different approaches used for improving performance of high-end routers. The content includes a discussion on switch architectures. **Effective From: Spring 2010**

ECE 682 - Introduction to Computer Network Design: Internet Perspective (3 credits)
Explicit emphasis on design considerations. Covers the basics of computer networking and the important current network technologies including the premier local area network and wide area network technologies and services, as well as the description of the relevant protocols. Also covers explicit related design considerations and implications. Amplifies the conclusions with discussions of relevant examples and case studies.

ECE 683 - Computer Network Design and Analysis (3 credits)
Corequisite: ECE 673. Queueing models and state-transition models are introduced to model, design and analyze computer networks. The OSI model, LANS (including token ring, token bus, and Ethernet), and useful network protocols. Emphasis on the physical, data link and network layers. ALOHA, Stop-and-Wait protocol, Go-Back-N protocol, window-flow-control, and shortest-path routing.

ECE 684 - Advanced Microprocessor Systems (3 credits)
Prerequisites: undergraduate course in computer architecture and microprocessors, and some experience in assembly language programming. Architecture of advanced microprocessors; CPU architecture, memory management and protection, interrupt and exception facilities, instruction sets, systems aspects including peripheral interfaces, communications ports, and real-time systems.

ECE 685 - Network Interface Design (3 credits)
Prerequisite: ECE 683 or equivalent. Provides a working knowledge of data communications networking devices, the building blocks upon which networks are constructed. Emphasizes devices and their function in data communication networks. Covers the use of devices in the design, implementation, modification, and optimization of data communications networks.

ECE 686 - Instrumentation Systems and Microprocessors (3 credits)
Prerequisite: undergraduate course in microprocessors. Principles of instrumentation transducers and the electronic amplifiers and filters needed to process the electrical signals generated by them; types and characteristics of A/D and D/A converters and other

circuits necessary for the interfacing of instrumentation data to a computer or digital data transmission system. Emphasis placed on development of stand-alone analog instrumentation systems as well as microprocessor-based systems. Tradeoffs and alternatives for both implementations are emphasized as well as cost effectiveness of each design. Hardware and software are developed as needed.

ECE 687 - Design of Medical Instrumentation (3 credits)
Prerequisite: undergraduate course in electronics. Principles and practice of medical instrumentation. Instrument components and medical instrument systems design. Examples taken from electrocardiography, clinical chemistry, medical imaging. Microprocessor-based systems emphasized.

ECE 688 - Microcontrollers in Instrumentation (3 credits)
Prerequisite: undergraduate course in microprocessors. Microcontroller as single chip computer system for diverse applications. System microcontroller real-time design concepts from architecture to interface. Assembly language programs. Real-time facilities of advanced microcontrollers are emphasized.

ECE 689 - Computer Arithmetic Algorithms (3 credits)
Prerequisite: undergraduate course in logic design. Data representation, integers, floating point and residue representation. Bounds on arithmetic speed, algorithms for high speed addition, multiplication, and division. Pipelined arithmetic. Hardware implementation and control issues. **Effective From: Fall 2012**

ECE 690 - Computer Systems Architecture (3 credits)
Prerequisites: ECE 684 and CoE 353 (see undergraduate catalog for description) or CIS 650. Discusses advanced topics in modern computer systems architecture such as pipelined and superscalar processors, parallel computers (vector, SIMD, MIMD), multithreaded and dataflow architectures, cache and memory hierarchy, and system interconnect architectures. Also discusses relevant system software design issues such as shared memory and message-passing communication models, cache coherence and synchronization mechanisms, latency-hiding techniques, virtual memory management, program partitioning and scheduling. Examples are drawn from real systems.

ECE 692 - Embedded Computing Systems (3)
Pre-requisites: ECE 353 (CoE) or ECE 684 (EE) and CS 105 (or equivalents). Introduction of the methodology for the design and implementation of embedded computing systems, and its application to real-world problems. Topics include Embedded System Design Process, UML, ARM Instruct Set Architectures, CPU's Hardware Platforms, Software Design and Analysis, Embedded Operating Systems, Real-Time Scheduling, Hardware Accelerators, Distributed Embedded Systems, and Design Methodology and Quality Assurance. **Effective From: Fall 2006**

ECE 698 - Selected Topics in Electrical and Computer Engineering (3 credits)
Special area course given when suitable interest develops. Advance notice of forthcoming topics will be given.

ECE 699 - Selected Topics in Electrical and Computer Engineering II (3 credits)
See description for ECE 698 above.

ECE 700 - Master's Project (3 credits)
Prerequisite: written approval of project advisor. An extensive paper involving design, construction, and analysis, or theoretical investigation. Joint projects with industry may be acceptable. Work is carried out under the supervision of a member of the department faculty. A maximum of 3 credits may be applied to the degree.

ECE 701 - Master's Thesis (3 credits)
Prerequisite: written approval of thesis advisor. Projects involving design, construction, experimental or theoretical investigation. Joint projects with industry or governmental agencies may be acceptable. Work is carried on under the supervision of a designated member of the department faculty. Completed work in the form of a written thesis should be of a quality leading to journal publication. The completed thesis must be defended by the student in an open forum and must be approved by a committee of at least three people. A student must register for a minimum of 3 credits per semester. Only the 6 credits indicated for the thesis will be applied to the degree.

ECE 710 - Economic Control of Interconnected Power Systems (3 credits)
Prerequisite: ECE 610. Theoretical developments and computer methods in determining economic operation within the boundaries of a given steam-electric operating area. Energy accounting control and economic theories for interconnected steam and hydroelectric power systems.

ECE 711 - Power System Dynamics and Stability (3 credits)
Prerequisites: ECE 610 and undergraduate course in electric machines. Elements of the stability problem: principal factors affecting stability, ordinary simplified methods of making stability calculations, and illustrations of the application of these methods

to studies of power systems, damping, and saturation.

ECE 719 - Advanced Electromechanical Energy Conversion II (3 credits)
Prerequisites: ECE 615, ECE 622. Derivation of circuit models of rotating systems, based on the cross-sectional space wave method and the study of generalized Maxwell-Lorentz equations, applied to coupled rotational bodies.

ECE 725 - Independent Study I (3 credits)
Prerequisite: departmental approval. Program of study prescribed and approved by student's faculty coordinator. This special course covers areas of study in which one or more students may be interested but is not of sufficiently broad interest to warrant a regular course offering. Master's degree students cannot count ECE 725 as degree credit but can count these credits to qualify for full-time status.

ECE 726 - Independent Study II (3 credits)
See description for ECE 725 above. This course is not available to master's students.

ECE 730 - Theory of Guided Waves (3 credits)
Prerequisite: ECE 620 or equivalent. Modes, rays and beam propagation in guiding structures. Non-uniform waveguides and transitions, excitation of waveguides and optical fibers. Coupled modes theory with applications to resonators and couplers. Wave propagation in anisotropic media.

ECE 739 - Laser Systems (3 credits)
Prerequisite: ECE 620 or permission of instructor. Optical resonators, laser radiation and oscillation. Laser characteristics: semiconductor lasers, gas and glass lasers; mode-locking, Q-switching. Quantum-well lasers, noise; modulation and detection of laser light, optical systems for communication and computation.

ECE 740 - Advanced Digital Signal Processing (3 credits)
Prerequisites: ECE 601, ECE 640 and ECE 673. Topics in stationary discrete time stochastic processes; modeling of discrete time processes, Yule-waker equations, aspects of discrete wiener theory; principle of orthogonality, linear predictors; Levinson-Durbin recursion and algorithm, lattice predictors, method of least squares (RLS) algorithm, systolic array implementation of QRD-Ls.

ECE 742 - Communication Systems II (3 credits)
Prerequisites: ECE 642 and ECE 673 or equivalents. Principles of digital communication. Topics include fundamentals of information theory, digital modulation techniques, optimum detector receivers for digitally modulated signals, the bandlimited gaussian channel and intersymbol interference, equalization, spread spectrum, CDMA.

ECE 744 - Optimization for Communication Networks (3-0-3)
Modern communication are required to provide optimal performance in terms of quality-of-service under strict constrains on the utilization of resources, such as spectrum of power. In addition, the emerging paradigm of decentralized communication systems, such as ad hoc and sensor networks, calls for distributed, and possibly competitive, optimization techniques. This course covers the basic analytical and algorithmic tools that enable such centralized and decentralized optimization. **Effective From: Fall 2013**

ECE 745 - Advanced Wireless Networks (3 credits)
Prerequisite: ECE 645. This course explores next generation wireless networks. Students are expected to conduct research on the up to the minute advances in research, development, and standards activities in wireless networks. Resource allocation and Quality of Service provisioning which include advanced queueing tools in the case of long range dependent and self-similar traffic are discussed. State of the art topics such as mobility management, routing, Mobile IP, Cellular IP, and relevant open issues are studied. New network architectures are studied in detail. These include advanced wireless data communications via ad hoc networking, wireless Internet, and multimedia service provisioning over broadband air interfaces.

ECE 746 - Adaptive Array Processing and Interference Cancellation (3 credits)
Prerequisites: ECE 642 and ECE 673. Principles of array processing, performance criteria used, and adaptive algorithms for realization of these processors; and ideas and principles of array processing in the design of contemporary radar systems.

ECE 747 - Signal Decomposition Techniques: Transforms, Sub-bands, and Wavelets (3 credits)
Prerequisites: ECE 640 and ECE 673. Multiresolution signal decomposition techniques, transforms, sub-bands, and wavelets. Time-frequency localization properties of multiresolution algorithms. Evaluation and critique of proposed decomposition strategies from compression and performance standpoints. Applications to speech and video compression, and localized feature extraction. These are basic signal processing tools used in diverse applications such as speech and image processing and storage, seismology, machine vision.

ECE 755 - Advanced Topics in Digital Communications (3 credits)
Prerequisites: ECE 642 and ECE 673 or equivalent. Advanced topics in digital communication systems in the presence of intersymbol interference, noise, and fading: modulation and demodulation in the presence of gaussian noise, efficient signaling

with coded modulation, trellis decoding, Viterbi algorithm, digital transmission with intersymbol interference, and digital signaling over imperfect channels.

ECE 756 - Advanced Topics in Semiconductor Devices (3 credits)
Prerequisite: ECE 657 or permission of instructor. Builds on ECE 657. Covers photonic devices particularly semiconductor laser and photodetectors for optical systems; microwave and other high speed devices; scaled advanced MOS, FET, and bipolar transistors.

ECE 757 - Advanced Wireless Communications (3 credits)
Prerequisite: ECE 742 or equivalent. Introduction of digital cellular radio. In-depth analytical characterization of linear, time-variant systems as they apply to wireless channels. Thorough consideration of the principles of the CDMA multiuser system, together with methods for reducing multiple-access interference. Emphasis on general topics such as diversity interleaving.

ECE 758 - VLSI Design II (3 credits)
Prerequisite: ECE 658 (with ECE 657 suggested). Use of CMOS, biCMOS and bipolar semiconductor technology for VLSI design. Digital techniques are emphasized with minor coverage of analog design. Application areas for full custom, gate arrays, standard cell, and compiled designs are compared. Mentor VLSI design tools running on the HP and Sun workstations are used in the course projects for each enrollee. The course attempts to provide a design environment for projects that is similar to that encountered by VLSI designers in industry.

ECE 759 - Principles of Phase Lock and Frequency Feedback (3 credits)
Prerequisites: ECE 642 and ECE 673 or equivalents. Principles of operation and design for phase locked and frequency feedback loops, linear equivalent circuit, nonlinear effects, and optimization against noise used in a wide range of applications including low-level signal reception, tracking, phase extraction, filtering, and frequency synchronization. F.M. communication is emphasized.

ECE 760 - Solid-State Image Sensors (3 credits)
Prerequisites: ECE 657 and ECE 648 or ECE 658. Construction, operation, and performance evaluation of visible and infrared image sensors. Included are a review of the main approaches for photodetectors and readout structures, image sensor architectures, performance evaluation and trade-offs, noise considerations, modulation transfer function, techniques for control of blooming, interlacing, color-coding for visible imagers, HDTV imagers, photo-counting amplifiers, and radiometry and figures of merit for infrared imagers.

ECE 766 - Stability Theory of Nonlinear Systems (3 credits)
Prerequisite: ECE 666. Concepts of stability in dynamic systems, theory and application of Lyapunov's direct method. Use of functional analysis, and frequency response method of Popov and its extensions including their application to the investigation of stability, boundedness, and damping in a class of unforced and forced nonlinear systems.

ECE 768 - Optimal Control Theory (3 credits)
Prerequisite: ECE 677. Optimal control for classes of deterministic systems with various constraints using calculus of variations, dynamic programming and the maximum principle, state variable constraints, and application of theory to design problems.

ECE 769 - Stochastic Estimation and Control (3 credits)
Prerequisites: ECE 660 and ECE 673. Markov processes. The discrete-time Kalman filter as a minimum variance estimator. The continuous-time Kalman-Bucy filter. Relationship to the Wiener filter. Nonlinear systems: the extended Kalman filter and other generalizations. Computational difficulties and methods for avoiding them: separated-bias estimation, ?UDU? factorization. Applications in navigation and control.

ECE 773 - Random Signal Analysis II (3 credits)
Prerequisite: ECE 673. Continuation of ECE 673. Non-stationary stochastic processes, harmonic analysis, the zero crossing problem, Markov processes, the Poisson process, orthogonal expansions, non-Gaussian processes, non-linear operations.

ECE 776 - Information Theory (3 credits)
Prerequisites: ECE 642 and ECE 673 or equivalents. Classical theory of information developed from Shannon's theory. Information measure, Markov sources and extensions, the adjoint source, uniquely decodable and instantaneous codes and their construction, Shannon's first and second theorems, mutual information, and performance bounds on block and convolutional codes.

ECE 777 - Statistical Decision Theory in Communications (3 credits)
Prerequisite: ECE 642 or equivalent. Relation between detection theory and statistical hypothesis testing problem. Use of Bayes decision criteria, Neyman-Pearson, and mini-max tests; receiver operating characteristics. Representation of signals in signal space, probability of error calculations. Estimation of random and non-random signal parameters, Cramer-Rao Inequality. The general Gaussian problem and the use of covariance matrices.

ECE 778 - Algebraic Coding for Information Transmission (3 credits)

Prerequisites: ECE 642 and ECE 673. Coding for reliable digital transmission and storage, error detection and correction codes. Decoding techniques and performance evaluation of block and convolutional codes, including BCH, Reed-Solomon code and Trellis coded modulation.

ECE 782 - Advanced Data Security and Privacy (3 credits)
Prerequisites: CS 608, CS 696, or instructor approval. In-depth study of the security and privacy issues associated with the massive amount of data that is collected, stored, shared and distributed in today's society. New paradigms are needed to address the security/privacy challenges when data is outsourced at untrusted servers (such as in cloud computing), when data is anonymized in order to be shared among untrusted parties, or when copyrighted data needs to be protected from unauthorized use. **Effective From: Fall 2010**

ECE 783 - Computer Communication Networks (3 credits)
Prerequisites: ECE 673 and ECE 683. Data link control and communication channels. Delay models in data networks. Queueing analysis techniques are taught in detail. Multi-access communication techniques. Routing in computer communication networks.

ECE 785 - Parallel Processing Systems (3 credits)
Prerequisite: ECE 684 or equivalent. Parallel computer architectures. General purpose and specialized parallel computers. Shared-memory multiprocessors, message-passing multicomputers, and vector supercomputers. Principles of scalable performance. MPP designs. SIMD and MIMD computers. Design of parallel algorithms (merging and sorting of data, FFT, etc.) and performance evaluation. Load balancing, data decomposition, and scheduling of operations.

ECE 788 - Selected Topics in Electrical and Computer Engineering (3 credits)
Special-area course given when suitable interest develops. Advance notice of forthcoming topics will be given.

ECE 789 - Selected Topics in Electrical and Computer Engineering II (3 credits)
See description for ECE 788.

ECE 790 - Doctoral Dissertation (Credits as designated)
Required of all students working toward the Ph.D. in Computer Engineering or in Electrical Engineering. A minimum of 36 credits is required. The student must register for at least 6 credits of dissertation per semester; registration for additional credits may be permitted beyond the 6, with the approval of the advisor, up to a maximum of 12 credits per semester. If the student is still actively engaged in the research after completion of 36 credits, continued registration of 3 credits per semester is required.

ECE 791 - Graduate Seminar (0 credit)
All master's and doctoral students must register for two semesters and six semesters of ECE 791 Graduate Seminar, respectively. To receive a satisfactory grade, students must attend at least five seminars during the semester, as approved by the seminar supervisor. **Effective From: Spring 2006**

ECE 792 - Pre-Doctoral Research (3 credits)
Prerequisite: permission of the department. For students admitted to the program leading to the Ph.D. in Computer Engineering or Electrical Engineering. Research carried on under the supervision of a designated member of the department faculty. If the student's research activity culminates in doctoral research in the same area, up to a maximum of 6 credits may be applied toward the 36 credits required under ECE 790 after the student fulfills requirements of doctoral candidacy.

Engineering Design : Coordinated by the Office of the Dean, Freshman Studies and through the Office of the Dean, Newark College of Engineering

UNDERGRADUATE COURSES:

FED 101 - Fundamentals of Engineering Design (2-1-2)
Corequisite: HUM 101 and Math 110 or Math 131 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.

FED 101C - Fundamentals of Engineering Design, Computer Aided Design/Graphics Component (0-2.25-1)
Corequisite: HSS 100 in the spring or HSS 101 in the fall. Study technical graphics and the computer as a technical drawing tool. Introduces projections and multiview drawings and visualization. Discuss geometry commonly used in engineering design graphics, orthographic projections, dimensioning techniques, tolerancing and introduction to auxiliary and sectional views. Apply software program pro/ENGINEER to various problems. Interdisciplinary course coordinated by the Office of the Dean, Freshman Studies and through the Office of the Dean, Newark College of Engineering. **Effective Until: Fall 2011**

Engineering Graphics: Offered by the Department of Mechanical Engineering. See Mechanical Engineering course list for faculty.

UNDERGRADUATE COURSES:

EG 101 - Engineering Graphics (1-2-2)
Engineering students are introduced to the fundamentals of engineering graphics. Representative topics covered are sketching, isometric and orthographic drawings, dimensioning and scales. In addition, students are taught the principles of charts and graphs including graphical calculus. Applications in the various engineering disciplines are studied by means of graphical vectors in force analysis, piping symbols and diagrams, electrical symbols and diagrams, and plot plans. An introduction to CAD is implemented in creating three-dimensional solid models and detailed drawings. Students who have completed FED 101C and FED 101D are not eligible for EG 101.

Engineering Sciences:

UNDERGRADUATE COURSES:

ESC 491 - Research and Independent Study I (3-0-3)
Prerequisite: senior standing in engineering science. Provides the student with an opportunity to work on a research project under the individual guidance of a program faculty member.

ESC 491H - Honors Research and Independent Study I (3-0-3)
Prerequisite: senior standing in engineering science and enrolled in the Honors College. Same as ESC 491, but projects are more comprehensive and are of greater depth.

ESC 492 - Research and Independent Study II (3-0-3)
Prerequisite: ESC 491. A continuation of ESC 491.

ESC 492H - Honors Research and Independent Study II (3-0-3)
Prerequisite: ESC 491 and enrolled in the Honors College. A continuation of ESC 491H.

Enginering Technology: Offered by the Department of Engineering Technology

UNDERGRADUATE COURSES:

ET 101 - Introduction to Engineering Technology (0-2-1)
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. **Effective From: Fall 2006**

ET 370 - Technical Product Selling (3-0-3)
Prerequisite: Eng 352. Corequisite: Mgmt 390. Consideration of all the decisions in selling high-technology goods or services. Sales organization, communication skills, the industrial purchasing structure and the sales process in the context of selling products in the technological area. Examples, case studies, and simulation of real life situations, including developing engineering solutions, to complete a sale. Contact database management and presentation software is used.

ET 459 - Computer Adaptations for Persons with Disabilities (2-2-3)
Prerequisite: CIS 101 or equivalent. Specific needs of persons with sensory impairments, speech impairments, learning disabilities and orthopedic handicaps. Laboratory experience with actual adaptive equipment.

Computer Technology : Offered by the Department of Engineering Technology

UNDERGRADUATE COURSES:

CPT 310 - Computer Design Fundamentals for Computer Technology (2-2-3)
Prerequisite: 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 (2-2-3)
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. **Effective From: Spring 2003**

CPT 325 - Medical Informatics Technology (3-0-3)
Prerequisite: 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. **Effective From: Summer 2008**

CPT 330 - Software Web Applications for Engineering Technology I (2-2-3)
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 (2-2-3)
Prerequisites: C++, Visual Basic, UNIX utilities. Covers common gateway interface (CGI), servers, network protocols, network administration, server and network per-formance.

CPT 340 - Visual Basic for Engineering Technology (2-2-3)
Creation of windows with text, controls, menus and graphics. Events detection. Files and _objects management. **Effective Until: Fall 2002**

CPT 341 - Visual Basic.NET for Engineering Technology (2-2-3)
Prerequisites: Previous programming experience. Creation of windows with text, controls, menus and graphics, events detection, files and objects management, object oriented techniques. **Effective From: Fall 2005**

CPT 373 - Web App Development for Mobile (2-2-3)
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. **Effective From: Spring 2013**

CPT 395 - Co-op Work Experience I (3 degree credits)
Prerequisites: 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 **Effective From: Spring 2013**

CPT 401 - Senior Project (0-4-2)
Prerequisites: senior standing in computer technology, MIS 345. 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 (2-2-3)
Prerequisites: CPT 325 and Senior standing. Medical Informatics Technology II, 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. **Effective From: Summer 2008**

CPT 430 - Software Web Applications for Engineering Technology II (2-2-3)
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 (2-2-3)
Prerequisite: CPT 335. Network security. Database implementations. Scaling.

CPT 440 - Visual Basic Applications for Engineering Technology (2-2-3)
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 (2-2-3)
Prerequisite: 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. **Effective From: Spring 2003**

CPT 491 - Special Projects in Computer Technology (1-0-1)
Prerequisite: Senior standing in computer technology. The student works on selected projects guided by the department staff.

CPT 492 - Special Projects in Computer Technology (2-0-2)
See CPT 491.

CPT 493 - Special Projects in Computer Technology (3-0-3)
See CPT 492.

Concrete Industry Management: Offered by the Department of Engineering Technology

UNDERGRADUATE COURSES:

CIMT 101 - Introduction to Concrete (1-2-2)
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. **Effective From: Spring 2007**

CIMT 205 - Concrete Properties and Testing (2-2-3)
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. **Effective From: Spring 2007**

CIMT 210 - Concrete Applications I (3-0-3)
Prerequisites: CIMT 101 Introduction to Concrete and CIMT 205 Concrete Properties and Testing. 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. **Effective From: Fall 2007**

CIMT 305 - Concrete Applications II (3-0-3)
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. **Effective From: Spring 2008**

CIMT 310 - Concrete Products and Delivery (3-0-3)
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. **Effective From: Fall 2007**

CIMT 405 - Advanced Concrete Testing & Quality Assurance (2-2-3)
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. **Effective From: Spring 2008**

CIMT 410 - Senior Project in CIM (3-0-3)
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. **Effective From: Fall 2009**

CIMT 497 - Co-op Work Experience I (3-0-3)
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 **Effective From: Spring 2013**

Construction Engineering Technology: Offered by the Department of Engineering Technology

UNDERGRADUATE COURSES:

CET 233 - Structural Analysis in Construction (3-0-3)
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 beans, slabs and columns a well review of the connection of these structural members as encountered in practice. **Effective From: Spring 2013**

CET 313 - Construction Procedures I (3-0-3)
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 (3-0-3)
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 (3-0-3)
Prerequisites: CIS 101 or equivalent; basic courses in steel and concrete design, fluids/_hydraulics, and surveying; access to a personal computer is also needed. An introduction to construction computing using menu-driven software programs. 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 (3-0-3)
Corequisite: CET 317. 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. **Effective From: Spring 2005**

CET 323 - Construction Safety ((3-0-3))
This course will address the safety issues encountered in construction as mandated by the Occupational Safety and Health Act (OSHA)and other similar regulations. **Effective From: Fall 2005**

CET 331 - Structural Systems (3-0-3)
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 ma-sonry systems, and wind and seismic analysis. **Effective From: Spring 2013**

CET 341 - Soils and Earthworks (3-0-3)
Prerequisite: MET 237 and CMT 332. 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. **Effective From: Spring 2013**

CET 411 - Cost Estimating (3-0-3)
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 (3-0-3)
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. **Effective From: Fall 2006**

CET 415 - Construction Project Management (3-0-3)
Prerequisites: Senior standing in construction enginerring technology or contructions 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. **Effective From: Spring 2013**

CET 416 - Senior Construction Project (1-2-2)
Prerequisite: 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 auto-mation. Extensive use of construction-related computer software. Written submittals and oral presentations required. **Effective From: Spring 2013**

CET 421## - Construction Contracts (3-0-3)
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 (2-2-3)
Prerequisite: CET 331. 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 (3-0-3)
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. **Effective From: Fall 2006**

CET 441 - Soils and Earthworks (3-0-3)
Prerequisite: Strength of materials, CET 317. 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. **Effective Until: Fall 2010**

CET 450 - Mechanical and Electrical Systems I (3-3-4)
Prerequisite: College physics. This course provides a technical working knowledge of the various systems used in the building construction industry. Such topics as site work; thermal control systems including plumbing, heating, ventilating, and air conditioning; electrical power distribution and lighting are discussed in detail. Lectures presented using residential, industrial and commercial applications from industry. Class projects included in the laboratory.

CET 451 - Mechanical and Electrical Systems II (3-0-3)
Prerequisite: CET 450. A continuation of CET 450 from a more advanced viewpoint. Specifications will be studied along with mechanical and electrical designs as related to overall architectural studies. These comprehensive designs will require decisions of a more sophisticated nature.

CET 460 - Forensics in Construction (3-0-3)
Prerequisite: 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. **Effective From: Fall 2009**

CET 490 - Special Project (3-0-3)
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. **Effective From: Spring 2013**

CET 491 - Special Project (1-0-1)
Prerequisite: 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 Project (2-0-2)
Prerequisite: 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 497 - Co-op Work Experience (3 degree credits)
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 **Effective From: Spring 2013**

Same as EM 640 and Tran 640 course designations pending

Construction Management Technology: Offered by the Department of Engineering Technology

UNDERGRADUATE COURSES:

CMT 332 - Structural Systems for Construction Management (3-0-3)
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 (3-0-3)
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 (3-0-3)
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 (3-0-3)
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.

Electrical and Computer Engineering Technology: Offered by the Department of Engineering Technology

UNDERGRADUATE COURSES:

ECET 201 - Circuits I (2-2-3)
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. **Effective From: Fall 2006**

ECET 202 - Circuits II (2-2-3)
Prerequisite: ECET 201. 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. **Effective From: Fall 2006**

ECET 205 - Fundamentals of Analog Electronics (2-2-3)
Prerequisite: ECET 202. 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 suppoort the theory and provide measurement skills. **Effective From: Fall 2006**

ECET 210 - Intro. to Microprocessors and Computer Architecture (2-2-3)
Prerequisite: ECET 215. 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. **Effective From: Fall 2006**

ECET 214 - Introduction to Communications (2-2-3)
Prerequisites: ECET 202. 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. **Effective From: Fall 2006**

ECET 215 - Introduction to Digital Electronics (2-2-3)
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. **Effective From: Fall 2006**

ECET 300 - Circuit Analysis: Transform Methods (3-0-3)
Prerequisites: ECET 303 and MATH 238. Corequisite: Math 322. 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 (1-3-2)
Prerequisite: ECET 205. 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 (2-2-3)
Prerequisite: ECET 303. 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 (2-2-3)
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 (2-2-3)
Prerequisite: CPT 315. 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. **Effective From: Fall 2010**

ECET 314 - Communication Systems (2-2-3)
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 (2-2-3)
Prerequisites: Physics I and calculus (AAS level). 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 (2-2-3)
Prerequisite: ECET 201. For non-ECET majors. Building on ECET 319, a study of more advanced topics in electronics including op-amps, digital logic and the logic families, an introduction to microprocessors and interfacing, with particular attention to the common buses used in instrumentation and data acquisition. Computer simulation as well as laboratories are required.

ECET 344 - Numerical Computing for Engineering Technology (2-2-3)
Prerequisite: CS 101 or CS 100 and MATH 238. Corequisite: Math 309. An introduction to the use of a computer to analyze and solve problems common in engineering technology. Write original programs in C language, integrating existing mathematical routines in programs.

ECET 350 - Computerized Industrial Controls (2-2-3)
Prerequisite: 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. **Effective From: Spring 2001**

ECET 365 - Digital Logic and Circuit Design (3-0-3)
Prerequisite: ECET 215. 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 degree credits)
Prerequisites: 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 **Effective From: Spring 2013**

ECET 401 - EET Senior Project I (2-0-2)
Prerequisites: MATH 309, ECET 300, ECET 305, ECET 411 and ENG 352. Project management, concurrent engineering, proposal development, library research, and computer usage are stressed. Develop a formal proposal, technical specifications, Gantt chart, and design specifications for the senior project to be implemented in ECET 402. The project is appropriate to the student's concentration.

ECET 402 - EET Senior Project II (0-2-1)
Prerequisite: ECET 401 (within one year). Apply technical knowledge to the implementation of the project approved in ECET 401. Complete design specifications, computer analysis and/or simulation and a formal test procedure. This portion of the project includes library research, time and cost planning, oral and written reports, as well as construction, trouble-shooting and

demonstration of a working -prototype.

ECET 406 - Control Systems and Transducers (3-3-4)
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 (2-2-3)
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 (2-2-3)
Prerequisites: ECET 311 and ECET 365. 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 the senior project course and also in industry. C Compilers from a variety of sources are used for the programming. At least two different embedded hardware platforms, with two different microcontrollers, will be employed in the lab. **Effective From: Fall 2010**

ECET 412 - Power Generation and Distribution (3-0-3)
Prerequisite: ECET 205. Electrical power generation systems, including hydroelectric, steam, and nuclear plants. Substation and transmission line topics are included as part of the distribution system.

ECET 415 - Fundamentals of Telecommunications (2-2-3)
Prerequisite: ECET 214. Topics include transmission media, transmission facilities such as T1 and T3, emerging technologies including SONET, ATM and spread spectrum, switching systems, with emphasis on data communications, data communication protocols, and the open system interface (OSI).

ECET 416 - Networking Applications (2-2-3)
Corequisite: ECET 344. Introduces students to the technology of networking with a particular focus on local area networks (LANs). Comprises two components: concept/theory and hands-on/applications in the laboratory. Topics include: overview of telecommunications systems; networking concepts, protocols and standards; wide area networks, (LANs), the enter-prise network, LAN topology, media access control, transport control protocol (TCP), internet protocol (IP), routing in the Internet, the asynchronous transfer mode (ATM) networks, and other topics related to installation, configuration and troubleshooting of local area networks.

ECET 418 - Transmission Systems (2-2-3)
Prerequisites:ECET 214. 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 440 - Clinical Internship (3 credits)
"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 (2-2-3)
Prerequisites: ECET 344. Brings together prior software knowledge and applies it to the World Wide Web. Comprises theory and hands-on applications in the laboratory. Concepts in modular/structured design and object-oriented design with C++ and Java will be combined with Internet real-time 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)
"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)
"By Advisement". See ECET 491.

ECET 493 - Special Projects in ECET (3 credits)
"By Advisement". See ECET 491.

ECET 495 - Co-op Work Experience II (0 credits)

Prerequisites: 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. **Effective From: Fall 2011**

Manufacturing Engineering Technology: Offered by the Department of Engineering Technology

UNDERGRADUATE COURSES:

MNET 300 - Concepts in Machining (2-4-4)
Applications in the machining of various materials. Topics include speeds and feeds calculations, tooling concepts, gauging techniques and prototype construction.

MNET 303 - Advanced Techniques in CAD/CAM (2-2-3)
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 (2-2-3)
Introduction to statistics covering data collection, analysis and presentation. Specialized topics include probability, control charts, correlation, regression, hypothesis testing, and -experimentation.

MNET 318 - Manufacturing Process Design (2-2-3)
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 - Co-op Work Experience I (3 degree credits)
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 **Effective From: Spring 2013**

MNET 405 - Numerical Control for Machine Tools (2-2-3)
Prerequisite: MNET 300 or equivalent. Fundamental concepts of numerical control systems. Assignments include mill and lathe programming techniques, sheet metal processing, and CNC economics.

MNET 414 - Industrial Cost Analysis (3-0-3)
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 (3-0-3)
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 (2-2-3)
Prerequisite: Basic statistics. 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 422 - Tool Design (2-2-3)
Prerequisite: 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 and Time Study Techniques (2-2-3)
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 424 - Facilities Planning (1-2-2)
Prerequisites: MNET 318. Operational principles and techniques of plant design. Topics are plant organization, plant location, layout, materials handling, production planning and control, inspection, methods and standards.

MNET 426 - Manufacturing Project (1-3-2)
Prerequisite: Senior standing. A capstone project requiring a formal written report and oral presentation.

MNET 491 - Special Projects in MNET (1 credit)
Special projects for MNET students with subject matter to be arranged by instructor and approved by program coordinator.

MNET 492 - Special Projects in MNET (2 credits)
See MNET 491.

MNET 493 - Special Projects in MNET (3 credits)
See MNET 491.

MNET 495 - Co-op Work Experience II (3 additive credits)
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.

Mechanical Engineering Technology: Offered by the Department of Engineering Technology

UNDERGRADUATE COURSES:

MET 103 - Engineering Graphics & Intro. to CAD (1-2-2)
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 **Effective From: Fall 2006**

MET 105 - Applied Computer Aided Design (1-2-2)
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. **Effective From: Fall 2006**

MET 205 - Advanced Computer Aided Design (2-2-3)
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. **Effective From: Fall 2006**

MET 235 - Statics for Technology (3-0-3)
Prerequisites: Phys 102 and Math 238. 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. **Effective From: Fall 2006**

MET 236 - Dynamics for Technology (2-0-2)
Prerequisite: MET 235 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. **Effective From: Fall 2006**

MET 237 - Strength of Materials for Technology (2-2-3)
Prerequisite: MET 235 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. **Effective From: Fall 2006**

MET 301 - Analysis and Design of Machine Elements I (2-2-3)
Prerequisites: Elementary strength of materials, calculus (AAS level), Physics I, C++ or BASIC. 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 (3-0-3)
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 (3-0-3)
Prerequisites: Calculus (AAS level), C++ or BASIC, Physics II. Basic principles of thermodynamics and their applications to internal

combustion engines, turbines, compressors, power generating and refrigeration systems.

MET 304 - Applied Fluid Mechanics (2-2-4)
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. **Effective From: Fall 2012**

MET 307 - Plastics Technology (2-2-3)
Prerequisite: MET junior standing. An introduction to the basic concepts of plastics conversion, resin classification, processing techniques and significant engineering properties.

MET 308 - Plastics Processing Techniques (2-2-3)
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 (2-2-3)
Prerequisites: Dynamics or kinematics (mechanisms), calculus (AAS level), C++ or BASIC. 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 degree credits)
Prerequisites: Completion of freshmen year. 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 **Effective From: Spring 2013**

MET 401 - Mechanical Design Project I (2-0-2)
Prerequisites: , MET 302, MET 303, MET 304, MET 314, ECET 329, Eng 352. 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 (2-2-3)
Prerequisites: Math 309, MET 303 or its equivalent, 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 (2-2-3)
Prerequisites: Math 309, MET 303, 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 (2-2-3)
Prerequisites: C++ or BASIC, elementary strength of materials. 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 (2-2-3)
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 (2-2-3)
Prerequisites: MET senior standing. 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 trouble shooting of.

MET 448 - Mechanical Design Project II (0-2-1)
Prerequisite: MET 401. Continuation of project MET 401. Oral presentation and formal written report are required.

MET 491 - Special Projects in MET (1-0-1)
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 (2-0-2)
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 (3-0-3)
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 (0 credits)
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. **Effective From: Fall 2011**

Medical Informatics Technology: Offered by the Department of Engineering Technology

UNDERGRADUATE COURSES:

MIT 326 - Electronic Medical Record Design (2-2-3)
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. **Effective From: Spring 2010**

Surveying Engineering Technology: Offered by the Department of Engineering Technology

UNDERGRADUATE COURSES:

SET 200 - Introduction to Geomatics (3-3-3)
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 computer for solving typical field and office problems. Lab should be taken concurently. Laboratory: Corequisite: SET 200. Field exercises in conjunction with the classroom exercises in SET 200 utilizing classical and electronic instruments and COGO/CAD software. **Effective From: Summer 2009**

SET 207 - Evidence and Procedures for Property Surveys (3-0-3)
Prerequisites: CE 200. 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 280 - Marine Surveying (3-3-4)
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. **Effective From: Spring 2010**

SET 301 - Route Surveying (Surveying III) (3-3-4)
Prerequisites: CE 200 or equivalent. 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. Also included is a review of the concepts of right-of-way surveys.

SET 302 - Geodetic Control Surveying (Surveying IV) (3-3-4)
Prerequisites: CE 200 or equivalent. A study of the higher order methods and techniques of surveying such as Global Positioning System (GPS) with observations of HARNs, 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 (3-3-4)
Prerequisite: CE 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 (4-0-4)
Prerequisites: Calculus I 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 (3-0-3)
Prerequisite: SET 207. 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. **Effective From: Fall 2006**

SET 360 - Digital Surveying Methods (3-0-3)

Prerequisites: SET 200 or MET 205 or equivalent, or instructor permission. Digital surveying methods focus on skills using robotic and digital geospatial data collection technologies for mapping using CAD methods. Topics include digital data collection, data preparation, reductions, and data processing for coordinate computations. Topics in CAD focus preparing as-built site plans, plat or survey diagram, Digital Elevation Model (DEM) or a Digital Surface Model (DSM) development. Students will experience "hands on" exercises in the practice of geospatial data collection, handling instrumentation, data processing and data representation. **Effective From: Fall 2012**

SET 401 - Fundamentals of Geodesy (Surveying V) (3-0-3)
Prerequisite: SET 302 and SET 303. 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 (3-0-3)
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. **Effective From: Summer 2009**

SET 404 - Adjustment Computations II (4-0-4)
Prerequisite: SET 304. Introduction to the concepts of observations and models. A continuation of the theory of least squares and the mathematical weighting of observations. Also includes the statistical evaluation of least square results.

SET 407 - Boundary Line Analysis (3-3-4)
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 (3-3-4)
Prerequisites: SET 307 or MET 205 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. **Effective From: Spring 2011**

SET 435 - Land Surveying Field Exercise (0-8-3)
Prerequisite: SET 302 or permission of instructor. A ?real world? surveying project is carried out, presented with a descriptive request for a survey, similar to a common work order from a client. The student prepares a survey (work) plan, carries out the survey, completes data processing and submits a final map. The map will have two forms, a hardcopy surveying plate and a database in an LIS format. **Effective Until: Summer 2007**

SET 440 - Land Development (2-3-3)
Prerequisite: SET 207 and CE 321 or equivalent. 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. **Effective From: Fall 2001**

SET 490 - Senior Project in Surveying (2-0-2)
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 (1-0-1)
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. **Effective From: Spring 2010**

SET 492 - Special Projects in Surveying (2-0-2)
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. **Effective From: Spring 2010**

SET 493 - Special Projects in Surveying (3-0-3)
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. **Effective From: Spring 2010**

NJIT New Jersey's Science & Technology University

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Main Links

- About the University
- Academic Policies and Procedures
- Academic Calendar
- Accreditation
- Admissions
- Campus Directory
- Continuing Professional Education / Online Learning
- Course Code Explanation
- Executive Program
- Financial Support
- Graduate Certificates
- Graduate Studies
- Research Centers and Specialized Labs
- Residence Life
- Special Programs
- Tuition and Fees

Directory

- Administrative Staff
- Board of Overseers
- Board of Trustees
- Emeritus Faculty
- Faculty
- Professional/ Instructional Staff, University and Special Lecturers
- University Advisory Committees
- University Boards of Visitors
- Visiting / Research Professors and Others

Abbreviations

The following abbreviations are used in this catalog:

GMAT	-	Graduate Management Admission Test
GPA	-	Grade Point Average
GRE	-	Graduate Record Examinations
GUR	-	General University Requirements
LSAT	-	Law School Admission Test
MCAT	-	Medical College Admission Test
TOEFL	-	Test of English as a Foreign Language
Rutgers-New Brunswick	-	Rutgers University, New Brunswick campus
UMDNJ	-	University of Medicine and Dentistry of New Jersey

Degree Programs

- Applied Mathematics
- Applied Statistics
- Architecture
- Bioinformatics
- Biology
- Biomedical Engineering
- Biopharmaceutical Engineering
- Biostatistics
- Business Administration in Management of Technology
- Business and Information Systems
- Chemical Engineering
- Chemistry
- Civil Engineering
- Computational Biology
- Computer Engineering
- Computer Science
- Computing and Business
- Critical Infrastructure Systems
- Cyber Security and Privacy
- Electrical Engineering
- Emergency Management and Business Continuity
- Engineering Management
- Engineering Science
- Environmental Engineering
- Environmental Policy Studies
- Environmental Science
- Healthcare Systems Management
- History
- Industrial Engineering
- Information Systems
- Information Technology Administration and Security
- Infrastructure Planning
- International Business
- Internet Engineering
- Management
- Manufacturing Systems Engineering
- Materials Science and Engineering
- Mathematical and Computational Finance
- Mathematical Sciences
- Mechanical Engineering
- Occupational Safety & Health Engineering

Courses

- Accounting
- Architecture
- BioInfomatics
- Biology
- Biomedical Engineering
- Biostatistics
- Chemical Engineering
- Chemistry
- Civil Engineering
- Computer Science
- Ecology and Evolution
- Economics
- Electrical and Computer Engineering
- Engineering Management
- English
- Environmental Engineering
- Environmental Policy Studies
- Environmental Science
- Epidemiology
- Finance
- Geology
- History
- Human Resource Management
- Humanities
- Industrial Engineering
- Infrastructure Planning
- Information Systems
- Information Technology
- International Studies
- Management
- Management Information Systems
- Manufacturing Systems Engineering
- Marketing
- Marketing Management
- Materials Science and Engineering
- Mathematics
- Mechanical Engineering
- Mechanics
- Nursing
- Operations Management

NJIT's Division of Continuing Professional Education

provides adult learners with the opportunity to earn Online master's degrees and graduate certificates as well as professional development certifications without coming to campus.

About CPE

- Master's Degree Programs
- Graduate Certificate Programs
- Professional Development for You
- Professional Development for Your Staff

CPE Open House

October 10th - 5-7:30 pm ET, Campus Center Atrium

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From Our Blog

What's the Big Data?

Is Big Data a big deal, or much ado about nothing? According to IBM, we create 2.5 quintillion bytes of data every day- 90% of the data in the world today has been created in the last two years alone. With the abundance of consumer information being mined, corporations can... Read More

News

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NJIT: Adult Learner: Android Developer Class starts Sep. 5 - ow.ly/o3BPj #njit #njitcpe #android

7 IT skills to get you hired ow.ly/nTyyM

Upcoming Professional Development Offerings

1. Android Developer (online)
2. Better Software Development
3. CloudMASTER
4. iOS (iPhone & iPad) App Dev (online)
5. IT Project Management
6. Lean / Six Sigma Overview
7. Open Source Unix (online)
8. Professional Engineer PDH Classes
9. Project Management Basics
10. Six Sigma Green Belt
11. Solar Panel Installer
12. Underground Storage Tank Regulation Review
13. WebMASTER TNG (online)

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Monday - Friday
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Unix Admin I course starts Sept. 3 ow.ly/nRli0 #njit #njitcpe #unix

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NJIT Ranks 6th nationally among public colleges and 27th overall for return on investment

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No matter where you're heading in life, a technology-focused education gives you the extra something that will set you apart from all the rest: an edge.

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 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 program—put the edge within your reach.

Affordable Colleges Online
HIGH ROI COLLEGES
affordablecollegesonline.org

Affordable Colleges Online ranked NJIT 3rd in "AC Online's Highest Return on Investment Colleges in New Jersey" ranking.

AC Online analyzed 162 colleges in New Jersey and ranked the top 24 colleges that provided students the biggest return on investment. Colleges were ranked based on several criteria including:

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Considering NJIT? Join us for an Open House!

Graduate Open Houses

Thursday, August 1, 2013
5:00PM to 7:30PM
Fenster Hall, Room 100, Admissions Office
[Reserve Your Spot]().

Thursday, August 15, 2013
5:00PM to 7:30PM
Campus Center Atrium
[Reserve Your Spot]().

- Net tuition prices (Provided by IPEDS/NCES)
- Graduate's average starting salaries and ROI calculation (Provided by Payscale)
- Fully accredited, 4-year not-for-profit institutions (Provided by the Carnegie Foundation)

Read more.

Related Links

- Info for guidance counselors
- Info for transfer counselors
- Info for parents

New Jersey Institute of Technology
University Heights Newark, New Jersey 07102

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- Academic Calendars
- Academic Policies and Procedures
- Catalogs
- Certification Requests
- Course Schedules
- Dean's List
- Degree Programs
- Department Directory and Advisors
- Exam Schedules
- Forms
- Graduation Information
- Minors and GUR
- NJIT Factbook
- Registration
- Residency
- Special Programs
- Transfer Credit Evaluation
- Transcript Requests
- Tuition and Fees

Office of the Registrar

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COMMENCEMENT INFORMATION

Fall and Spring Registration Instructions

2013 January Graduates

2013 May Graduates

2013 August Candidates for Graduation

Complete Academic Calendars

Sep	2	Monday	Labor Day
Sep	3	Tuesday	First day of classes Fall semester
Sep	7	Saturday	Saturday classes begin
Sep	9	Monday	Last day to add a course
Sep	10	Tuesday	W grades posted for course withdrawals
Oct	21	Monday	Last day for 25% refund based on total withdrawal - No refund for total withdrawal after this date
Nov	4	Monday	Last day to withdraw
Nov	4	Monday	Spring Registration Begins
Nov	26	Tuesday	Follow Thursday schedule
Nov	27	Wednesday	Follow Friday schedule
Nov	28	Thursday	Thanksgiving Recess - no classes
Nov	29	Friday	Thanksgiving Recess - no classes

Registrar @ Your Service

Online:Highlander Pipeline

24-Hour Email

Student Mall Staff

Spring/Fall Office Hours:
M-Th-F, 8:30 a.m.-4:30 p.m.
T-W, 8:30 a.m.-6:00 p.m.

Summer Hours
M-F, 8:30 a.m.-5:00 p.m

- NJIT Privacy Policy
- Customer Service Credo
- Campus Directory
- Visiting NJIT: Maps and Directions

Dec	11	Wednesday	Last day of classes
Dec	12	Thursday	Reading Day
Dec	13	Friday	Final exams begin
Dec	19	Thursday	Final exams end
Dec	20	Friday	Final grades due on Registrar's Office
Jan	20	Monday	Martin Luther King, Jr. Day
Jan	21	Tuesday	First day of classes Spring semester
Jan	25	Saturday	Saturday classes begin
Jan	27	Monday	Last day to add a course

They Made It Through Boot Camp: Meet These Freshmen

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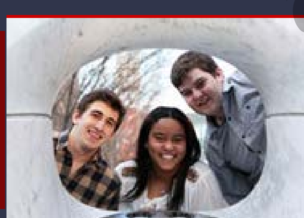
First Year Connections 2.0
NJIT Campus



September 02
University Closed
NJIT Campus

September 03
Fall 2013 Semester Classes Begin
NJIT Campus

September 04
Welcome Back Greek Block Party!
Campus Green & Atrium
2pm

New Jersey Institute of Technology
University Heights Newark, New Jersey 07102

Contact Us | **Maps & Directions**

NJIT Course Catalog Archives

The archived online NJIT Undergraduate and Graduate Catalogs are the same as those in print. These archives are not indexed for website searches and are in PDF format.

Current (2011-2012)

- Undergraduate
- Graduate

Undergraduate Catalogs

- 2009-2010
- 2007-2008
- 2004 - 2005
- 2003-2004
- Fall 2000 (This catalog contains all changes to courses and academic programs through May, 2000.)
- 1997-2000
- 1994-1997
- 1991-1994

Graduate Catalogs

- 2009-2010
- 2007-2008
- 2004 - 2005
- 2003-2004
- Spring 2000 (This catalog contains all changes to courses and academic programs approved through December 1999.)
- 1996-1999
- 1992-1995

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Industrial Engineering

Administered By: Department of Mechanical and Industrial Engineering

Administration

Chairperson	Reggie J. Caudill
Associate Chairperson	Athanassios Bladikas
Program Director	Athanassios Bladikas

Faculty

Professors	Layek Abdel-Malek, Reggie J. Caudill, Sanchoy K. Das, Paul G. Ranky, Stephen J. Tricamo
Associate Professors	George Abdou, Golgen Bengu, Athanassios Bladikas, Kevin J. Mcdermott, Arijit Sengupta* , Jian Yang

Advisors

Graduate Advisor	Sanchoy K. Das

* Joint appointment with Department of Engineering Technology

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.

The Mission of Industrial Engineering

The mission of the department is to

(1) provide for all our students an environment conducive to learning and personal growth;

(2) educate a diverse undergraduate and graduate student body for successful employment in industry and the pursuit of advanced studies;

(3) prepare students, both undergraduate and graduate, for future managerial and 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) serve our profession through membership and leadership on national and international societies, and editorial boards, and

(6) serve our community by offering our expertise to industries, state and local constituencies, and pre-college students and teachers.

Program Educational Objectives

1. Program graduates use mathematics, science, computational methodologies, and analytical techniques and fundamental principles 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 design, improve, and manage integrated systems of people, technologies, information, and resources in the socioeconomic environment of today and the foreseeable future.

4. Program graduates have communication, team work and management skills to pursue diverse career paths and advance in leadership positions.

Program Outcomes

Graduates of the Industrial Engineering program will have:

(a) An ability to apply knowledge of mathematics, science, and engineering
(b) An ability to design and conduct experiments, as well as to analyze and interpret data
(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) An ability to function on multi-disciplinary teams
(e) An ability to identify, formulate, and solve engineering problems
(f) An understanding of professional and ethical responsibility
(g) An ability to communicate effectively
(h) The broad education necessary to understand the impact of engineering solutions in a global and societal context
(i) A recognition of the need for, and the ability to engage in life-long learning
(j) A knowledge of contemporary issues
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
(l) An ability to design, develop, implement and improve integrated systems that include people, materials, information, equipment and energy

The undergraduate Industrial Engineering Program is accredited by the Engineering Accreditation Commission of ABET, http://abet.org

B.S. in Industrial Engineering (128 credits minimum)

FIRST YEAR:

1st Semester: (16 credits)

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.

{		Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
		Chem 125	General Chemistry I (3-0-3)
		FED 101	Fundamentals of Engineering Design (2-1-2)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)

		Math 111	Calculus I (4-1-4)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (18 credits)

{		Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
		Chem 126	General Chemistry II (3-0-3)
		CS 101	Computer Programming and Problem Solving (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Math 112	Calculus II (4-1-4)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR:

1st Semester: (17 credits)

		IE 203	Applications of Computer Graphics in Industrial Engineering (1-2-2)
		Math 211	Calculus III A (3-0-3)
		Mech 320	Statics and Strength of Materials (3-0-3)
		Econ 201	Economics (3-0-3)
		EPS 202	Society, Technology, and the Environment (3-0-3)
		Eng 352	Technical Writing (3-0-3)

2nd Semester: (16 credits)

		IE 224	Production Process Design (2-2-3)
		Mech 236	Dynamics (2-0-2)
		Math 222	Differential Equations (4-0-4)
		Hist 213	The Twentieth-Century World (3-0-3)
		IE 331	Applied Statistical Methods (3-0-3)
		Elective	(Physical Education:GUR) (0-1-1)

THIRD YEAR:

1st Semester: (15 credits)

		IE 355	Human Factors (3-0-3)
		IE 335	Engineering Cost Analysis and Control (3-0-3)
		IE 439	Deterministic Models in Operations Research (3-0-3)
		ME 339	Fundamentals of Mechanical Design (3-0-3)
		Elective	(Open:GUR) (3-0-3)

2nd Semester: (15 credits)

		ECE 405	Electrical Engineering Principles (3-0-3)
		IE 334	Engineering Economy and Capital Investment (3-0-3)
		IE 339	Work Measurement and Standards (2-2-3)
		IE 440	Stochastic Models in Operations Research (3-0-3)
		IE 445	Idustrial Simulation (2-2-3)

FOURTH YEAR:

1st Semester: (17 credits)

		Elective	(IE Technical Elective) (3-0-3)
		IE 443	Senior Project I (1-3-2)
		Elective	(Management) (GUR) (3-0-3)
		IE 461	Product Quality Assurance (3-0-3)
		ME 435	Thermodynamics (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)

2nd Semester: (14 credits)

		IE 444	Senior Project II (2-2-3)
		IE 459	Production Planning and Control (3-0-3)
		IE 466	Material Handling and Facilities Layout (3-0-3)
		Elective	(IE Technical) (3-0-3)
		Elective	(IE Technical Elective) (3-0-3)

Electives

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); History (Hist); Literature (Lit); Philosophy (Phil); Science, Technology and Society (STS); Social Science (SS); or Theater (Thtr). Students may also satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark.

Basic Social Sciences GUR: Three credits of the basic social sciences requirement must be taken in economics; acceptable courses are Econ 201, Econ 265, or Econ 266. The remaining 3 credits may be satisfied by HSS 202, STS 257 or STS 258. Students may also take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H.

Management GUR: Students take IE 492 or Mgmt 390 or AS 333, which is acceptable only for students taking the aerospace option. Students enrolled in a dual degree program between architecture and management take HRM 601 to fulfill this requirement.

IE (Technical Electives)

Students in industrial engineering may pursue a general industrial engineering program of study and select 9 credits of technical electives from a wide variety of elective courses or concentrate their choice of 9 credits of technical electives in one of the designated options. Courses from other departments may be used to substitute for technical electives. The student must consult with the undergraduate advisor for a list of qualified courses and obtain approval. Those students choosing an option must obtain the advisor's approval of their entire choice of option electives prior to registering for their first technical elective course. Listed below are four options and suggested technical electives for each:

Industrial Engineering Elective courses usually include the following:

		IE 441	Information and Knowledge Engineering (3-0-3)
		IE 449	Industrial Robotics (2-2-3)
		IE 453	Computer Integrated Manufacturing (2-2-3)
		IE 455	Robotics and Programmable Logic Controllers (2-2-3)
		IE 463	Invention and Entrepreneurship (2-1-3)
		IE 469	Reliability in Engineering Systems (3-0-3)
		IE 450	Product Engineering Standards (3-0-3)
		IE 451	Industrial Measuring Systems (2-2-3)
		IE 447	Legal Aspects of Engineering (3-0-3)
		IE 456	Introduction to Industrial Hygiene (3-0-3)
		IE 473	Safety Engineering (3-0-3)

Refer to the General University Requirement section of this catalog for further information on electives.

Co-op

Two co-op courses taken in sequence replace a technical elective. In industrial engineering, IE 310 is taken without credit, and IE 411 is taken for degree credit, with IE 310 as a prerequisite.

Information Systems

Administered By: Department of Information Systems, College of Computing Sciences, Guttenberg InformationTechnologies Center, Room 5500. For more details, please visit the IS web page at http://is.njit.edu

Administration

Interim Dean, College of Computing Sciences	James Geller
Associate Dean, College of Computing Sciences	Barry Cohen
Assistant to the Dean, College of Computing Sciences	Serena Branson
Chair, Information Systems Department	Yi-fang Wu
Assistant to the Chair, Information Systems	Michelle D. Craddock-Bouler
Director of Undergraduate HCI Program	Quentin Jones
Director of Undergraduate IS Programs	Lin Lin
Director of Master's Programs	Michael P. Bieber
Director of Emergency Management & Business Continuity	Michael J. Chumer
Director of PhD Program	Michael P. Bieber
Secretary	Patricia B. Lundberg

Faculty

Professors Emeriti	S R. Hiltz, Marilyn Tremaine, Murray Turoff
Professors	Michael P. Bieber, Fadi Deek
Associate Professors	Quentin Jones, Michael L. Recce, Julian M. Scher, Yi-fang Wu
Assistant Professors	Lian Duan, Songhua Xu
Senior University Lecturers	Richard W. Egan, Lin Lin, Keith A. Williams

Advisors

Advisor B.A./ B.S.	Amanda D. Ackerman, George W. Olsen, Casey L. Hennessey
Advisor M.S.	George W. Olsen
Advisor Ph.D.	Michael P. Bieber

Accredited by the Computing Accreditation Commission of ABET, http://abet.org

Information systems (IS) are computer systems that support business operations, management, and decision making in organizations. IS are an integral part of virtually every work environment and play a critical role in running organizations. They are the heart of the internet-based economy. IS enable people to access the information they need, to collaborate, make informed decisions, and perform their jobs and personal activities effectively. IS and the Web are deeply intertwined.

The field of Information Systems bridges computing and business. IS professionals serve as the critical link between the technical and business areas of an organization. They collaborate to solve problems and then design, analyze, implement, deploy and evaluate the computing systems that drive the modern enterprise. IS professionals are thus among the most essential individuals in an organization, building and managing the systems upon which the enterprise survives and thrives.

BA in Information Systems

The BA IS degree features a strong practical focus in designing, developing and evaluating IS, databases, management information systems, and decision support systems. Students complete a specialization in business or graphics, a career track in a specific area of interest, and a capstone project with a major local company. The US Bureau of Labor Statistics notes that IS jobs are among the highest paying and fastest growing in the nation. Jobs in this field include application systems analyst, information systems auditor, database designer, and for those with a business minor, business systems analyst.

The program is available partially on-line.

B.A. in Information Systems (129 credit)

FIRST YEAR:

1st Semester: (16 credits)

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.

		CS 100	Roadmap to Computing (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
	*	Math 138	General Calculus I (3-0-3)
		Elective	(Science with Lab) (3-1-4)
	****	IT 101	Introduction to Information Technology (3-0-3)
		CS 107	Computing as a Career (1-0-1)

2nd Semester: (16 credits)

		CS 113	Introduction to Computer Science (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
{		EPS 202	Society, Technology, and the Environment (3-0-3) ***or***
		Econ 201	Economics (3-0-3)
		IS 265	Introduction to Information Systems (3-0-3)
		Elective	(Science Elective) (3-1-4)
		Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR:

1st Semester: (16 credits)

		IS 350	Computers, Society and Ethics (3-0-3)
		IS 247	Designing the User Experience (3-0-3)
	*	Math 105	Elementary Probability and Statistics (3-0-3)
{		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		Elective	(General Elective) (3-0-3)
		PE	(Physical Education) (0-1-1)

2nd Semester: (16 credits)

		IS 218	Building Web Applications (3-0-3) ***or***

{		IT 310	E-commerce Technology (3-0-3)
		Elective	(General Elective) (3-0-3)
		IS 344	Computing Applications in Business (3-0-3)
	**	Elective	(Graphic or Business Specialization) (3-0-3)
	***	Elective	(Career Track Elective) (3-0-3)
		CS 207	Computing and Effective Communication (1-0-1)

THIRD YEAR:
1st Semester: (18 credits)

		IS 333	Social Networking: Application and Interface Design (3-0-3)
		IS 390	Requirements Analysis and Systems Design (3-0-3)
		IS 331	Database Design Management and Applications (3-0-3)
		Elective	(Social Science GUR) (3-0-3)
{		Eng 352	Technical Writing (3-0-3) ***or***
		Eng 340	Oral Presentations (3-0-3)
	**	Elective	(Graphic or Business Specialization) (3-0-3)

2nd Semester: (15 credits)

		IS 375	Evaluating the User Experience (3-0-3)
		CS 356	Introduction to Computer Networks (3-0-3)
	**	Elective	(Graphics or Business Specialization) (3-0-3)
	***	Elective	(Career Track Elective) (3-0-3)
		Elective	(General Elective) (3-0-3)

FOURTH YEAR:
1st Semester: (16 credits)

		IS 465	Advanced Information Systems (3-0-3)
	*****	IE 492	Engineering Management (3-0-3)
	**	Elective	(Graphics or Business Specialization) (3-0-3)
	***	Elective	(Career Track Elective) (3-0-3)
		Elective	(HSS Capstone Seminar) (3-0-3)
		CS 407	Professional Development in Computing (1-0-1)

2nd Semester: (15 credits)

{		IS 491	Senior Project (3-0-3) ***or***
		IT 491	IT Capstone Project (3-0-3) ***or***
		CS 491	Senior Project (3-0-3)
		IS 455	Information Systems Management (3-0-3)
		Elective	(Upper Lit/Phil/Hist/STS Elective) (3-0-3)
	**	Elective	(Graphics or Business Elective) (3-0-3)
		Elective	(General Elective) (3-0-3)

Notes

***Math:** Math 111 and Math 333 are highly recommended to replace Math 138 and Math 105, 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 (Statistics), Math 344 (Regression Analysis), Math 334 (Operations Research) and Math 443 (Statistical Methods), all of which require Math 333 as a prerequisite.

****Business and Graphic Specialization Electives:** Students must complete an entire set of either 5 approved business electives or 5 approved graphics electives.

Recommended Business Specialization Electives

BA IS students who take the following 5 courses qualify for a formal minor in Business. A more extensive list of other approved business electives is available at http://is.njit.edu

Number	Title
Acct 117	Principles of Financial Accounting
Mgmt 190	Introduction to Business
Fin 315	Fundamentals of Corporate Finance
Mrkt 330	Principles of Marketing

+ Choose 1 of the following courses:

Mrkt 360	Internet Marketing
HRM 301	Organizational Behavior
Mgmt 492	Business Policy

Recommended Graphics Specialization Electives The graphics electives include several English courses which utilize graphics in communications. A more extensive list of approved graphics electives is available at http://is.njit.edu

Number	Title
Com 266	Foundations of Game Production
Com 335	3-D Modeling and Animation
Com 345	Character Modeling and Animation
Com 350	Digital Video Production
Com 376	Game Design Studio
Com 390	Electronic Writing Workshop
Eng 200	Communicating in Organizations
Eng 333	Cybertext
Eng 352	Technical Writing
Eng 353	Composing Documents for Print
Eng 354	Composing Documents for the Web

*** **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.

Recommended Career Track Electives

1. Database: IS 392 (Web Mining and Information Retrieval), IS 433 (Electronic Commerce Requirements and Design) **or** IT 310 (E-Commerce Technology), IS 631 (Enterprise Database Management), IS 634 (Information Retrieval), IS 687 (Transaction Mining and Fraud Detection), CS 434 (Advanced Database Design), CS 441 (Database Programming), or one advisor approved elective.

2. Networks: IS 448 (Ubiquitous Computing), IS 464 (Information Systems Auditing and Security), CS 357 (Technologies for Network Security), CS 408 (Cryptography and Internet Security), CS 451 (Network Technologies), CS 456 (Open Systems Networking), CS 458 (Open Systems Networking), IT 120 (Introduction to Network Technology), IT 202 (Internet & Applications), IT 220 (Wireless Networks), IT 230 (Computer and Network Security), IT 420 (Computer Systems & Networks).

3. Management of Information Systems: IS 392 (Web Mining and Information Retrieval), IS 413 (Requirements for Emergency Management Information Systems), IS 433 (Electronic Commerce Requirements and Design) **or** IT310 E-Commerce Technology), IS 461 (Systems Simulation), IS 464 (Information Systems Auditing and Security), IS 677 (Information Systems Principles), IS 678

(Business Systems Management), IS 679 (Management of Computer & Information Systems), IS 680 (Information Systems Auditing), IS 681 (Computer Security Auditing), IS 687 (Transaction Mining and Fraud Detection), IT 332 (Digital Crime), IT 430 (Ethical Hacking for Administrators).

4. Medical Informatics (Healthcare Information Systems): For an IS Career Track in Medical Informatics, the student must complete both CPT 325 (Medical Informatics Technology) and CPT 425 (Medical Informatics II), and complete any two of the following courses: IS 392 (Web Mining and Information Retrieval), IS 448 (Ubiquitous Computing), IS 686 (Pervasive Computing ? An HCI Perspective), IT 220 (Wireless Networks), CS 370 (Artificial Intelligence).

5. Systems Analysis & Design: IS 373 (Web Standards), IS 461 (Systems Simulation), IS 663 (Systems Analysis and Design), IS 685 (Enterprise Architecture and Integration), CS 280 (Programming Language Concepts), CS 288 (Intensive Programming Practicum), CS 433 (Introduction to Linux Kernel Programming), CS 490 (Guided Design in Software Engineering), IT 335 (Introduction to .NET Framework), IT 340 (Linux Systems Administration), IT 490 (Systems Integration)

6. Intelligence & Decision Support:, IS 392 (Web Mining and Information Retrieval), IS 433 (Electronic Commerce Requirements and Design) **or** (IT 310 E-Commerce Technology), IS 461 (Systems Simulation), CS 370 (Introduction to Artificial Intelligence), CS 434 (Advanced Database Systems), IT 380 (Educational Software Design) or one advisor approved elective.

7. Web Systems: IS 117 (Introduction to Website Development), IS 217 (Advanced Website Development), IS 218 (Web Application Development), IS 322 (Mobile Applications: Design, Interface, Implementation), IS 373 (World Wide Web Standards), IS 392 (Web Mining and Information Retrieval), IS 433 (Electronic Commerce Requirements and Design) **or** IT 310 (E-Commerce Technology), IS 448 (Ubiquitous Computing), IS 683 (Open Source Web Development), IS 688 (Web Mining), IS 690 (Web Services and Middleware), IT 202 (Internet and Applications), IT 302 (Advanced Internet Applications).

8. Information Systems Security, Auditing and Crisis Response: IS 413 (Requirements for Emergency Management Information Systems) **or** IS 613 (Design of Emergency Management Information Systems), IS 464 (Information Systems Auditing and Security), IS 612 (Principles of Emergency Management), IS 614 (Command and Control Systems), IS 616 (Learning Methodologies and Training Technologies) , IS 681 (Computer Security Auditing), IS 687 (Transaction Mining and Fraud Detection), CS 357 (Technologies for Network Security), CS 408 (Cryptography and Internet Security), CS 458 (Technologies for Network Security), IT 230 (Computer & Network Systems Security), IT 330 (Computer Forensics; prereqs IT 230 & CS 332), IT 331 (Privacy and Information Technology), IT 332 (Digital Crime), IT 430 Ethical Hacking for Administrators; prereq IT 420).

9. Human Computer Interaction: IS 448 (Ubiquitous Computing), IS 686 (Pervasive Computing An HCI Perspective), IS 764 - Research Methods for Human-Centered Computing and Design, IT 201 (Information Design Techniques, prereq IT 101), CS/IT265 (Game Architecture and Design), CS/IT266 (Game Modification Development).

10. Build your Own Career Track: Students may construct a career track of 3-4 electives in consultation with their advisor.

**** Transfer students may substitute a free elective instead of IT 101

***** Off-campus, e-learning only students may substitute HRM 301 or Mgmt 390 instead of IE 492.

Information Technology

Administered By: College of Computing Sciences

Administration

Director, Information Technology Program	Michael H. Halper
Academic Coordinator, Information Technology Program	
IT Advisor	Amanda D. Ackerman, Casey L. Hennessey, George W. Olsen

Information Technology (IT) is the applied computing degree at NJIT, addressing the integration, design, deployment and management of computing and telecommunication resources and services, as well as the development of technology infrastructures in organizations. The field of information technology is interdisciplinary, with applications to all aspects of the economy. Information technologists solve complex hardware and software problems requiring fundamental knowledge and competencies with the processes of needs assessment, technology transfer, and user support.

The College of Computing Sciences at NJIT offers the Bachelor of Science in Information Technology program with an array of specializations from each of NJIT's colleges and schools that prepare students to enter the information economy. Students choosing to major in Information Technology are those who are interested in applying computing and telecommunication tools to a specific domain. Each program specialization requires students to understand hardware and software, but the area emphasis depends upon the student's individual interests. The program requires completion of a common IT core, specialization courses, electives, and a capstone project.

The four years of the program have been carefully structured to meet the following goals: Year 1: breadth and depth of information technology; Year 2: tools and applications of information technology; Year 3: software and hardware infrastructure of information technology; and Year 4: management and synthesis of information technology.

All Information Technology majors are required to prepare a Program of Study Form, an approved copy of which must be on file with the Academic Advisor. The form should be prepared as early as possible in the student's career, and changes can be made in consultation with the advisor.

A curriculum layout for the information technology program including specialization descriptions follows.

The curriculum described below is for freshmen entering NJIT in fall 2009. Students entering before that date may have a different program and should consult their Academic Advisor to learn which curriculum applies.

B.S. in Information Technology (129 credits minimum)

FIRST YEAR:
1st Semester:

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.

		IT 101	Introduction to Information Technology (3-0-3)
		CS 100	Roadmap to Computing (3-0-3)

		Math 138	General Calculus I (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Science #1	(Phys1/202 or Chem1 or Bio 1 or Geol 1)
		CS 107	Computing as a Career (1-0-1)

2nd Semester:

		CS 113	Introduction to Computer Science (3-0-3)
		IT 120	Introduction to Network Technology (3-3-3)
		Math 105	Elementary Probability and Statistics (3-0-3)
		Science #1	(Phys2/203 or Chem 2 or Bio 2 or Geol 2)
		Science #2	(Lab)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)

SECOND YEAR:
1st Semester:

		IT 114	Advanced Programming for Information Technology (3-0-3)
		IT 201	Information Design Techniques (3-0-3)
		Elective	(Social Science:GUR 3-0-3)
		General Elective 1	(General Elective) (3-0-3)
		Elective	(Cultural History:GUR 3-0-3)

2nd Semester:

		IT 202	Internet and Applications (3-0-3)
		Specialization	(Specialization Course 1)
		Specialization	(Specializationn Course 2)
		General Elective 2	(General Elective)
		Elective	(Social Science:GUR 3-0-3)
		CS 207	Computing and Effective Communication (1-0-1)

THIRD YEAR:
1st Semester:

		IS 331	Database Design Management and Applications (3-0-3)
		Elective	(Lit/Hist/Phil/STS) (GUR) (3-0-3)
{		Mgmt 390	Principles of Management (3-0-3) ***or***
		IE 492	Engineering Management (3-0-3)
		Specialization	(Specialization Course 3)
		Specialization	(Specialization Course 4)
		IT 340	Introduction to System Administration (3-0-3)

2nd Semester:

		IT 420	Computer Systems and Networks (3-0-3)
{		Eng 352	Technical Writing (3-0-3) ***or***
		Eng 340	Oral Presentations (3-0-3)
		IS 350	Computers, Society and Ethics (3-0-3)
		Specialization	(Specialization Course 5)
		Specialization	(Specialization Course 6)
		PE	(Physical Education) (0-1-1)

FOURTH YEAR:
1st Semester:

		IT 490	Systems Integration (3-0-3)
		Elective	(HSS Capstone Seminar) (GUR) (3-0-3)

		General Elective 3	(General Elective)
		Specialization	(Specialization Course 7)
		General Elective 4	(General Elective)
		PE	(Physical Education) (0-1-1)

2nd Semester:

		IT 491	IT Capstone Project (3-0-3)
		Specialization	(Specialization Course 8)
		General Elective 5	(General Elective)
		General Elective 6	(General Elective)
		General Elective 7	(General Elective)
		CS 407	Professional Development in Computing (1-0-1)

Electives

Basic Social Sciences GUR: Six credits of the basic social sciences requirement must be taken; acceptable courses are Econ 201, Econ 265, Econ 266, EPS 202, STS 257, or STS 258 . Students also may take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

IT students should select ENG 352 Technical Writing or Eng 340 Oral Presentations to fulfill the Open GUR requirement.

Cultural History GUR: Take one courses (3 credits) from among HUM 211,HUM 212 ,Hist 213, and 200-level history courses at Rutgers-Newark.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature, history, philosophy, or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404,HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H .

Management GUR: Engineering Management (IE 492) or Principles of Management (Mgmt 390). Leadership in Management I (AS 333) is acceptable only for students taking the aerospace option.

Mathematics: (9 credit minimum) At least one three-credit calculus course; the second math course is chosen in consultation with the IT Academic Advisor. At least three credits of probability and statistics must be included in the math GUR, as approved by advisor. Depending on the specialization, a specific math sequence may be required.

Natural Sciences: (7 credit minimum) Two courses, one of which must be a laboratory science, approved by advisor. Depending on the specialization, a specific natural science sequence may be required.

Information Technology Core: (30 credits) The Information Technology Core is a set information technology/computer and information science courses that provide fundamental knowledge and practice in information technology functions, system development, and software.

IT Capstone Project: 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.

Specialization Courses: A coherent set of 9 courses, focusing on an application area relevant to Information Technology. Students may select specializations from all four NJIT colleges and schools. A list of possible specialization areas can be obtained from the Academic Advisor.

General Electives: A minimum of six courses (18 credits) to be chosen in consultation with the advisor.

CCS Electives: CCS Electives are a coherent set of courses in conjunction with the declared specialization. They must be courses within the College of Computing Sciences and 300/400 level.

CO-OP
In IT, IT 311 and IT 411 can be taken for degree credit.

Information Technology Specializations: Students can choose from a partial or full array of specializations, each consisting of 9 courses. The specialization provides coherent set of courses, focusing on an application area of Information Technology relevant to the student's interest.

Criminal Justice and Law Specialization

Choose 9 (27 Credits) from the following:

The IT specialization in Criminal Justice and Law offers students the opportunity to study different aspects of criminal justice. Students take core courses in conjunction with Rutgers-Newark School of Criminal Justice and study the origins of both digital and traditional crime. Students will learn how new technologies can be implemented to investigate and prevent crimes. Skills learned in this specialization can lead to careers in law enforcement, forensics, or future study in law school.

COURSES

CORE (18 Credits)

		IT 220	(Wireless Networks) (3-0-3)
		IT 230	Computer and Network Security (3-0-3)
		IT 310	E-commerce Technology (3-0-3)
		IT 330	Computer Forensic (3-0-3)
		IT 400	Information Technology and the Law (3-3-3)
		IT 430	Ethical Hacking for System Administrators (3-0-3)

Choose 3 additional:

		R202:203	Police and Community (3-0-3)
		R202:301	(Introduction to Criminal Justice)
		R202:102	(Criminology)
		R202:310	(Law Proc. Law and Courts)
		R202:331	(Delinquency & JUU Justice)
		R202:202	(Gender, Crime and Justice)

Criminal Justice and Law Specialization - Seton Hall University Law School Option [B.S. in Information Technology/JD Curriculum]

SPECIALIZATION COURSES

CORE (18 Credits)

		IT 230	Computer and Network Security (3-0-3)
		IT 310	E-commerce Technology (3-0-3)
		IT 330	Computer Forensic (3-0-3)
		IT 400	Information Technology and the Law (3-3-3)
		Law6014	(Criminal Law) (3)
		Law6005	(Contracts) (3 cr. from 5)
		IE 447	Legal Aspects of Engineering (3-0-3)

TRACK 2 Law - Year 1 Seton Hall University Law School (18 credits)

		LAW6009	(Civil Procedures) (5 credits)

		LAW6015	(Constitutional law) (5 credits)
		LAW6016	(Property) (5 credits)
		LAW6005	(Contracts) (2 cr. from 5)
		LAW6008	(Torts) (1 cr. from 4)

AREA ELECTIVES (9 credits)

Seton Hall University Law Note: 6 cr. from 30 first year credits will count as 2 of the 3 required area electives. LAW 6003, Legal Research & Writing 1 (1 cr); LAW 6004, Legal Research & Writing II (2 cr.); LAW 6008, Torts (3 cr. from 4).

Management Information Systems Specialization

Choose 9 (27 credits) from the following:

The IT specialization in Management focuses on the design of information systems that improve business effectiveness. Students will be exposed to current technologies and their impact on organizations, and examine issues that will need to be addressed in the current and future technologically-oriented economy, both nationally and internationally.

COURSES

{		MIS 245	Introduction to Management Information Systems (3-0-3) ***or***
		IS 265	Introduction to Information Systems (3-0-3)
		Acct 117	Survey of Accounting (3-0-3)
		IS 245	Information Technology Systems: Hardware/Software (3-0-3)
		IT 220	(Wireless Networks) (3-0-3)
		IT 310	E-commerce Technology (3-0-3)
		HRM 301	Organizational Behavior (3-0-3)
		Mrkt 330	Principles of Marketing (3-0-3)
		IS 465	Advanced Information Systems (3-0-3)
{		OM 375	Management Science (3-0-3) ***or***
		Mgmt 380	Principles of E-Commerce (3-0-3)
		IS 390	Requirements Analysis and Systems Design (3-0-3)
		IS 455	Information Systems Management (3-0-3)
{		Mgmt 480	Managing Technology and Innovation (3-0-3) ***or***
		MIS 363	Project Management for Managers (3-0-3)

Game Development Specialization

Choose 9 (27 credits) from the following:

The Game Development specialization is designed to give students a command of programming in C and C++ as well as other scripting languages (such as Unreal Script, XML, Lua and Python are commonly used in game development) associated with game development. The students will learn how the system architecture for games is designed with various considerations in mind such as the target platform and 2D or 3D graphics. Students will learn how to design and create their own game engines as well as how to program the game logic that uses those engines. Upon graduation, a student from the Game Development specialization will have completed both game modification projects and a number of games they have programmed from scratch and implemented on multiple platforms.

COURSES

		IT 265	Game Architecture and Design (3-0-3) ***or***
		CS 265	Game Architecture and Design (3-0-3)

	CS 266	Game Modification Development (3-0-3) ***or***
	IT 266	Game Modification Development (3-0-3)
	CS 276	2D Game Development (3-0-3) ***or***
	IT 276	Game Development (3-0-3)
	AD 150	Color and Composition (2-3-3)
	STS 318	Educational Media Design (3-0-3)
	CS 280	Programming Language Concepts (3-0-3)
	IT 386	3D Modeling and Animation (3-0-3) ***or***
	COM 335	3-D Modeling and Animation (2-1-3)
	Math 337	Linear Algebra (3-0-3)
	COM 345	Character Modeling and Animation (2-1-3)
	IT 286	Foundations of Game Production (3-0-3) ***or***
	COM 266	Foundations of Game Production (2-1-3)
	IT 4XX	(Game Development Workshop)
	CS 366	3D Game Development (3-0-3) ***or***
	IT366	
	IT 287	Advanced Game Production (3-0-3)
	Arch 434	Simulated Environments (3-0-3)

Multimedia Specialization

Choose 9 (27 credits) from the following:

The IT specialization in Multimedia offers students significant opportunities to build on fundamental principles of computer-aided graphic design, audio and video production as they are used in streaming media, web-based commerce, entertainment, education and public information services.

COURSES

Core:

	IS 270	Designing the Multimedia Experience (3-0-3)
	COM 335	3-D Modeling and Animation (2-1-3) ***or***
	IT 386	3D Modeling and Animation (3-0-3)
	COM 350	Digital Video Production (2-2-3)
	STS 347	Introduction to Music (3-0-3)

Choose 5 additional:

	STS 349	Advanced Music Technology (3-0-3)
	COM 266	Foundations of Game Production (2-1-3) ***or***
	IT 286	Foundations of Game Production (3-0-3)

COM 303	Video Narrative (3-0-3)
COM 345	Character Modeling and Animation (2-1-3)
COM 351	Documentary Studies (3-0-3)
COM 352	Photojournalism (2-2-3)
COM 369	Digital Poetry (3-0-3)
COM 376	Game Design Studio (2-1-3)
IT 265	Game Architecture and Design (3-0-3) ***or***
CS 265	Game Architecture and Design (3-0-3)
IT 266	Game Modification Development (3-0-3) ***or***
CS 266	Game Modification Development (3-0-3)
IT 276	Game Development (3-0-3) ***or***
CS 276	2D Game Development (3-0-3)
IT366	***or***
CS 366	3D Game Development (3-0-3)
Arch 434	Simulated Environments (3-0-3)
AD 150	Color and Composition (2-3-3)
Eng 353	Composing Documents for Print (3-0-3)
Eng 354	Composing Documents for the Web (3-0-3)
Eng 355	Television News Writing and Production (3-1-3)
IS 373	Web Standards (3-0-3)
IS 447	Designing the User Experience (3-0-3)
STS 318	Educational Media Design (3-0-3)

Network and Information Security Specialization

Choose 9 (27 credits) from the following:

Network Security is a high priority for computing professionals in business organizations, government agencies, the military, and any proprietary setting. Students choosing this specialization will come to understand the evolution of computer security; applied computer operations and security protocols; data transmission and storage protection methods via cryptography; ways of identifying, understanding and recovering from attacks against computer systems; methods of security breach prevention; network systems availability; applications security, recovery and business continuation procedures; and counter systems penetrations techniques.

COURSES

IT220	
IT 230	Computer and Network Security (3-0-3)
IT 310	E-commerce Technology (3-0-3)
IT 330	Computer Forensic (3-0-3)
IT 331	Privacy and Information Technology (3-0-3)
IT 332	Digital Crime (3-0-3)
IT 400	Information Technology and the Law (3-3-3)
IT 430	Ethical Hacking for System Administrators (3-0-3)
CS 332	Principles of Operating Systems (3-0-3)
CS 357	Fundamentals of Network Security (3-0-3)
CS 451	Network Technologies (3-0-3)
CS 458	Technologies-Network Security (3-0-3)

Web Applications Specialization

Choose 9 (27 credits) from the following:

The IT specialization in Web Applications focuses on different aspects of the Information Systems lifecycle. Students will take courses in different areas of web and information systems including web design techniques and web application development. Students will learn how these technologies can be best utilized within organizations.

COURSES

		IS 118	Introduction to Software Application Tools (3-0-3)
		IS 218	Building Web Applications (3-0-3)
		IS 270	Designing the Multimedia Experience (3-0-3)
		IS 265	Introduction to Information Systems (3-0-3)
		IS 245	Information Technology Systems: Hardware/Software (3-0-3)
		IS 455	Information Systems Management (3-0-3)
		IS 350	Computers, Society and Ethics (3-0-3)
		IS 390	Requirements Analysis and Systems Design (3-0-3)
		IS 373	Web Standards (3-0-3)
		IS 447	Designing the User Experience (3-0-3)
		IT 310	E-commerce Technology (3-0-3)
{		Mgmt 380	Principles of E-Commerce (3-0-3) ***or***
		Mgmt 480	Managing Technology and Innovation (3-0-3)

Interior Design

Administered By: College of Architecture and Design

Administration

Dean	Urs P. Gauchat
Associate Dean for Administration	Margaret Fitzpatrick
Associate Dean for Academics	John M. Cays
Director, School of Art + Design	Glenn Goldman

Faculty

Advisors

Undergraduate Advisor	Sasha N. Corchado

Interior Design - a regulated/certified profession - involves the design, construction, and manipulation of space in buildings: from the layout and organization of large commercial endeavors to the selection of finishes, fabrics, and furnishings for the hospitality industry and single-family homes. Interior designers work on their own and in collaboration with other professionals as part of the design and building team. They bring a sensitivity to, and knowledge of, color and space, user needs, building materials and systems, lighting, and cultural awareness to the design and management of a project.

At NJIT interior design students benefit from the co-location of architecture and industrial design programs. As such, interior design students have the opportunity to learn from a faculty that participates in all phases of the design and construction process: architects, engineers, interior designers, and product/industrial designers. The interior design program is a studio-centric curriculum, with students working on design projects in dedicated studio spaces after a foundation year common to all Art & Design students that includes courses in color and composition, graphic communication with both traditional and digital media, and art history as well as general education courses. In addition to design studio, interior design students will be taking a variety of courses including "Building and Interior Systems" (covering HVAC, electrical systems, lighting and acoustics), "History of Furniture," Building Information Modeling," "Contract Documents," and "Human Factors/Ergonomics." Design electives allow students to either broaden their exposure to a variety of traditional or digital media-based courses, or to specialize in one or more areas related to a topic of interest.

The four-year Bachelor of Arts in Interior Design provides the opportunity for students to become prepared to enter the profession of interior design as an intern and ultimately take the NCIDQ (National Council for Interior Design Qualification) examination. With judicious selection of design and free elective courses, students may also qualify to apply for graduate programs in art (M.F.A.) or architecture (M. Arch - first professional degree) or to continue further study and research in interior design at the graduate level.

Credit distribution for the Bachelor of Art in Interior Design:

Required Interior Design Courses	70
Design Electives	6

Free Electives	9
General University Requirements	46
Total Minimum Credits	**131**

Bachelor of Arts in Interior Design (131 credits)

FOUNDATION YEAR

FIRST YEAR

1st Semester:

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.

AD 150	Color and Composition (2-3-3)
AD 161	History of Art and Design I (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Math 115	Elements of Geometry (3-0-3)
CS 104	Computer Programming and Graphics Problems (3-0-3)
PE	(Physical Education:GUR) (0-1-1)
Math 120	Basic Concepts in Statistics (1-0-1)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester:

AD 111	Communication in Art and Design - Traditional Media (1-5-3)
AD 112	Communication in Art and Design - Digital Media (1-5-3)
AD 162	History of Art and Design II (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Math 116	Mathematics of Design (3-0-3)
STS 201	Understanding Technological Society (3-0-3)
STS 257	Technology, Society and Culture: An American View (3-0-3) ***or***
STS 258	Technology, Society and Culture: A Global View (3-0-3)
EPS 202	Society, Technology, and the Environment (3-0-3)

SECOND YEAR

1st Semester:

INT 263	Interior Design Studio I (1-9-4)
INT 221	Building & Interior Systems I (3-0-3)
Arch 251	History of Architecture I (3-0-3)
HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
Phys 102	General Physics (3-0-3)

		Phys 102A	General Physics Laboratory (0-2-1)
		PE XXX	(Physical Education:GUR) (0-1-1)

2nd Semester:

		INT 264	Interior Design Studio II (1-9-4)
		INT 222	Building and Interior Systems II (3-0-3)
		Arch 282	Structural Principles (3-0-3)
{		STS 210	General Psychology (3-0-3) ***or***
		R830:101	Principles of Psychology I (3)
		Elective	(Natural Science:GUR) (3-0-3)
		PE	(Physical Education) (0-1-1)

THIRD YEAR

1st Semester:

		INT 363	Interior Design Studio III (1-12-5)
		INT 321	Methods & Materials (3-0-3)
		INT 350	History of Furniture (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)

2nd Semester:

		INT 364	Interior Design Studio IV (1-12-5)
		INT 322	Contract Documents (3-0-3)
		AD 201	Human Factors/Ergonomics (3-0-3)
		INT/DD/ID/FA	(Design Elective) (3-0-3)
		Elective	(Eng/Lit/Hist/Phil/STS/SS/Thr:GUR) (3-0-3)

FOURTH YEAR

1st Semester:

		AD 463	Collaborative Design Studio (1-12-5)
		Arch 337	Building Information Modeling (3-0-3)
		Elective	(Free Elective) (3-0-3)
		Elective	(Free Elective) (3-0-3)

2nd Semester:

		INT 464	Interior Design Studio V (1-12-5)
		INT/DD/ID/FA	(Design Elective) (3-0-3)
		Elective	(Free Elective) (3-0-3)
		Elective	(Humanities Capstone:GUR) (3-0-3)

Students interested in pursuing graduate studies in Architecture (either at NJIT or elsewhere) are strongly advised to take the calculus math sequence (Math 113, and Math 114), and one additional Physics course and corresponding lab (Phys103/103A). Students should consult admissions requirements for any program and/or institution they are considering.

The minimum credit requirement for graduation is the successful completion of 128 credits of prescribed courses within the curriculum and the maintenance of a 2.0 average. Students are required to maintain a 2.0 cumulative studio average to advance to each succeeding year.

Basic Social Sciences GUR: Six (6) credits in basic (100 and 200 level) Social Sciences (Econ 201, Econ 265, Econ 266, EPS 202, STS 258, or any of the following Rutgers-Newark courses: R070:203 or 204, R790:201 or 202, R830:101 or 102, R920:201 or 202, R202:201. Students may take R220:101 or 102 instead of Econ 265 or 266.

Cultural History GUR: The Cultural History courses are the Pre-Modern World (HUM 211), The Making of the Modern World (HUM 212, and the Twentieth Century World (Hist 213). Students may also take approved introductory courses at Rutgers-Newark.

Lit/Hist/Phil/STS: One 300+ level course in lit, hist or philosophy or STS approved 300-level Rutgers Course with prefix 350 (English Literature), 352 (American Literature), 510 (History), 512 (American History) or 730 (Philosophy).

Natural Science GUR: At least seven (7) credits in natural sciences, including a laboratory experience. Courses may be selected from Biology Courses (R120:101, R120:102, R120:109, R120:110, R120:205, R120:206, R120:207, R120:208, R120:237, R120:241, R120:242), Chemistry Courses (Chem 122, Chem 123, Chem 124, Chem 125, Chem 126), Physics Courses (Phys 102, Phys 102A, Phys 103, Phys 103A, Phys 106, Phys 106A, Phys 111, Phys 111A, Phys 121, Phys 121A, Phys 202, Phys 202A, Phys 203, Phys 203A), Geology Courses (R460:101, R460:103, R460:104, R460:206, R460:207).

Open Elective in Hum/SS: One 300+ level course in English, social science, theater, literature, history, philosophy or STS or any 300-level Rutgers-Newark courses in humanities, social sciences, fine arts, or performing arts. (prefixes 070, 080, 081, 202, 220, 350, 352, 370, 420, 510, 560, 570, 700, 701, 790, 810, 861, 920, 940, 965, 988).

International Business

Administered By: School of Management

Administration

Dean	Pius J. Egbelu
Associate Dean	Lisa B. Axe
Sponsored Chairs	Katia Passerini(Hurlburt Professor)* , William V. Rapp(Henry J. Leir Chair in International Business)
Director, Executive Program	Delores E. Frazier

Advisors

Undergraduate Advisor	Michael T. Sweeney
Graduate Advisor	Lilia A. Lozarito

Faculty

Distinguished Professors	Pius J. Egbelu
Professors	Asokan Anandarajan, Jerry L. Fjermestad* , Shanthi Gopalakrishnan, Kenneth D. Lawrence, Rajiv Mehta, Hindy L. Schachter, Mark Somers, Cheickna Sylla
Associate Professors	Theologos H. Bonitsis, Katia Passerini* , Marguerite A. Schneider, Stephan P. Kudyba, Yi Chen
Assistant Professors	Michael A. Ehrlich, Wei Xu, Zhipeng Yan, Ronald Sverdlove, Ellen Thomas, James E. Cicon, Cesar Bandera
Special Lecturer	Jose C. Casal, Porchiung B. Chou, Diana Walsh, Karen P. Schoenebeck

* Joint appointee with the Department of Computer and Information Science

** Joint appointee with the School of Architecture

Bachelor of Science in International Business (124)

FIRST YEAR:

1st Semester: (15 credits)

		Acct 115	Fundamentals of Financial Accounting (3-0-3)
{		CS 103	Computer Science with Business Problems (3-0-3) ***or***
		IS 118	Introduction to Software Application Tools (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 135	Calculus for Business (3-0-3)
		Mgmt 190	Introduction to Business (3-0-3)

		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (16 credits)

		Acct 215	Managerial Accounting I (3-0-3)
		Econ 265	Microeconomics (3-0-3)
		MIS 245	Introduction to Management Information Systems (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3) ***or***
		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		PE	(Physical Education GUR) (0-1-1)
		Mgmt 290	Business Law I (3-0-3)

SECOND YEAR:

1st Semester: (16 credits)

		Econ 266	Macroeconomics (3-0-3)
		Math 105	Elementary Probability and Statistics (3-0-3)
		Elective	(Natural Science:GUR) (3-0-3)
		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		Phys Ed	(Physical Education:GUR) (0-1-1)
		Elective	(Free Elective 3--0-3)

2nd Semester: (16 credits)

		Fin 218	Financial Markets and Institutions (3-0-3)
		Mgmt 216	Business Statistics (3-0-3)
		Elective	(HUM 251 or any 200 level and above Philosophy or Ethics Course) (3-0-3)
		Elective	(Eng 200 or any Eng 300 level or above) (3-0-3)
		Elective	(Natural Science with Lab) (4)

THIRD YEAR:

1st Semester: (15 credits)

		Fin 315	Fundamentals of Corporate Finance (3-0-3)
		HRM 301	Organizational Behavior (3-0-3)
		Mgmt 316	Business Research Methods (2-1-3)
		Mrkt 330	Principles of Marketing (3-0-3)
		Elect.	(Business Specialization Course) (3-0-3)

2nd Semester: (15 credits)

		MIS 363	Project Management for Managers (3-0-3)
		Mrkt 435	International Marketing (3-0-3)
		Elective	(Business Specialization Course) (3-0-3)
		Elective	(300 level STS or Phil or Lit or Hist GUR) (3-0-3)
		Fin 422	International Finance (3-0-3)

FOURTH YEAR:

1st Semester: (15 credits)

		Mgmt 491	International Business (3-0-3)
		Elect.	(300 level HUM/SS/Eng/Thtr/Lit/Hist/Phil/Econ/Poli. Sci.) ((3-0-3)
		OM 375	Management Science (3-0-3)
		Elective	(Business Specialization Course) (3-0-3)
		Elective	(Free Elective) (3-0-3)

2nd Semester: (15 credits)

		Mgmt 492	Business Policy (3-0-3)
		Mgmt 480	Managing Technology and Innovation (3-0-3)
		Mgmt 499	Senior Seminar: Career Planning and MFT (1-0-1)
		Elective	(HSS Capstone Seminar) (3-0-3)
		Elective	(Business Specialization course) (3-0-3)
		Elective	(Free Elective) (3-0-3)

International Business Electives

Choose 4:

		SS 318	International Economic Policy (3-0-3)
		SS 351	International Relations (3-0-3)
		Eng 360	Collaborative Communication: Community and Global Perspectives (3-0-3)
		MGMT 3XX	(Special Topics)
		HRM 310	Managing Diversity in Organizations (3-0-3)

Catalog and curricula information approved by the relevant academic department.

Law, Technology and Culture

Administered By: NJIT History Faculty of the Federated History Department

Administration

Chairperson	Richard B. Sher
Director	Alison Lefkovitz

Faculty

Distinguished Professor	Richard B. Sher
Associate Professor	Neil M. Maher, Stephen G. Pemberton
Assistant Professors	Alison Lefkovitz
University Lecturers	Rolanne Henry, Theodore Nicholson, Diana Walsh, Kyle Riismandel
Adjunct Instructor	Marion Tuttle

The B.A. program in Law, Technology and Culture represents the new focal point for pre-law education at NJIT, preparing students for careers in law and law-related areas of business and government, as well as for further graduate study in various disciplines. Although administered by the History faculty at NJIT, the program draws upon a wide array of NJIT and Rutgers-Newark courses in different academic disciplines, including history, STS, philosophy, engineering, management, environmental science and policy, information technology, criminal justice, and political science. By combining features of traditional liberal arts pre-law programs with the study of law in relation to growing technological fields-Internet and media law, intellectual property law (including patent law), environmental law (including both earth and space), and health law and bioethics - the B.A. in Law, Technology and Culture meets the need for a new kind of undergraduate law education that is attuned to the complexities of the modern world.

Major Requirements

The major in Law, Technology and Culture (LTC) requires 123 credits:

1. 51 credits of major courses with a grade of C or higher, taken from the following four categories:

   a. 9 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: Hist 369 Law and Society in History; Hist 364 American Law and the World; MGMT 290 Legal Environment of Business; Phil 300 Philosophy of Law and Social Justice; SS 300 Basic Principles of Law and the Judicial System; and STS 300 Legal Reasoning, Writing, and Technology or R790:304 Introduction to Law and Legal Research..

   b. 12 credits of LTC core courses, which treat the history, policy, and practice of law in relation to engineering, environment, health, information technology, and media: 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; IE 447 Legal Aspects of Engineering; and IT 400 Information Technology and the Law.

   c. 24 credits of law-related electives and other approved courses offered at NJIT and Rutgers-Newark that fit each student's special interests. Examples include Hist 373 International Law and Diplomatic History; IE 472 Product Liability Engineering: R202:201 Introduction to Criminal Justice; R202:305 Case Processing: Law and Courts; R512:365, 366 American Legal History I and II; R512:379 U.S. History in the Courts; R790:356 Sex Law and Public Policy; R790:367 Jurisprudence and Legal Theory; R790:381 Judicial Process; R790:387

International Law; R790:401, 402 American Constitutional Law and Politics I and II; R790:409 Law and Public Policy (writing intensive); R920:349 Law and Society.

Note: 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 approved course work in that field toward the electives requirement for the major. For example, a student interested in environmental law might take Hist 344: Environmental History of North America and 6 credits of courses in environmental science and/or environmental policy for elective course credit in the major.

d. 6 credits of focused senior coursework: HSS 404: Senior Seminar in Law, Technology and Culture, in which students prepare a project or write a thesis in a relevant field, and HIST 310: Co-Op in Law, Technology and Culture, 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.

2. 48 credits (minimum) of General University requirements, including 6 credits in English composition (Hum 101 and Hum 102); 3 credits in cultural history (Hist 213 or another 200-level history course at Rutgers-Newark); 7 credits in the natural sciences; 6 credits in the social sciences; 3 credits in computer/information science; 6-7 credits in mathematics, including one course in statistics; 3 credits in management: Mgmt 390; and 2 credits of physical education.

3. 36 credits of free electives.

Patent Law Curriculum (124 credits minimum)

The curriculum for students interested in pursuing a career as a patent attorney or patent examiner differs from the standard curriculum in Law, Technology and Culture in the following ways:

1. All students take Math 111 to fulfill the GUR in calculus (4 cr.)
2. Students apply (a) 7-8 credits of the Natural Sciences GUR, (b) up to 9 credits of Law, Technology and Culture electives, and (c) up to 24 credits of Free Electives in order to fulfill one of the following options (as mandated by the U.S. Patent and Trademark Office):
    a. Physics Option (24 cr.): 24 credits of approved physics courses.
    b. Biology Option (32 cr.): 8 credits of approved chemistry or physics courses and 24 credits of approved courses in biology, botany, microbiology, or molecular biology.
    c. Chemistry Option (30 cr.): 30 credits of approved chemistry courses.
    d. Science/Engineering Option (40 cr.): 8 credits of approved chemistry or physics courses and 32 credits of approved courses in chemistry, physics, biology, botany, microbiology, molecular biology, or engineering.

Accelerated Pre-Law Curriculum with Seton Hall School of Law (105 credits at NJIT + the first year at Seton Hall School of Law)

The accelerated pre-law curriculum in Law, Technology and Culture differs from the standard curriculum in the following ways:

1. Students take a total of 105 credits at NJIT during three years of study. The B.A. is granted from NJIT after successful completion of the first year of law school.
2. In order to complete all NJIT course requirements in their three years at NJIT, students take 12 of their required 105 credits during the summers after their first and second years or as an overload during fall and spring semesters.
3. Students take 6 credits of free electives instead of 24.
4. Students fulfill all the requirements of the Albert Dorman Honors College, and an honors level of scholarship is expected in projects or theses submitted in HSS 404.

B. A. in Law, Technology and Culture (123 credits minimum)

FIRST YEAR:

1st Semester: (16-17 credits)

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.

HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Math 101	Foundations of Mathematics for the Liberal Arts (3-0-3) ***or***
Math 111	Calculus I (4-1-4) ***or***
Math 131	Calculus A (4-1-4)
CS 100	Roadmap to Computing (3-0-3)
Elective	(Natural Sciences with Lab:GUR) (3-1-4)
Mgmt 290	Business Law I (3-0-3)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (15 credits)

Elective	(Social Science: GUR) (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Math 105	Elementary Probability and Statistics (3-0-3)
Elective	(Law Related) (3-0-3)
Elective	(Natural Science GUR) (3-0-3)

SECOND YEAR:

1st Semester: (16 credits)

Elective	(Law Related) (3-0-3)
Elective	(Law Related) (3-0-3)
Elective	(Cultural History) (3-0-3)
Elective	(Social Sciences Elective) (3-0-3)
Elective	(Free Elective) (3-0-3)
Phys Ed	(Physical Education:GUR) (0-1-1)

2nd Semester: (16 credits)

Elective	(Law Technology and Culture Core) (3-0-3)
Elective	(Law Technology and Culture Core) (3-0-3)
Elective	(Free) (3-0-3)
Elective	(Free) (3-0-3)
Elective	(Legal Foundations) (3-0-3)
Elective	(Physical Education) (0-1-1)

THIRD YEAR:

1st Semester: (15 credits)

Elective	(Law Technology and Culture Core) (3-0-3)
Elective	(Law Technology and Culture Core) (3-0-3)
Elective	(Law Related) (3-0-3)
Elective	(Law Related) (3-0-3)
Elective	(Free) (3-0-3)

2nd Semester: (15 credits)

		Elective	(Law Related) (3-0-3)
		Elective	(Legal Foundations) (3-0-3)
		Elective	(Free,3-0-3)
		Elective	(Free,3-0-3)
		Elective	(Free,3-0-3)

FOURTH YEAR:

1st Semester: (15 credits)

		Focused Sr. Coursework	(Hist 310:Co-op in LTC & Hist) (3-0-3)
		Focused Sr. Cousework	(HSS 404 LTC Senior Seminar:GUR) (3-0-3)
{		Mgmt 390	Principles of Management (3-0-3) ***or***
		HRM 301	Organizational Behavior (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)

2nd Semester: (15 credits)

		Elective	(Law Related) (3-0-3)
		Elective	(Law Related) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Free) (3-0-3)

Electives:

Law, Technology and Culture (21 credits): Students select electives from among a pre-approved list of law-related courses and other relevant courses. In consultation with an advisor, up to 9 credits may be elected from courses not on the pre-approved electives list.

Free (24 credits): Students select appropriate electives in consultation with the Law, Technology and Culture major advisor.

Natural Sciences GUR (7 credits): Course work totaling 7 credits in any of the following disciplines: biology, botany, chemistry, geology, and physics. Students may take a sequence of courses in one of these disciplines or courses in different disciplines. Laboratory credit must be included in the 7 credits.

Physical Education GUR (2 credits): Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course.

Catalog and curricula information approved by the relevant academic department.

Mathematical Sciences

Administered By: Department of Mathematical Sciences

Administration

Chair	Jonathan H. Luke
Associate Chair, Administration	John K. Bechtold
Associate Chair, Undergraduate Studies	Zoi-heleni Michalopoulou
Director, Graduate Studies	Michael R. Booty
Director, Statistics Program	Aridaman K. Jain
Departmental Coordinator	Eileen M. Michie

Faculty

Distinguished Professors	Gregory A. Kriegsmann, Robert M. Miura*
Professors	Daljit S. Ahluwalia, Roman I. Andrushkiw, John K. Bechtold, Manish Bhattacharjee, Denis L. Blackmore, Michael R. Booty, Amitabha K. Bose, Wooyoung Choi, Fadi Deek** , Lou Kondic, Jonathan H. Luke, Zoi-heleni Michalopoulou**** , Petronije Milojevic, Farzan Nadim*** , Manuel Perez, Michael S. Siegel
Associate Professors	Bruce G. Bukiet, Hamilton A. Chase, Linda J. Cummings, Sunil K. Dhar, Rose Dios, Jorge P. Golowasch*** , Roy H. Goodman, David J. Horntrop, Shidong Jiang, Jay M. Kappraff, Martin Katzen, Murray I. Lieb, Victor V. Matveev, Richard O. Moore, Cyrill B. Muratov, Horacio G. Rotstein, Peter G. Petropoulos, Roy A. Plastock, Gareth J. Russell*** , Sundarraman Subramanian, Yuan-nan Young
Assistant Professors	Shahriar Afkhami zakerzadeh, Yassine Boubendir, Daniel E. Bunker*** , Peter Gordon, Wenge Guo, Ronald Sverdlove*****
Senior University Lecturers	Aridaman K. Jain, Karen D. Rappaport, Jeyakumaran Ratnaswamy
Lecturers	John Hunter, Rudy Kelly, Diana P. Klimek, Soroosh Mohebbi Forushani, Jonathan J. Porus, Joseph Zaleski
Post Doctoral Fellows	Gabriel D. Chaves, Christopher C. Fazioli, Arnaud B. Goullet, Jacek Wrobel

* Joint appointment with Department of Biomedical Engineering

** Joint appointment with the Department of Information Systems

*** Joint appointment with the Federated Department of Biological Sciences

**** Joint appointment with the Department of Electrical and Computer Engineering

***** Joint appointment with School of Mangement

For the list of Undergraduate advisors please click here

NJIT's Department of Mathematical Sciences offers a strong undergraduate program leading to:

The Bachelor of Science in Mathematical Sciences

This program prepares students for job opportunities in industry or government, for pursuing graduate studies in mathematics, statistics, or a related field, or for entrance into various professional schools. The Department of Mathematical Sciences is one of the few departments in this country with a strong emphasis on applied mathematics and statistics and is one of the strongest departments in North America for Applied Mathematics with excellent research groups in Mathematical Neurophysiology, Fluid Dynamics, Numerical Analysis, Combustion, Materials Science, Electromagnetics, and Acoustics. The department offers four concentrations which are the following:

Applied Math
Applied Statistics
Mathematical Biology
Mathematics of Finance and Acturial Science

Majors:

The undergraduate curriculum in Mathematical Sciences with one of the options listed above offers training for majors in a broad range of topics, including basic courses in calculus, differential equations, probability, discrete mathematics, statistics, advanced calculus, mathematical analysis, and complex variables, as well as more advanced courses in ordinary and partial differential equations, operations research, applied numerical methods, nonlinear dynamics, mathematical biology, applied statistics, actuarial science, and methods of applied mathematics. Many of the courses in this program emphasize the techniques required to formulate physical, biological, and industrial phenomena as mathematical models and to solve the resulting mathematical problems by using analytical and computational techniques. Senior "capstone" courses provide an opportunity for students in the Applied Mathematics and Mathematical Biology options to synthesize the knowledge gained during their undergraduate experience by combining mathematical modeling with physical and computational experiments that are conducted in the Undergraduate Mathematics Computing Laboratory. Click on one of the options above to get more information about becoming a major in Mathematical Sciences. You will need to see a faculty advisor in the Department of Mathematical Sciences to become a major.

Minors:

Students can easily earn a Minor in Applied Mathematics, Applied Statistics, Computational Mathematics, financial Mathematics or Mathematical Biology by taking only 5 courses beyond your major's requirements. Students can learn more about taking a minor by clicking on this link and should see one of the Department of Mathematical Sciences faculty advisors for the minor program.

Double Majors:

Students may earn a second major in addition to their primary major in Mathematical Sciences with one of the options listed above. Three of the most popular double majors with the Mathematical Sciences major are the Computer Science (B.S.) major, the Biology (B.S.) major, and the Applied Physics major. Completion is usually feasible within four years of full-time study.

Contact a faculty advisor in the Department of Mathematical Sciences for a list of appropriate courses to complete a double major with the major in Mathematical Sciences. For general rules about double majors, see Degree Options in the Academic Policies and Procedures section of this catalog.

7 Year Accelerated B. S. Program in Mathematical Sciences for MD, DDS, DMD, or OD (115 credits)

Effective from Fall 2007.

FIRST YEAR:

1st Semester: (18 credits)

Math 111	Calculus I (4-1-4)
Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
Chem 125	General Chemistry I (3-0-3)
R120:101	General Biology I (3-3-4)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
Frsh Sem	Freshman Seminar (1-0-0)

	PE	(Physical Education:GUR) (0-1-1)

2nd Semester: (19 Credits)

	Math 112	Calculus II (4-1-4)
{	Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
	Chem 126	General Chemistry II (3-0-3)
	Chem 124	General Chemistry Laboratory (0-2-1)
	R120:102	General Biology II (3-3-4)
	EPS 202	Society, Technology, and the Environment (3-0-3)
	Phys 121	Physics II (3-0-3)
	Phys 121A	Physics II Laboratory (0-2-1)

Summer I: (7 credits)

	CS 115	Intro. to CS I in C++ (3-0-3)
	Math 213	Calculus III B (4-0-4)

SECOND YEAR:

1st Semester: (18 credits)

	Math 222	Differential Equations (4-0-4)
	Math 337	Linear Algebra (3-0-3)
	R120:301	Foundations of Biology: Cell and Molecular Biology (3-0-3)
	Chem 243	Organic Chemistry I (3-0-3)
	HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
	PE	(Physical Education:GUR) (0-1-1)

2nd Semester: (17 credits)

	Math 331	Introduction to Partial Differential Equations (3-0-3)
	Math 340	Applied Numerical Methods (3-1-3)
	Math 333	Probability and Statistics (3-0-3)
	Chem 244	Organic Chemistry II (3-0-3)
	Chem 244A	Organic Chemistry II Laboratory (0-4-2)
	GUR	(Cultural History) (3-0-3)

Summer II: (6 credits)

	GUR	(Lit/Hist/Phil/STS) (3-0-3)
	Econ 201	Economics (3-0-3)

THIRD YEAR:

1st Semester: (15 credits)

	Math 332	Introduction to Functions of a Complex Variable (3-0-3)
	Math 430	Analytical and Computational Neuroscience (3-1-3)
	Math 450H	Methods of Applied Mathematics I (Capstone I) (3-0-3)
	Chem 473	Biochemistry (3-0-3)
	GUR	(Open Humanities and Social Science) (3-0-3)

2nd Semester: (15 credits)

	Math 371	Physiology and Medicine (3-0-3)
	Math 451H	Methods of Applied Mathematics II (Capstone II) (3-0-3)
	Math3XX	(Math 300+) (3-0-3)
	GUR	(Management) (3-0-3)
	GUR	(Capstone Seminar-Humanities and Social Science) (3-0-3)

7 Year Accelerated B. S./MD Program in Mathematical Sciences (121 credits)

FIRST YEAR:

1st Semester: (18 credits)

	Math 111	Calculus I (4-1-4)
{	Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
	Chem 125	General Chemistry I (3-0-3)
	R120:101	General Biology I (3-3-4)
	HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
	Phys 111	Physics I (3-0-3)
	Phys 111A	Physics I Laboratory (0-2-1)
	Frsh Sem	Freshman Seminar (1-0-0)
	PE	(Physical Education) (0-1-1)

2nd Semester: (19 credits)

	Math 112	Calculus II (4-1-4)
{	Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
	Chem 126	General Chemistry II (3-0-3)
	Chem 124	General Chemistry Laboratory (0-2-1)
	R120:102	General Biology II (3-3-4)
	EPS 202	Society, Technology, and the Environment (3-0-3)
	Phys 121	Physics II (3-0-3)
	Phys 121A	Physics II Laboratory (0-2-1)

Summer I: (7 credits)

CS 115	Intro. to CS I in C++ (3-0-3)
Math 213	Calculus III B (4-0-4)

SECOND YEAR:

1st Semester: (18 credits)

Math 222	Differential Equations (4-0-4)
Math 337	Linear Algebra (3-0-3)
R120:301	Foundations of Biology: Cell and Molecular Biology (3-0-3)
Chem 243	Organic Chemistry I (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
PE	(Physical Education:GUR) (0-1-1)

2nd Semester: (17 credits)

Math 331	Introduction to Partial Differential Equations (3-0-3)
Math 340	Applied Numerical Methods (3-1-3)
Math 333	Probability and Statistics (3-0-3)
Chem 244	Organic Chemistry II (3-0-3)
Chem 244A	Organic Chemistry II Laboratory (0-4-2)
GUR	(Cultural History) (3-0-3)

Summer II: (6 credits)

GUR	(Lit/Hist/Phil/STS) (3-0-3)
Econ 201	Economics (3-0-3)

THIRD YEAR:

1st Semester: (18 credits)

		Math 332	Introduction to Functions of a Complex Variable (3-0-3)
		Math 430	Analytical and Computational Neuroscience (3-1-3)
		Math 450H	Methods of Applied Mathematics I (Capstone I) (3-0-3)
		Chem 473	Biochemistry (3-0-3)
		GUR	(Open Humanities and Social Science) (3-0-3)
		GUR	(Engineering Technology) (3-0-3)

2nd Semester: (18 credits)

		Math 371	Physiology and Medicine (3-0-3)
		Math 451H	Methods of Applied Mathematics II (Capstone II) (3-0-3)
		Math3XX	(Math 300+) (3-0-3)
		GUR	(Management) (3-0-3)
		GUR	(Capstone Seminar Humanities and Social Science) (3-0-3)
		GUR	(Engineering Technology) (3-0-3)

Applied Mathematics

Administered By: Department of Mathematical Sciences

Administration

Chair	Jonathan H. Luke
Associate Chair, Administration	John K. Bechtold
Associate Chair, Undergraduate Studies	Zoi-heleni Michalopoulou
Director, Graduate Studies	Michael R. Booty
Director, Statistics Program	Aridaman K. Jain
Departmental Coordinator	Eileen M. Michie

Faculty

Distinguished Professors	Gregory A. Kriegsmann, Robert M. Miura*
Professors	Daljit S. Ahluwalia, Roman I. Andrushkiw, John K. Bechtold, Manish Bhattacharjee, Denis L. Blackmore, Michael R. Booty, Amitabha K. Bose, Wooyoung Choi, Fadi Deek**, Lou Kondic, Jonathan H. Luke, Zoi-heleni Michalopoulou****, Petronije Milojevic, Farzan Nadim***, Manuel Perez, Michael S. Siegel
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* Joint appointment with Department of Biomedical Engineering
** Joint appointment with the Department of Information Systems
*** Joint appointment with the Federated Department of Biological Sciences
**** Joint appointment with the Department of Electrical and Computer Engineering
***** Joint appointment with School of Mangement

The undergraduate program in applied mathematics prepares students for analytical and computational work in industry or government, for graduate study in mathematics or a related field, or for various professional schools.

B.S. in Mathematical Sciences with an option in Applied Mathematics (127 credits minimum)

FIRST YEAR:
1st Semester: (15 credits)

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.

		Math 111	Calculus I (4-1-4)
		CS 115	Intro. to CS I in C++ (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Frsh Sem	Freshman Seminar (1-0-0)
		PE	(Physical Education:GUR) (0-1-1)

2nd Semester: (15 credits)

		Math 112	Calculus II (4-1-4)
		PE	(Physical Education) (0-1-1)
	**	EPS 202	Society, Technology, and the Environment (3-0-3)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)

SECOND YEAR:
1st Semester: (18 credits)

		Math 213	Calculus III B (4-0-4)
		Math 227	Mathematical Modeling (4-0-4)
	*	Math 244	Introduction to Probability Theory (3-0-3)
		Phys 234	Physics III (3-0-3)
		Phys 231A	Physics III Laboratory (0-2-1)
		Elective	(Cultural History:GUR) (3-0-3)

2nd Semester: (16 credits)

		Math 222	Differential Equations (4-0-4)
		Math 337	Linear Algebra (3-0-3)
		Econ 201	Economics (3-0-3)
		Elective	(Technical) (3-0-3)
		Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)

THIRD YEAR:
1st Semester: (15 credits)

		Math 340	Applied Numerical Methods (3-1-3)
		Math 473	Intermediate Differential Equations (3-0-3)
		Math 480	Introductory Mathematical Analysis (3-0-3)
		Elective	(Management:GUR) (3-0-3)
		Elective	(Free) (3-0-3)

2nd Semester: (18 credits)

		Math 331	Introduction to Partial Differential Equations (3-0-3)
		Math 332	Introduction to Functions of a Complex Variable (3-0-3)

		Math 481	Advanced Calculus (3-0-3)
		Elective	(Humanities & Social Science Upper Level Elective)
		Elective	(Free) (3-0-3)
{		Math 391	Numerical Linear Algebra (3-0-3) ***or***
		Math 440	Advanced Applied Numerical Methods (3-0-3) ***or***
		Math 448	Stochastic Simulation (3-0-3)

FOURTH YEAR:
1st Semester: (15 credits)

		Math 450H	Methods of Applied Mathematics I (Capstone I) (3-0-3)
		Elective	(Mathematics 300+) (3-0-3)
		Elective	(Senior Seminar-Humanities and Social Science:GURI) (3-0-3)
		Elective	(Technical) (3-0-3)
		Elective	(Free) (3-0-3)

2nd Semester: (15 credits)

		Math 451H	Methods of Applied Mathematics II (Capstone II) (3-0-3)
		Elective	(Mathematics 400+) (3-0-3)
		Elective	(Technical) (3-0-3)
		Elective	(Technical) (3-0-3)
		Elective	(Technical) (3-0-3)

General University Requirements

Philosophy

B. S. Double Major in Applied Physics and Applied Mathematics (130 Credits)

FIRST YEAR:
1st Semester:

		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Math 111	Calculus I (4-1-4)
{		CS 113	Introduction to Computer Science (3-0-3) ***or***
		CS 115	Intro. to CS I in C++ (3-0-3)
		Chem 125	General Chemistry I (3-0-3)
		Frsh Sem	(Freshman Seminar) (1-0-0)

2nd Semester:

		Phys 114	Introduction to Data Reduction with Applications (3-0-3)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		Math 112	Calculus II (4-1-4)
		Chem 126	General Chemistry II (3-0-3)
		Chem 124	General Chemistry Laboratory (0-2-1)
		Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR:
1st Semester:

		Math 213	Calculus III B (4-0-4)

	*	Math 244	Introduction to Probability Theory (3-0-3)
		Phys 234	Physics III (3-0-3)
		Phys 231A	Physics III Laboratory (0-2-1)
		Elective	(Social Science:GUR) (3-0-3)
		Elective	(Eng/Comm. or Cultural History:GUR) (3-0-)

		Math 222	Differential Equations (4-0-4)
		Math 328	Mathematical Methods for Scientists and Engineers (3-0-3)
		Phys 335	Introductory Thermodynamics (3-0-3)
		HSS21X	(Cultural History: GUR) (3-0-3)
		Elective	(Social Science:GUR) (3-0-3)
		Elective	(Physical Education) (0-1-)

THIRD YEAR:
1st Semester:

		Math 337	Linear Algebra (3-0-3)
		Phys 430	Classical Mechanics I (3-0-3)
		Phys 432	Electromagnetism I (3-0-3)
{		Math 227	Mathematical Modeling (4-0-4) ***or***
		Elective	(Math 300+ elective) (3-0-3)
		Math 332	Introduction to Functions of a Complex Variable (3-0-3)
		Elective	(Eng/Lit/Hist/Phil/STS:GUR) (3-0-3)

2nd Semester:

		Math 340	Applied Numerical Methods (3-1-3)
		Math 331	Introduction to Partial Differential Equations (3-0-3)
		Elective	(Physics/OPSE Elective) (3-0-3)
		Elective	(Physics/OPSE Elective) (3-0-3)
		Phys 433	Electromagnetism II (3-0-3)

FOURTH YEAR:
1st Semester:

		Math 480	Introductory Mathematical Analysis (3-0-3)
		Phys 442	Introduction to Quantum Mechanics (3-0-3)
		Math 473	Intermediate Differential Equations (3-0-3)
		Elective	(Eng/Hist/Lit/Phil/STS/SS/THTR:GUR) (3-0-3)
		Math 450H	Methods of Applied Mathematics I (Capstone I) (3-0-3)

2nd Semester:

		Elective	(Management:GUR) (3-0-3)
		HSS40X	(Capstone Seminar:GUR) (3-0-3)
		Phys 450	Advanced Physics Laboratory (1-4-3)
		Math 451H	Methods of Applied Mathematics II (Capstone II) (3-0-3)
	****	Elective	(Phys/OPSE Elective) (3-0-3)

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* Can be replaced with Math 333 Probability and Statistics (3-0-3)

** or approved course at Rutgers-Newark

*** This course must satisfy the Engineering Technology GUR requirement. The following courses may be substituted for MTSC 301: all OPSE courses, Phys 443, Phys 444, Phys 481, Phys 482 and Phys 485.

**** This Phys/OPSE course must satisfy the Engineering Technology GUR requirement. Courses that meet this requirement are all OPSE courses, Phys 443, Phys 444, Phys 481, Phys 482 and Phys 485.

Double Major in Computer Science and Mathematical Sciences (135 credit minimum)

FIRST YEAR

1st Semester:

CS 100	Roadmap to Computing (3-0-3)
Math 111	Calculus I (4-1-4)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Frsh Sem	Freshman Seminar (1-0-0)
Elective	(Physical Education:GUR) (0-1-1)

2nd Semester:

CS 113	Introduction to Computer Science (3-0-3)
Math 112	Calculus II (4-1-4)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
EPS 202	Society, Technology, and the Environment (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Elective	(Physical Education:GUR) (0-1-1)

SECOND YEAR

1st Semester:

Math 227	Mathematical Modeling (4-0-4)
CS 114	Introduction to Computer Science II (3-0-3)
Math 211	Calculus III A (3-0-3)
Phys 234	Physics III (3-0-3)
Phys 231A	Physics III Laboratory (0-2-1)

2nd Semester:

CS 280	Programming Language Concepts (3-0-3)
CS 332	Principles of Operating Systems (3-0-3)
Math 222	Differential Equations (4-0-4)
CS 252	Computer Organization and Architecture (3-0-3)
Elective	(Cultural History GUR) (3-0-3)
Elective	(Social Science) (3-0-)

THIRD YEAR

1st Semester:

CS 241	Foundations of Computer Science I (3-0-3)
CS 288	Intensive Programming in Linux (3-0-3)
Math 333	Probability and Statistics (3-0-3)
Math 337	Linear Algebra (3-0-3)
Math 340	Applied Numerical Methods (3-1-3)
Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)

2nd Semester:

CS 435	Advanced Data Structures and Algorithm Design (3-0-3)
CS 341	Foundations of Computer Science II (3-0-3)
Elective	(Open:GUR) (3-0-3)
Elective	(Math 300+) (3-0-3)
Math 331	Introduction to Partial Differential Equations (3-0-3)
Math 332	Introduction to Functions of a Complex Variable (3-0-3)

FOURTH YEAR

1st Semester:

		CS 431	Database System Design and Management (3-0-3)
		CS 490	Guided Design in Software Engineering (3-0-3)
		Elective	(Management:GUR) (3-0-3)
		Elective	(CS) (3-0-3)
		Math 450H	Methods of Applied Mathematics I (Capstone I) (3-0-3)
		Math 480	Introductory Mathematical Analysis (3-0-3)

2nd Semester:

		CS 491	Senior Project (3-0-3)
		Elective	(CS) (3-0-3)
		Math 451H	Methods of Applied Mathematics II (Capstone II) (3-0-3)
		Elective	(Math 300+) (3-0-3)
		Elective	(Capstone Seminar:GUR) (3-0-3)

Applied Statistics

Administered By: Department of Mathematics Sciences

Administration

Chair	Jonathan H. Luke
Associate Chair, Administration	John K. Bechtold
Associate Chair, Undergraduate Studies	Zoi-heleni Michalopoulou
Director, Graduate Studies	Michael R. Booty
Director, Statistics Program	Aridaman K. Jain
Departmental Coordinator	Eileen M. Michie

Faculty

Distinguished Professors	Gregory A. Kriegsmann, Robert M. Miura*
Professors	Daljit S. Ahluwalia, Roman I. Andrushkiw, John K. Bechtold, Manish Bhattacharjee, Denis L. Blackmore, Michael R. Booty, Amitabha K. Bose, Wooyoung Choi, Fadi Deek** , Lou Kondic, Jonathan H. Luke, Zoi-heleni Michalopoulou**** , Petronije Milojevic, Farzan Nadim*** , Manuel Perez, Michael S. Siegel
Associate Professors	Bruce G. Bukiet, Hamilton A. Chase, Linda J. Cummings, Sunil K. Dhar, Rose Dios, Jorge P. Golowasch*** , Roy H. Goodman, David J. Horntrop, Shidong Jiang, Jay M. Kappraff, Martin Katzen, Murray I. Lieb, Victor V. Matveev, Richard O. Moore, Cyrill B. Muratov, Horacio G. Rotstein, Peter G. Petropoulos, Roy A. Plastock, Gareth J. Russell*** , Sundarraman Subramanian, Yuan-nan Young
Assistant Professors	Shahriar Afkhami zakerzadeh, Yassine Boubendir, Daniel E. Bunker*** , Peter Gordon, Wenge Guo, Ronald Sverdlove*****
Senior University Lecturers	Aridaman K. Jain, Karen D. Rappaport, Jeyakumaran Ratnaswamy
Lecturers	John Hunter, Rudy Kelly, Diana P. Klimek, Soroosh Mohebbi Forushani, Jonathan J. Porus, Joseph Zaleski
Post Doctoral Fellows	Gabriel D. Chaves, Christopher C. Fazioli, Arnaud B. Goullet, Jacek Wrobel

* Joint appointment with Department of Biomedical Engineering

** Joint appointment with the Department of Information Systems

*** Joint appointment with the Federated Department of Biological Sciences

**** Joint appointment with the Department of Electrical and Computer Engineering

***** Joint appointment with School of Mangement

Administered By: Department of Mathematical Sciences, Cullimore Hall, Room 606.

The undergraduate program in Mathematical Sciences with an option in Applied Statistics prepares students for the application of mathematics to designing an experiment, sampling and data collection, statistical modeling, and analytical work in industry or government. Statistical techniques are widely used in the area of business marketing, medicine and public health, developmental disabilities, education, political science and many other areas. NJIT's Department of Mathematical Sciences is one of the few departments in New Jersey with a strong program in Applied Statistics.

Majors: The undergraduate curriculum provides students with training in a broad range of mathematical techniques, problem formulation and problem solving strategies. Students learn about the many facets of data analysis through courses in sampling, regression, experimental design, time series analysis and simulation. A strong background in Computer Science and programming languages make our students even more marketable as applied statisticians.

Double Majors: Students may earn a second major in addition to their primary major in Mathematical Sciences. Contact the Department of Mathematical Sciences for a list of appropriate courses to complete a double major. For general rules about double majors, see Degree Options in the Academic Policies and Procedures section of this catalog.

Contact the Department of Mathematical Sciences for a list of appropriate courses to complete a double major with the major in Mathematical Sciences with an option in Applied Statistics. For general rules about double majors, see Degree Options in the Academic Policies and Procedures section of this catalog.

Curriculum: The curriculum described below is for students who entered NJIT in the Fall of 2002 or later. Students who entered NJIT before that date have been moved into this new program and should consult their faculty advisor in the Department of Mathematical Sciences if they have any questions regarding this new curriculum.

B.S. in Mathematical Sciences with an Option in Applied Statistics (126 credit minimum)

FIRST YEAR:

1st Semester: (15 credits)

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.

Math 111	Calculus I (4-1-4)
CS 115	Intro. to CS I in C++ (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
Frsh Sem	Freshman Seminar (1-0-0)
PE	(Physical Education:GUR) (0-1-1)

2nd Semester: (15 credits)

Math 112	Calculus II (4-1-4)
PE	(Physical Education:GUR) (0-1-1)
EPS 202	Society, Technology, and the Environment (3-0-3)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
Elective	(Communication/Cultural History:GUR) (3-0-3)

SECOND YEAR:

1st Semester: (17 credits)

Math 213	Calculus III B (4-0-4)
Math 227	Mathematical Modeling (4-0-4)
Math 244	Introduction to Probability Theory (3-0-3)
Econ 201	Economics (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)

2nd Semester: (16 credits)

Math 222	Differential Equations (4-0-4)
Math 341	Statistical Methods II (3-0-3)
Math 337	Linear Algebra (3-0-3)
Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)
Elective	(Technical) (3-0-3)

THIRD YEAR:
1st Semester: (18 credits)

Math 334	Operations Research (3-0-3)
Math 340	Applied Numerical Methods (3-1-3)
Math 345	Multivariate Distributions (3-0-3)
Elective	(Humanities and Social Science Upper Level Elective:GUR) (3-0-3)
Elective	(Management:GUR) (3-0-3)
Elective	(Free) (3-0-3)

2nd Semester: (15 credits)

Math 344	Regression Analysis (3-0-3)
Math 321	Introduction to the Finite Element Method (3-0-3) ***or***
Math 391	Numerical Linear Algebra (3-0-3) ***or***
Math 440	Advanced Applied Numerical Methods (3-0-3)
Elective	(Senior Seminar-Humanities and Social Science Upper Level:GUR) (3-0-3)
Elective	(Technical) (3-0-3)
Elective	(Free) (3-0-3)

FOURTH YEAR:
1st Semester: (15 credits)

Math 447	Applied Time Series Analysis (3-0-3)
Math 448	Stochastic Simulation (3-0-3)
Math 480	Introductory Mathematical Analysis (3-0-3)
Elective	(400+ level course with advisor's approval) (3-0-3)
Elective	(Free) (3-0-3)

2nd Semester: (15 credits)

Math 477	Stochastic Processes (3-0-3)
Elective	(400+ level course with advisor's approval) (3-0-3)
Elective	(Free) (3-0-3)
Elective	(Technical Elective) (3-0-3)
Elective	(Technical Elective) (3-0-3)

General University Requirements and Electives

All students are required to satisfy the General University Requirements (GUR). All GUR 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 University Requirements section of this catalog for further information on electives.

Electives

All electives should be selected after consultation with a Mathematical Sciences faculty advisor. 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.

Co-op Courses

In Mathematical Sciences, the co-op courses, Math 310 and Math 410, bear degree credit and count as technical or free electives, subject to approval by a faculty advisor in the Department of Mathematical Sciences.

Mathematical Biology

Administered By: Department of Mathematical Sciences

Administration

Chair	Jonathan H. Luke
Associate Chair, Administration	John K. Bechtold
Associate Chair, Undergraduate Studies	Zoi-heleni Michalopoulou
Director, Graduate Studies	Michael R. Booty
Director, Statistics Program	Aridaman K. Jain
Departmental Coordinator	Eileen M. Michie

Faculty

Distinguished Professors	Gregory A. Kriegsmann, Robert M. Miura*
Professors	Daljit S. Ahluwalia, Roman I. Andrushkiw, John K. Bechtold, Manish Bhattacharjee, Denis L. Blackmore, Michael R. Booty, Amitabha K. Bose, Wooyoung Choi, Fadi Deek** , Lou Kondic, Jonathan H. Luke, Zoi-heleni Michalopoulou**** , Petronije Milojevic, Farzan Nadim*** , Manuel Perez, Michael S. Siegel
Associate Professors	Bruce G. Bukiet, Hamilton A. Chase, Linda J. Cummings, Sunil K. Dhar, Rose Dios, Jorge P. Golowasch*** , Roy H. Goodman, David J. Horntrop, Shidong Jiang, Jay M. Kappraff, Martin Katzen, Murray I. Lieb, Victor V. Matveev, Richard O. Moore, Cyrill B. Muratov, Horacio G. Rotstein, Peter G. Petropoulos, Roy A. Plastock, Gareth J. Russell*** , Sundarraman Subramanian, Yuan-nan Young
Assistant Professors	Shahriar Afkhami zakerzadeh, Yassine Boubendir, Daniel E. Bunker*** , Peter Gordon, Wenge Guo, Ronald Sverdlove*****
Senior University Lecturers	Aridaman K. Jain, Karen D. Rappaport, Jeyakumaran Ratnaswamy
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Post Doctoral Fellows	Gabriel D. Chaves, Christopher C. Fazioli, Arnaud B. Goullet, Jacek Wrobel

* Joint appointment with Department of Biomedical Engineering
** Joint appointment with the Department of Information Systems
*** Joint appointment with the Federated Department of Biological Sciences
**** Joint appointment with the Department of Electrical and Computer Engineering
***** Joint appointment with School of Mangement

Administered By: Department of Mathematical Sciences, Cullimore Hall, Room 606

The undergraduate program in Mathematical Sciences with an option in Mathematical Biology prepares students for modeling, computational, and analytical work in industry or government, for graduate study in mathematics or a related field, or for various professional schools. NJIT's Department of Mathematical Sciences is one of the few departments in North America with such a strong program in Mathematical Biology. There are ten active researchers in Mathematical Biology, including seven in Computational Neuroscience.

Majors:

The undergraduate curriculum provides students with training in a broad range of mathematical techniques and problem solving strategies. Many of the courses in this program emphasize the techniques required to formulate physical, biological, and industrial phenomena as mathematical models and to solve the resulting mathematical problems by using computational and analytical techniques. Senior "capstone" courses provide an opportunity for students to synthesize the knowledge gained during their undergraduate experience by combining mathematical modeling with physical and computational experiments conducted in the Undergraduate Mathematics Computing Laboratory.

Double Majors:

Students may earn a second major in addition to their primary major in Mathematical Sciences with a specialization in Applied Mathematics. The most popular double major with the Mathematical Sciences major – specialization of Mathematical Biology is the Biology (B.S.) major. Completion is usually feasible within four years of full-time study. Contact the Department of Mathematical Sciences for a list of appropriate courses to complete a double major with the major in Mathematical Sciences - specialization in Mathematical Biology. For general rules about double majors, see Degree Options in the Academic Policies and Procedures section of this catalog.

Contact the Department of Mathematical Sciences for a list of appropriate courses to complete a double major with the major in Mathematical Sciences with an option in Mathematical Biology. For general rules about double majors, see Degree Options in the Academic Policies and Procedures section of this catalog.

Curriculum:

The curriculum described below is for students who entered NJIT in the Fall of 2002 or later. Students who entered NJIT before that date have been moved into this new program and should consult their faculty advisor in the Department of Mathematical Sciences if they have any questions regarding this new curriculum.

B.S. in Mathematical Sciences with an Option in Mathematical Biology (125 credit minimum)

FIRST YEAR:

1st Semester (15 credits):

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.

Math 111	Calculus I (4-1-4)
CS 115	Intro. to CS I in C++ (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
Frsh Sem	Freshman Seminar (1-0-0)
Elective	(Physical Education: GUR) (0-1-1)

2nd Semester (15 credits):

Math 112	Calculus II (4-1-4)
Econ 201	Economics (3-0-3)
EPS 202	Society, Technology, and the Environment (3-0-3)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
PE	(Physical Education: GUR) (0-1-1)

SECOND YEAR:
1st Semester (18 credits):

		Math 213	Calculus III B (4-0-4)
		Math 227	Mathematical Modeling (4-0-4)
		Math 337	Linear Algebra (3-0-3)
		R120:101	General Biology I (3-3-4)
		Chem 125	General Chemistry I (3-0-3)

2nd Semester (17 credits):

		Math 222	Differential Equations (4-0-4)
		Math 333	Probability and Statistics (3-0-3)
		R120:102	General Biology II (3-3-4)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Elective	(Technical) (3-0-3)

THIRD YEAR:
1st Semester (15 credits):

		Math 331	Introduction to Partial Differential Equations (3-0-3)
		Math 340	Applied Numerical Methods (3-1-3)
		Math 373	Introduction to Mathematical Biology (3-0-3)
		R120:301	Foundations of Biology: Cell and Molecular Biology (3-0-3)
		Elective	(Cultural History: GUR) (3-0-3)

2nd Semester (15 credits):

		Math 332	Introduction to Functions of a Complex Variable (3-0-3)
		Math 371	Physiology and Medicine (3-0-3)
		Elective	(Humanities and Social Science Upper Level Elective:GUR) (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Lit/Hist/Phil/STS: GUR) (3-0-3)

FOURTH YEAR:
1st Semester (15 credits):

		Math 430	Analytical and Computational Neuroscience (3-1-3)
		Math 450H	Methods of Applied Mathematics I (Capstone I) (3-0-3)
		Math 480	Introductory Mathematical Analysis (3-0-3)
		Elective	(Free) (3-0-3)
		Elective	(Management: GUR) (3-0-3)

2nd Semester: (15 credits)

		Math 451H	Methods of Applied Mathematics II (Capstone II) (3-0-3)
		Math 481	Advanced Calculus (3-0-3)
		Elective	(Technical) (3-0-3)
		Elective	(Senior Seminar-Humanities and Social Science:GUR) (3-0-3)
		Elective	(Free) (3-0-3)

General University Requirements and Electives

All students are required to satisfy the General University Requirements (GUR). All GUR 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 University Requirements section of this catalog for further information on electives.

Co-op Courses

In Mathematical Sciences, the co-op courses, Math 310 and Math 410, 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.

Double Major in Biology and Mathematical Sciences (132 Credit minimum)

FIRST YEAR:

1st Semester (17 Credits):

		Biol 200	Concepts in Biology (4-0-4)
		Chem 125	General Chemistry I (3-0-3)
		Math 111	Calculus I (4-1-4)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		BNFO 135	Programming for Bioinformatics (3-0-3)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester (16 Credits):

		R120:201	(Foundations of Biology) (3)
		R120:202	(Foundations Bio Lab) (1)
		Chem 124	General Chemistry Laboratory (0-2-1)
		Chem 126	General Chemistry II (3-0-3)
		Math 112	Calculus II (4-1-4)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		PE	(Physical Education:GUR) (0-1-1)

SECOND YEAR:

1st Semester (18 credits):

		Biol 205	Foundations of Biology: Ecology and Evolution Lecture (3-0-3)
		Biol 206	Foundations of Biology: Ecology and Evolution Lab (0-3-1)
		Chem 243	Organic Chemistry I (3-0-3)
		Phys 111	Physics I (3-0-3)
		Phys 111A	Physics I Laboratory (0-2-1)
		Math 211	Calculus III A (3-0-3)
		BNFO 136	Programming for Bioinformatics II (3-0-3)

2nd Semester (19 credits):

		Chem 244	Organic Chemistry II (3-0-3)
		Chem 244A	Organic Chemistry II Laboratory (0-4-2)
		Phys 121	Physics II (3-0-3)
		Phys 121A	Physics II Laboratory (0-2-1)
		Math 337	Linear Algebra (3-0-3)
		GUR Elective	(Social Sciences) (3-0-3)
		GUR Elective	(Physical Education) (0-1-1)

THIRD YEAR:

1st Semester (16 credits):

		Math 222	Differential Equations (4-0-4)
		Math 340	Applied Numerical Methods (3-1-3)
		Biology Elective	(Functional Organism Lab) (4)
		Biology Elective	(Ecology and Evolution) (3)
		GUR Elective	(English and Cultural Hist) (3-0-3)

2nd Semester (19 credits):

		Math 331	Introduction to Partial Differential Equations (3-0-3)
		Math 332	Introduction to Functions of a Complex Variable (3-0-3)
		Math 373	Introduction to Mathematical Biology (3-0-3)
		Elective	(Laboratory Experience) (4)
		GUR Elective	(Social Sciences) (3)

FOURTH YEAR:

1st Semester (18 credits):

		Math 333	Probability and Statistics (3-0-3)
		Math 450	(Capstone I) (3-0-3)
		Math 480	Introductory Mathematical Analysis (3-0-3)
		Biol Elective	(Molecular and Cellular) (3)
		Biol Elective	(Laboratory Experience**) (3)
		GUR Elective	(HSS Upper Level) (3)

2nd Semester (15 credits):

		Math 451	(Capstone II) (3-0-3)
		Mgmt 390	Principles of Management (3-0-3)
		Elective	(Math Biology) (3-0-3)
		Elective	(HSS Upper Level) (3-0-3)
		Elective	(HSS Capstone Seminar:GUR) (3-0-3)

Catalog and curricula information approved by the relevant academic department.

Mathematics of Finance and Actuarial Science

Administered By: Department of Mathematical Sciences

Administration

Chair	Jonathan H. Luke
Associate Chair, Administration	John K. Bechtold
Associate Chair, Undergraduate Studies	Zoi-heleni Michalopoulou
Director, Graduate Studies	Michael R. Booty
Director, Statistics Program	Aridaman K. Jain
Departmental Coordinator	Eileen M. Michie

Faculty

Distinguished Professors	Gregory A. Kriegsmann, Robert M. Miura*
Professors	Daljit S. Ahluwalia, Roman I. Andrushkiw, John K. Bechtold, Manish Bhattacharjee, Denis L. Blackmore, Michael R. Booty, Amitabha K. Bose, Wooyoung Choi, Fadi Deek** , Lou Kondic, Jonathan H. Luke, Zoi-heleni Michalopoulou**** , Petronije Milojevic, Farzan Nadim*** , Manuel Perez, Michael S. Siegel
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Assistant Professors	Shahriar Afkhami zakerzadeh, Yassine Boubendir, Daniel E. Bunker*** , Peter Gordon, Wenge Guo, Ronald Sverdlove*****
Senior University Lecturers	Aridaman K. Jain, Karen D. Rappaport, Jeyakumaran Ratnaswamy
Lecturers	John Hunter, Rudy Kelly, Diana P. Klimek, Soroosh Mohebbi Forushani, Jonathan J. Porus, Joseph Zaleski
Post Doctoral Fellows	Gabriel D. Chaves, Christopher C. Fazioli, Arnaud B. Goullet, Jacek Wrobel

* Joint appointment with Department of Biomedical Engineering

** Joint appointment with the Department of Information Systems

*** Joint appointment with the Federated Department of Biological Sciences

**** Joint appointment with the Department of Electrical and Computer Engineering

***** Joint appointment with School of Mangement

Administered By: Department of Mathematical Sciences, Cullimore Hall, Room 606

The undergraduate program in Mathematical Sciences with an option in Mathematics of Finance and Actuarial Science prepares students for the application of mathematics to financial management, market transactions, business analysis, investments, insurance and pensions. NJIT's Department of Mathematical Sciences is one of the few departments in New Jersey with a strong program in Mathematics of Finance and Actuarial Science.

Majors: The undergraduate curriculum provides students with training in a broad range of mathematical techniques and problem solving strategies. Students learn about the many facets of financial analysis through courses in Mathematics, Accounting, Economics, and Finance. A strong background in Computers and Scientific Computing make our students an even greater asset to the industry.

Double Majors: Students may earn a second major in addition to their primary major in Mathematical Sciences. Contact the Department of Mathematical Sciences for a list of appropriate courses to complete a double major. For general rules about double majors, see Degree Options in the Academic Policies and Procedures section of this catalog.

Contact the Department of Mathematical Sciences for a list of appropriate courses to complete a double major with the major in Mathematical Sciences with an option in Mathematics of Finance and Actuarial Science. For general rules about double majors, see Degree Options in the Academic Policies and Procedures section of this catalog.

Curriculum: The curriculum described below is for students who entered NJIT in the Fall of 2002 or later. Students who entered NJIT before that date have been moved into this new program and should consult their faculty advisor in the Department of Mathematical Sciences if they have any questions regarding this new curriculum.

B.S. in Mathematical Sciences with option in Mathematics of Finance and Acturial Science (129 credits minimum)

FIRST YEAR

1st Semester: (15 credits)

Math 111	Calculus I (4-1-4)
CS 115	Intro. to CS I in C++ (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)
Frsh Sem	Freshman Seminar (1-0-0)
PE	(Physical Education:GUR) (0-1-1)

2nd Semester: (17 credits)

Math 112	Calculus II (4-1-4)
Acct 115	Fundamentals of Financial Accounting (3-0-3)
EPS 202	Society, Technology, and the Environment (3-0-3)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)

SECOND YEAR*:*

1st Semester: (17 credits)

Math 213	Calculus III B (4-0-4)
Math 227	Mathematical Modeling (4-0-4)
Math 244	Introduction to Probability Theory (3-0-3)
Econ 265	Microeconomics (3-0-3)
Elective	(Cultural History:GUR) (3-0-3)

2nd Semester: (17 credits)

Math 222	Differential Equations (4-0-4)
Math 340	Applied Numerical Methods (3-1-3)
Math 337	Linear Algebra (3-0-3)
Math 341	Statistical Methods II (3-0-3)

Econ 266	Macroeconomics (3-0-3)
PE	(Physical Education:GUR) (0-1-1)

THIRD YEAR:
1st Semester: (18 credits)

Math 447	Applied Time Series Analysis (3-0-3)
Math 346	Mathematics of Finance I (3-0-3)
Math 345	Multivariate Distributions (3-0-3)
Fin 315	Fundamentals of Corporate Finance (3-0-3)
Elective	(Humanities and Social Sciences Upper Level Elective:GUR) (3-0-3)
Elective	(Lit/Hist/Phil/STS:GUR) (3-0-3)

2nd Semester: (15 credits)

Math 331	Introduction to Partial Differential Equations (3-0-3)
Math 344	Regression Analysis (3-0-3)
Math 347	Mathematics of Finance II (3-0-3)
Elective	(Senior Seminar-Humanities and Social Science:GUR) (3-0-3)
Elective	(Management:GUR) (3-0-3)

FOURTH YEAR:
1st Semester: (15 Credits)

Elective	(Mathematics 400+:3-0-3)
Math 432	Mathematics of Financial Derivatives I (Capstone I) (3-0-3)
Fin 416	Advanced Corporate Finance (3-0-3) ***or***
R390:330	Corporate Finance (3)
Elective	(Option Elective-Math 440, 441, 442, 480, 481, Fin 401, 402, 422, 423) (3-0-3)
Elective	(Free) (3-0-3)

2nd Semester: (15 credits)

Math 477	Stochastic Processes (3-0-3)
Math 448	Stochastic Simulation (3-0-3)
Math 433	Mathematics of Financial Derivatives II (Capstone II) (3-0-3)
Elective	(Option Elective-Math 440, 441, 442, 480, 481, Fin 401, 402, 422, 423) (3-0-3)
Elective	(Free) (3-0-3)

General University Requirements and Electives

All students are required to satisfy the General University Requirements (GUR). All GUR 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 University Requirements section of this catalog for further information on electives.

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.

Co-op Courses

In Mathematical Sciences, the co-op courses, Math 310 and Math 410, bear degree credit and count as technical or free electives, subject to approval by a faculty advisor in the Department of Mathematical Sciences.

Mechanical Engineering

Administered By: Department of Mechanical and Industrial Engineering

Administration

Chairperson	Reggie J. Caudill
Associate Chair.	Kwabena A. Narh
Graduate Advisor	Zhiming Ji

Faculty

Professors	Rong-yaw Chen, Ian S. Fischer, Avraham Harnoy, Bernard Koplik, Kwabena A. Narh, Anthony D. Rosato, Pushpendra Singh, Rajpal S. Sodhi, Chao Zhu, I J. Rao
Associate Professors	Pasquale J. Florio, Zhiming Ji
Assistant Professors	Shawn A. Chester, Eon soo Lee
University Lecturers	Balraj S. Mani, Harry V. Kountouras, Herli Surjanhata, Veljko Samardzic

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 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.

Program Educational Objectives

The objectives are our expectations of the accomplishments and characteristics of the careers of our graduates in the areas of engineering practice, professional growth and service. The current Mechanical Engineering (ME) program objectives are:

1. ME graduates are successfully engaged in mechanical engineering design processes and the practical application of engineering theory, methods and practices into various fields including alternative energy systems, manufacturing, controls, robotics, materials, and biomedical systems and devices.

2. ME graduates advance their professional growth and development through activities such as graduate study in engineering, professional registration, and continuing education, with some graduates transitioning into other professional fields.

3. ME graduates are effectively engaged in service to their professional societies, as well as their local, national or global communities.

Program Outcomes

Graduates of the Mechanical Engineering program will have:

(a) An ability to apply knowledge of mathematics, science, and engineering

(b) An ability to design and conduct experiments, as well as to analyze and interpret data

(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) An ability to function on multidisciplinary teams

(e) An ability to identify, formulate, and solve engineering problems

(f) An understanding of professional and ethical responsibility

(g) An ability to communicate effectively

(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(i) A recognition of the need for, and an ability to engage in life-long learning

(j) A knowledge of contemporary issues

(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

This program is accredited by Engineering Accreditation Commission of ABET, http://abet.org

B.S. in Mechanical Engineering (130 credit minimum)

FIRST YEAR:

1st Semester:

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.

{		Chem 121	Fundamentals of Chemical Principles I (3-0-3) ***or***
		Chem 125	General Chemistry I (3-0-3)

**	FED 101	Fundamentals of Engineering Design (2-1-2)
*	HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
	Math 111	Calculus I (4-1-4)
	Phys 111	Physics I (3-0-3)
	Phys 111A	Physics I Laboratory (0-2-1)
	Frsh Sem	Freshman Seminar (1-0-0)
	Elective	(Physical Education: GUR) (0-1-1)

2nd Semester:

	Chem 124	General Chemistry Laboratory (0-2-1)
	Chem 122	Fundamentals of Chemical Principles II (3-0-3) ***or***
	Chem 126	General Chemistry II (3-0-3)
	CS 101	Computer Programming and Problem Solving (3-0-3)
	HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
	Math 112	Calculus II (4-1-4)
	Phys 121	Physics II (3-0-3)
	Phys 121A	Physics II Laboratory (0-2-1)

SECOND YEAR:
1st Semester:

	Hist 213	The Twentieth-Century World (3-0-3)
	Math 211	Calculus III A (3-0-3)
	Math 279	Statistics and Probability for Engineers (2-0-2)
	Mech 234	Engineering Mechanics (2-0-2)
	ME 215	Engineering Materials and Processes (2-2-3)
	EPS 202	Society, Technology, and the Environment (3-0-3)
	Elective	(Physical Education: GUR) (0-1-1)

2nd Semester:

	Math 222	Differential Equations (4-0-4)
	ME 231	Kinematics of Machinery (3-0-3)
	Mech 236	Dynamics (2-0-2)
	Mech 237	Strength of Materials (3-0-3)
	Econ 201	Economics (3-0-3)

THIRD YEAR:
1st Semester:

	ECE 405	Electrical Engineering Principles (3-0-3)
	ME 305	Introduction to System Dynamics (3-0-3)
	ME 311	Thermodynamics I (3-0-3)
	ME 315	Stress Analysis (3-0-3)
***	Phil 334	Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering (3-0-3)

2nd Semester:

	ME 304	Fluid Mechanics (3-0-3)
	ME 312	Thermodynamics II (3-0-3)
	ME 316	Machine Design (3-0-3)
	ME 343	Mechanical Laboratory I (2-2-3)
	ME 430	Introduction to Computer-Aided Design (2-2-3)

FOURTH YEAR:
1st Semester:

		ME 403	Mechanical Systems Design I (2-1-3)
		ME 405	Mechanical Laboratory II (1-2-2)
		ME 407	Heat Transfer (3-0-3)
	****	Elective	(Open:GUR) (3-0-3)
		Elective	(ME/TE) (3-0-3)
		Elective	(ME/TE) (3-0-3)

2nd Semester:

		ME 406	Mechanical Laboratory III (1-2-2)
		ME 408	Mechanical Systems Design II (1-2-2)
		Elective	(ME/TE) (3-0-3)
		Elective	(ME/TE) (3-0-3)
	*****	Elective	(Management:GUR) (3-0-3)
	******	Elective	(Capstone Seminar: GUR) (3-0-3)

Electives

*****Open Elective in Humanities and Social Science GUR:* Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students also may satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark.

*******Capstone Seminar in Humanities and Social Science GUR:* All students, except those enrolled in the honors college, take one of the following: HSS 403,HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one from HSS 491H-499H .

******Physical Education GUR:* Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course. Students are urged to complete the requirement as soon as possible.

Management GUR: Students take IE 492 or Mgmt 390 or AS 333, which is acceptable only for students taking the aerospace option. Students enrolled in a dual degree program between architecture and management take HRM 601 to fulfill this requirement.

ME/TE: Must be chosen from a list of courses available from the Department of Mechanical Engineering. Any other course must have prior departmental approval.

Refer to the General University Requirement section of this catalog for further information on electives.

Co-op

Co-op courses bearing degree credit may replace a technical elective or another course approved by the faculty advisor in the student's major department. In mechanical engineering, ME 310 is taken for additive credit and ME 410 may be taken for degree credit, with ME 310 as a prerequisite. Prior approval by ME Co-op advisor required.

Notes:

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* Some students will take these courses in reverse order. Transfer students may be permitted to substitute EG 101 for FED 101.

** FED 101 is taken concurrently with either HUM 099 or HUM 101.

*** Phil 334 is a required elective-Lit/Hist/Phil GUR.

**** Open elective Hum/SS at 300 level.

***** IE 492. Mgmt 390 is also available.

****** Choose 400 level capstone seminar in Hum/SS.

Note: ME and acceptable technical electives are listed. All other technical electives must have prior departmental approval.

Science, Technology and Society

Administered By: Offered by the Department of Humanities

Administration

Chairperson	Carol S. Johnson
Director	Maurie Cohen
Program Advisor	Michael L. Tress

Faculty

Professors	Norbert Elliot, Eric M. Katz, Burt J. Kimmelman, David B. Rothenberg
Associate Professors	Maurie Cohen, Nancy L. Steffen
Assistant Professor	Michael S. Brownstein
Lecturers	Rolanne Henry, James M. Lipuma, Narendra-neel Khichi, Caitlin D. Wylie, John M. Wolf

Students enroll in the Bachelor of Science in Science, Technology, and Society (STS) because they are interested in discovering how and why the work and communication strategies of scientists, technologists, and other professionals affect the social systems in which we all partake.

STS majors begin their studies by exploring the theoretical and historical foundations of science and technology as they concern politics, economics and culture. During the second and third years, core courses present case studies and practical assignments that build on the fundamentals learned in the first year. Students also select an area of specialization, and identify a topic for their senior projects. STS majors are continuously developing their abilities to analyze complex information, solve critical problems, and demonstrate their ethical awareness and sense of public responsibility.

STS alumni attend medical, law, or business graduate programs. Others go into businesses as diverse as environmental remediation to marketing and management. Still others engage in governmental, public policy, NGO administration or academia.

Albert Dorman Honors College (ADHC) students may participate in accelerated and other pre-professional programs allied with Seton Hall University's law school or UMDNJ's Medicine, Physical Therapy (DPT) or Physician's Assistant programs. STS students are encouraged to participate in NJIT's Cooperative Education program and internships in a corporate, nonprofit or government setting.

The STS Program encourages students in CSLA and other majors to consider a double major or minor in the program. During their senior year, double majors compose a senior thesis that places work done for their primary majors in an STS context.

Concentrations:

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

The STS major consists of four components: primary core courses, STS specialization courses, STS elective courses, and the senior thesis.

Primary core courses, which introduce students to the fundamental connections linking civilization, technology, and the global environment, focus on historical and cultural foundations, basic ideas and values, dominant institutions, environmental viewpoints, policy formation, and sustainable development.

STS specialization courses allow students to concentrate in one of five areas. STS elective courses enable students to develop a broad understanding of the field. The final phase of the STS degree entails preparation of a senior thesis under the supervision of a faculty advisor. This project gives students an opportunity to formulate a highly focused understanding of a topical issue at the interface of science technology and society.

B.S. in Science, Technology and Society (124 credit minimum)

FIRST YEAR:

1st Semester: (16 credits)

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.

Math 101	Foundations of Mathematics for the Liberal Arts (3-0-3)
HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Elective	(Natural Science GUR) (3-0-3)
Elective	(Natural Science Lab GUR) (0-2-1)
STS 201	Understanding Technological Society (3-0-3)
CS 100	Roadmap to Computing (3-0-3)
Elective	(Transfer-NA)

2nd Semester: (16 credits)

Math 105	Elementary Probability and Statistics (3-0-3)
HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
Elective	(Natural Science GUR) (3-0-3)
Elective	(Natural Science Lab GUR) (0-2-1)
Econ 201	Economics (3-0-3)
HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
PE	(Physical Education) (0-1-1)

SECOND YEAR:

1st Semester: (16 credits)

STS 308	Technology and Global Development: Introduction to STS (3-0-3)
EPS 202	Society, Technology, and the Environment (3-0-3) ***or***
STS 210	General Psychology (3-0-3) ***or***
STS 221	Sociology (3-0-3)
Free Elective	(100 or 200 level or equivalent) (3-0-3)
Free Elective	(100 or 200 level or equivalent) (3-0-3)
Free Elective	(100 or 200 level or equivalent) (3-0-3)
PE	(Physical Education) (0-1-1)

2nd Semester: (15 credits)

STS 310	Technology and Human Values (3-0-3)
Specialization	(300 Level STS Specialization) (3-0-3)
Free Elective	(100 or 200 level or equivalent) (3-0-3)

		Free Elective	(100 or 200 level or equivalent) (3-0-3)
		Free Elective	(100 or 200 level or equivalent) (3-0-3)

THIRD YEAR:

1st Semester: (15 credits)

		STS 304	Writing about Science, Technology and Society (3-0-3)
		Specialization	(300 Level STS Specialization) (3-0-3)
		Elective	(300 level Lit/Hist/Phil) (3-0-3)
		Free Elective	(300 or 400 level or equivalent) (3-0-3)
		Free Elective	(300 or 400 level or equivalent) (3-0-3)

2nd Semester: (16 credits)

		STS 307	Fundamentals of Research in STS (3-0-3)
		Specialization	(300 Level STS Specialization Course) (3-0-3)
		Elective	(STS Independent Study) (0-1-1)
		Elective	(300 Level Lit/Hist/Phil/Thtr GUR) (3-0-3)
		Free Elective	(300 or 400 level or equivalent) (3-0-3)
		Free Elective	(300 or 400 level or equivalent) (3-0-3)

FOURTH YEAR:

1st Semester: (15 credits)

		STS 490	Project and Seminar I (3 credits)
		Elective	(300 level STS elective) (3-0-3)
		Mgmt 390	Principles of Management (3-0-3) ***or***
		Entr 410	New Venture Management (3-0-3) ***or***
		HRM 301	Organizational Behavior (3-0-3) ***or***
		IE 492	Engineering Management (3-0-3)
		Free Elective	(300 or 400 Level (or equivalent) Free Elective) (3-0-3)
		Free Elective	(300 or 400 Level (or equivalent) Free Elective) (3-0-3)

2nd Semester: (15 credits)

		STS 491	Project and Seminar II (3 credits)
		Elective	(300 Level STS elective) (3-0-3)
		Seminar	(400 Level Senior Seminar) (3-0-3)
		Free Elective	(300 or 400 Level (or equivalent) Free Elective) (3-0-3)
		Free Elective	(300 or 400 Level (or equivalent) Free Elective) (3-0-3)

B. S. in Science, Technology, and Society/Business and Information Systems (129 Credits)

FIRST YEAR:

1st Semester: (18 credits)

		CS 100	Roadmap to Computing (3-0-3)
		Math 138	General Calculus I (3-0-3)
		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Science	(Science with Lab) (3-2-4)
		STS 201	Understanding Technological Society (3-0-3)
		PE	(Physical Education GUR) (0-1-1)
		CS 107	Computing as a Career (1-0-1)

2nd Semester: (16 credits)

		CS 113	Introduction to Computer Science (3-0-3)
		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Math 105	Elementary Probability and Statistics (3-0-3)
		Science	(Science with Lab) (3-0-3)
		Econ 201	Economics (3-0-3)
		PE	(Physical Education GUR) (0-1-1)

SECOND YEAR:

1st Semester: (16 credits)

		Mgmt 216	Business Statistics (3-0-3)
		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		IS 245	Information Technology Systems: Hardware/Software (3-0-3)
		Acct 117	Survey of Accounting (3-0-3)
		STS 308	Technology and Global Development: Introduction to STS (3-0-3)
		CS 207	Computing and Effective Communication (1-0-1)

2nd Semester: (18 credits)

		IS 265	Introduction to Information Systems (3-0-3)
		IS334	
		IS 350	Computers, Society and Ethics (3-0-3)
		STS 310	Technology and Human Values (3-0-3)
		EPS 202	Society, Technology, and the Environment (3-0-3) ***or***
		STS 210	General Psychology (3-0-3) ***or***
		STS 221	Sociology (3-0-3)
		Specialization	(300 Level STS) (3-0-3)

THIRD YEAR:

1st Semester: (15 credits)

		STS 304	Writing about Science, Technology and Society (3-0-3)
		Specialization	(300 level STS specialization) (3-0-3)
		Elective	(300 level STS elective) (3-0-3)
		IS 344	Computing Applications in Business (3-0-3)
		Fin 315	Fundamentals of Corporate Finance (3-0-3)

2nd Semester: (15 credits)

		IS 390	Requirements Analysis and Systems Design (3-0-3)
		STS 307	Fundamentals of Research in STS (3-0-3)
		Specialization	(300 level STS specialization) (3-0-3)
		HRM 301	Organizational Behavior (3-0-3)
		OM 375	Management Science (3-0-3)

FOURTH YEAR:

1st Semester: (16 credits)

		STS 490	Project and Seminar I (3 credits)
		IS 331	Database Design Management and Applications (3-0-3)
		IS 455	Information Systems Management (3-0-3)

		Mgmt 491	International Business (3-0-3)
		Elective	(300 level STS Elective) (3-0-3)
		CS 407	Professional Development in Computing (1-0-1)

2nd Semester: (15 credits)

		HSS	(HSS Capstone Seminar) (3-0-3)
		IS 491	Senior Project (3-0-3)
		Mgmt 492	Business Policy (3-0-3)
		Mrkt 330	Principles of Marketing (3-0-3)
		STS 491	Project and Seminar II (3 credits)

Electives and GUR Requirements

Major Option: 18 credits. Students choose appropriate electives in consultation with an advisor (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.

Basic Social Sciences GUR: Three credits of the basic social sciences requirement must be taken in economics; acceptable courses are Econ 201, Econ 265, or Econ 266 . The remaining 3 credits may be satisfied by HSS 202, STS 257, or STS 258. Students also may take approved introductory courses in basic social sciences at Rutgers-Newark to fulfill this requirement.

Lit/Hist/Phil/STS GUR: Students must take one 300-level course from any of the following fields: literature; history; philosophy; or science, technology, and society (STS); or an approved 300-level course at Rutgers-Newark.

Open Elective in Humanities and Social Science GUR: Students must take one 300-level course from any of the following fields: English (Eng); history (Hist); literature (Lit); philosophy (Phil); science, technology, and society (STS); social science (SS); or theater (Thtr). Students also may satisfy this requirement with Architectural History IV (Arch 382) or by taking an approved 300-level course at Rutgers-Newark.

Cultural History GUR: Take HUM 102, HUM 211 or HUM 212 or HIST 213, or an approved 200-level history course at Rutgers-Newark.

Capstone Seminar in Humanities and Social Science GUR: All students, except those enrolled in the honors college, take one of the following: HSS 403, HSS 404, HSS 405, HSS 406, HSS 407, HSS 408, HSS 409. Students enrolled in the honors college take one either HSS 408H or HSS 491H-499H.

Physical Education GUR: Students who register as full-time undergraduates for two or more consecutive semesters must take two PE courses, one of which must be a 100-level fitness core course. Students are urged to complete the requirement as soon as possible.

Free Electives: Students select appropriate electives in consultation with an advisor.*Refer to the General University Requirement section of this catalog for further information on electives.*

Co-op Co-op courses replace electives with the approval of an advisor. In science, technology and society, STS 311 and STS 411 are taken for degree credit.

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* The combination of these courses must equal at least 6 credits.

** In place of this course, students may also take an approved course at Rutgers-Newark; an approved list of courses is published each semester in the course registration bulletin.

B. S. in STS/MD-Three Year Undergraduate Component of Seven Year Medical/Dental/Optomety Program (117 credits)

FIRST YEAR:

1st Semester: (17 credits)

HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
Math 111	Calculus I (4-1-4) ***or***
Math 138	General Calculus I (3-0-3)
CS 113	Introduction to Computer Science (3-0-3) ***or***
CS 104	Computer Programming and Graphics Problems (3-0-3) ***or***
CS 103	Computer Science with Business Problems (3-0-3)
R120:101	General Biology I (3-3-4)
STS 201	Understanding Technological Society (3-0-3)
PE	(Physical Education:GUR) (0-1-1)
Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (17 credits)

HUM 211	The Pre-Modern World (3-0-3) ***or***
HUM 212	The Modern World (3-0-3) ***or***
Hist 213	The Twentieth-Century World (3-0-3)
Econ 201	Economics (3-0-3)
Math 105	Elementary Probability and Statistics (3-0-3)
Biol Lab	(Lab Science-Biology)
PE	(Physical Education)

Summer I: (10 credits)

EPS 202	Society, Technology, and the Environment (3-0-3) ***or***
STS 210	General Psychology (3-0-3) ***or***
STS 221	Sociology (3-0-3)
STS 308	Technology and Global Development: Introduction to STS (3-0-3)
Phys 111	Physics I (3-0-3)
Phys 111A	Physics I Laboratory (0-2-1)

SECOND YEAR:

1st Semester: (15 credits)

Specialization	(300 level STS specialization) (3-0-3)
STS 304	Writing about Science, Technology and Society (3-0-3)
Phil 351	Biomedical Ethics (3-0-3)
Chem 125H	General Chemistry I Honors (3-0-3)
Specialization	(300 level STS specialization) (3-0-3)

2nd Semester: (16 credits)

Mgmt 390H	Honors Principles of Management (3-0-3)
STS 310	Technology and Human Values (3-0-3)
STS310H	
STS 307	Fundamentals of Research in STS (3-0-3)
Chem 126H	General Chemistry II Honors (3-0-3)
Chem 124H	General Chemistry II Honors Laboratory (0-2-1)

Summer II: (10 credits)

Specialization	(300 level STS specialization) (3-0-3)
Elective	(300 level STS elective) (3-0-3)
Phys 121	Physics II (3-0-3)
Phys 121A	Physics II Laboratory (0-2-1)

THIRD YEAR:

1st Semester: (15 credits)

		Elective	(Free Elective)
		STS 490	Project and Seminar I (3 credits)
		Hon. Cap.	(HSS Honors Capstone)
		Chem 243	Organic Chemistry I (3-0-3)

2nd Semester: (17 credits)

		STS 491	Project and Seminar II (3 credits)
		Chem 244	Organic Chemistry II (3-0-3)
		Chem 244A	Organic Chemistry II Laboratory (0-4-2)
	******	Elective	(Concentration Elective-Medical Sci./Policy)
	******	Elective	(Concentration Elective-Medical Sci./Policy)
	******	Elective	(Concentration Elective-Medical Sci./Policy)

Summer III:

No required courses.

The three year undergraduate component contains only 109 credits but assumes acceptance into a medical school program-the first year of medical school replaces the credits of the fourth year of the undergraduate major.

B. S. in STS/JD Curriculum (Seton Hall Law School) (124 credits)

FIRST YEAR:

1st Semester: (16-18 credits)

		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 111	Calculus I (4-1-4) ***or***
		Math 138	General Calculus I (3-0-3)
		CS 113	Introduction to Computer Science (3-0-3) ***or***
		CS 104	Computer Programming and Graphics Problems (3-0-3)
		STS 201	Understanding Technological Society (3-0-3)
		Lab Sci.	(Lab Science)
		PE.	(Physical Education:GUR) (0-1-1)
		Frsh Sem	Freshman Seminar (1-0-0)

2nd Semester: (17 credits)

		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		Econ 201	Economics (3-0-3)
		Math 105	Elementary Probability and Statistics (3-0-3)
		Lab Sci.	(Lab Science)
		EPS 202	Society, Technology, and the Environment (3-0-3) ***or***
		STS 210	General Psychology (3-0-3) ***or***
		STS 221	Sociology (3-0-3)

	PE	(Physical Education:GUR) (0-1-1)

Summer I: (6 credits)

	HUM 211	The Pre-Modern World (3-0-3) ***or***
	HUM 212	The Modern World (3-0-3) ***or***
	Hist 213	The Twentieth-Century World (3-0-3)
	STS 308	Technology and Global Development: Introduction to STS (3-0-3)

SECOND YEAR:

1st Semester: (15 credits)

	Specialization	(300 level STS specialization) (3-0-3)
	STS 304	Writing about Science, Technology and Society (3-0-3)
	STS 310	Technology and Human Values (3-0-3)
	Elective	(300 level STS elective)
	Elective	(Free Elective) (3-0-3)

2nd Semester: (15 credits)

	Specialization	(300 level STS specialization) (3-0-3)
	STS 307	Fundamentals of Research in STS (3-0-3)
	Elective	(300 level STS elective) (3-0-3)
	Elective	(Free Elective) (3-0-3)
	Elective	(Free Elective) (3-0-3)

Summer II: (6 credits)

	Mgmt 390	Principles of Management (3-0-3)
	Elective	(Free Elective) (3-0-3)

THIRD YEAR:

1st Semester: (15 credits)

	Specialization	(300 level STS specialization) (3-0-3)
	Elective	(Free Eective) (3-0-3)
	STS 490	Project and Seminar I (3 credits)
	HSS Cap.	(HSS Honors Capstone)
	ENG300	

2nd Semester: (15 credits)

	STS 491	Project and Seminar II (3 credits)
	Elective	(Concentration Elective-Law/Policy)
	Elective	(Concentration Elective-Law/Policy)
	Elective	(Concentration Elective-Law/Policy)
	Elective	(Concentration Elective-Law/Policy)

Total credits at NJIT	105-107
SHLS credits counted towards degree	19-17
Total credits	124

Courses listed above that satisfy Legal Studies minor:

		ENG300	
		Elective	(Concentration Elective-Law/Policy)
		Elective	(Concentration Elective-Law/Policy)
		Elective	(Concentration Elective-Law/Policy)
		Elective	(Concentration Elective-Law/Policy)

*** Students take six credits of Social Science courses in a standard discipline (Political Science, Sociology, etc).

**** Students take six credits in the History of Science or Technology from the following list of courses: STS 320, STS 321, Hist 379, Hist 385, and Hist 386 are preferred but these other courses are also acceptable: Hist 334, Hist 345, Hist 377, Hist 382, Hist 383, Hist 390, and/or History senior capstones where approbriate (with approval of the STS Program Director).

***** Students take six credits from the following list of courses in STS and the Humanities: Lit 378, Lit 386, Phil 351, STS 342, STS 347, STS 348. (Pre-medical students are urged to take Phil 351 as one of the two courses).

****** Concentration Elective-Medical Science/Policy. Students should select from the following courses and other electives, in consultation with their advisor: 62:R120:104, 21 & 22: R120:205, Hist 379, Hist 380, Hist 381.

******* Students take 6 credits of Social Science courses in a standard discipline (Political Science, Sociology, etc.) and 6 credits of Science or Technology electives (Computing, Information Technology, Engineering, Physical Sciences, etc.)

Catalog and curricula information approved by the relevant academic department.

Theatre Arts and Technology

Administered By: Humanities Department Division of Theatre Arts and Technology

An undergraduate Bachelor of Arts (B.A.) degree in Theatre Arts and Technology is designed as a stand-alone major or as a double major with any other field of study offered at NJIT. The degree offers Core Courses that provide a foundational theatre introduction to acting, directing, writing for stage and media, light, set, and sound design, theatre history and literature. Our five areas of specialization are Performance, Theatre Technology, Stage and Media Writing, Communication and Media, Music and Technology.

Double Majors

A double major at NJIT in conjunction with another NJIT major expands on the growing demand for multiple skills in theatre and other technology outside of the performing arts. Subsequently, students in other NJIT disciplines are able to create unique career opportunities.By using the combined degrees, some career possibilities are Software Engineer, Story Artist, Theme Park Animator, Technical Director, Producer, Entertainment Technician, Graphic Artist, Designer, traditional theatre areas of work, just to name a few. Course offerings in theatre will be on both the NJIT and Rutgers-Newark campuses through the Joint Theatre Program.For general rules about double majors, see Degree Options in the Academic Policies and Procedures section of the undergraduate catalog. For further information about appropriate double majors with the Theatre Arts and Technology Division, contact the Humanities department.

Theatre Arts and Technology (126 credits)

FIRST YEAR:
1st Semester (14 credits)

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.

		HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
		Math 101	Foundations of Mathematics for the Liberal Arts (3-0-3)
		Elective	(Science GUR) (3-0-3)
		Elective	(Science GUR Lab)
		Frsh Sem	Freshman Seminar (1-0-0)
		PE	(Physical Education) (0-1-1)
		CS 100	Roadmap to Computing (3-0-3) ***or***
		CS 101	Computer Programming and Problem Solving (3-0-3) ***or***
		CS 103	Computer Science with Business Problems (3-0-3) ***or***
		CS 104	Computer Programming and Graphics Problems (3-0-3) ***or***
		CS 111	Introduction to Computer Science IB (3-0-3) ***or***
		CS 113	Introduction to Computer Science (3-0-3) ***or***
		CS 115	Intro. to CS I in C++ (3-0-3) ***or***
		IS 118	Introduction to Software Application Tools (3-0-3)

2nd Semester (15 credits)

		HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
		Elective	(Social Science) (3-0-3)
{		Phys 202	Introductory Astronomy and Cosmology (3-0-3) ***or***
		Phys 203	The Earth in Space (3-0-3)
		Math 105	Elementary Probability and Statistics (3-0-3)
{		Thtr 101	Living Theatre (3-0-3) ***or***
		Thtr 212	From Page to Stage (3-0-3)

SECOND YEAR:
1st Semester (16 credits)

		PE	(Physical Education) (0-1-1)
		Elective	(Social Science) (3-0-3)
{		HUM 211	The Pre-Modern World (3-0-3) ***or***
		HUM 212	The Modern World (3-0-3) ***or***
		Hist 213	The Twentieth-Century World (3-0-3)
		Thtr 102	Acting Fundamentals (3-0-3)
		Elective	(Free Elective) (3-0-3)
		Elective	(Free Elective) (3-0-3)

2nd Semester (15 credits)

		Mgmt 390	Principles of Management (3-0-3)
		Elective	(300 level Lit/Hist/Phil/STS GUR) (3-0-3)
		R21:088:313	(Theater Technology) (3-0-3)
		Elective	(Free Elective) (3-0-3)
		Elective	(Free Elective) (3-0-3)

THIRD YEAR:
1st Semester (15 credits)

{		R21:088:259	***or***
		R21:088:260	***or***
		R21:088:467	
		Thtr 310	Theatre History I (3-0-3)
		Elective	(Theatre Specialization) (3-0-3)
		Elective	(Theatre Elective) (3-0-3)
		Elective	(Free Elective) (3-0-3)

2nd Semester (18 credits)

		Thtr 315	Theatre History II (3-0-3)
		Elective	(Theatre Specialization) (3-0-3)
		Elective	(Theatre Specialization) (3-0-3)
		Elective	(Theatre Elective) (3-0-3)
		Elective	(Open GUR) (3-0-3)
		Elective	(Free Elective) (3-0-3)

FOURTH YEAR:
1st Semester: (18 credits)

		HSS 407	Humanities Senior Seminar - Theater (3-0-3)
		Thtr 365	Principles of Playwriting (3-0-3)

		Elective	(Specialization Option) (3-0-3)
		Lecture	(Specialization Option) (3-0-3)
		Elective	(Theatre elective) (3-0-3)
		Elective	(Free Elective) (3-3-3)

2nd semester (15 credits)

		Thtr 411	Special Topics in Theatre (3-0-3)
		Elective	(Specialization Option) (3-0-3)
		Elective	(Specialization Option) (3-0-3)
		Elective	(Theatre elective) (3-0-3)
		Elective	(Free Elective) (3-3-3)

{		Thtr 101	Living Theatre (3-0-3) ***or***
		Thtr 212	From Page to Stage (3-0-3)
		Thtr 310	Theatre History I (3-0-3)
		Thtr 315	Theatre History II (3-0-3)
		Thtr 102	Acting Fundamentals (3-0-3)
		Thtr 411	Special Topics in Theatre (3-0-3)
		Thtr 365	Principles of Playwriting (3-0-3)
		R21:088:313	(Theater Technology) (3-0-3)
{		R21:088:269	***or***
		R21:088:270	***or***
		R21:088:467	

Theatre Electives (12 credits)

Courses from additional major that apply directly to technology or additional theatre courses can count toward these electives.

Free Electives (24 credits)

Courses from additional major can count toward these electives.

Specialization Options (21 credits)

Technical Theatre

{		Thtr 209	Voice and Speech for Theatre I (3-0-3) ***or***
		Thtr 210	Voice and Speech for Theatre II (3-0-3)
		R21:088:250	(Intro to Scenic Art and Light Design) (3-0-3)
		R21:088:409	(Stage Management) (3-0-3)
		Thtr 483	Independent Study in Theater I (3-0-3)
{		R21:088:269	***or***
		R21:088:270	***or***
		R21:088:467	

Performance

		Thtr 208	Movement for Theatre (3-0-3)
{		Thtr 209	Voice and Speech for Theatre I (3-0-3) ***or***
		Thtr 210	Voice and Speech for Theatre II (3-0-3)

		Thtr 261	Performance I (3-0-3) ***or***
		Thtr 262	Performance II (3-0-3) ***or***
		Thtr 465	Performance II (3-0-3)
		Thtr 213	Directing I (3-0-3)

Writing for Stage and Media

		R21:089:445	(Drama Writing for TV) (3-0-3)
		LIT 360	Drama (3-0-3) ***or***
		LIT 361	20th Century American Drama (3-0-3) ***or***
		LIT 362	Non-Western Drama (3-0-3) ***or***
		LIT 364	Modern Continental and British Drama (3-0-3) ***or***
		LIT 384	Musical Theater Adaptations (3-0-3)
		Thtr 483	Independent Study in Theater I (3-0-3)

Take Two from the following courses

		Thtr 261	Performance I (3-0-3) ***or***
		Thtr 262	Performance II (3-0-3) ***or***
		Thtr 465	Performance II (3-0-3)

Communication and Media

		COM 350	Digital Video Production (2-2-3)
		COM 303	Video Narrative (3-0-3)
		Eng 339	Practical Journalism (3-0-3)
		Eng 340	Oral Presentations (3-0-3)
		COM 351	Documentary Studies (3-0-3)
		Elective	(by Advisement) (6 credit)

Music and Technology

		Thtr 344	American Musical Theater (3-0-3)
		LIT 384	Musical Theater Adaptations (3-0-3)
		Thtr 261	Performance I (3-0-3) ***or***
		Thtr 262	Performance II (3-0-3) ***or***
		Thtr 465	Performance II (3-0-3)

Catalog and curricula information approved by the relevant academic department.

Web and Information Systems

Administered By: Department of Information Systems, College of Computing Sciences, Guttenberg InformationTechnologies Center, Room 5500. For more details, please visit the IS web page at http://is.njit.edu

Administration

Interim Dean, College of Computing Sciences	James Geller
Associate Dean, College of Computing Sciences	Barry Cohen
Assistant to the Dean, College of Computing Sciences	Serena Branson
Chair, Information Systems Department	Yi-fang Wu
Assistant to the Chair, Information Systems	Michelle D. Craddock-Bouler
Director of Undergraduate HCI Program	Quentin Jones
Director of Undergraduate IS Programs	Lin Lin
Director of Master's Programs	Michael P. Bieber
Director of Emergency Management & Business Continuity	Michael J. Chumer
Director of PhD Program	Michael P. Bieber
Secretary	Patricia B. Lundberg

Faculty

Professors Emeriti	S R. Hiltz, Marilyn Tremaine, Murray Turoff
Professors	Michael P. Bieber, Fadi Deek
Associate Professors	Quentin Jones, Michael L. Recce, Julian M. Scher, Yi-fang Wu
Assistant Professors	Lian Duan, Songhua Xu
Senior University Lecturers	Richard W. Egan, Lin Lin, Keith A. Williams

Advisors

Advisor B.A./ B.S.	Amanda D. Ackerman, George W. Olsen, Casey L. Hennessey
Advisor M.S.	George W. Olsen
Advisor Ph.D.	Michael P. Bieber

Accredited by the Computing Accreditation Commission of ABET, http://abet.org

Information systems (IS) are computer systems that support business operations, management, and decision making in organizations. IS are an integral part of virtually every work environment and play a critical role in running organizations. They are the heart of the internet-based economy. IS and the Web are deeply intertwined. Most IS are now Web systems, and Web applications must interact with a company's IS, such as its database, analysis and customer systems. Web and IS enable people to access the information they need, to collaborate, make informed decisions, and perform their jobs and personal activities effectively.

The field of Information Systems bridges computing and business. Web and IS professionals serve as the critical link between the technical and business areas of an organization. They collaborate to solve problems, and then design, analyze, implement, deploy and evaluate the computing systems that drive the modern enterprise. Web and IS professionals are thus among the most essential individuals in an organization, building and managing the systems upon which the enterprise survives and thrives.

BS in Web & Information Systems
Students will gain a strong practical focus in designing, developing and evaluating web and mobile systems, in addition to learning about databases, application development tools, software use and evaluation, management information and decision support systems. The program concludes with a capstone project with a major local company. The U.S. Bureau of Labor Statistics notes that IS jobs are among the highest paying and fastest growing in the nation. Jobs in this field include web analyst, web developer, interactive media designer and application systems analyst.

B.S. in Web and Information Systems (129 credit minimum)

FIRST YEAR:
1st Semester: (17 credits)

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.

	CS 100	Roadmap to Computing (3-0-3)
	IS 117	Introduction to Website Development (3-0-3)
	HUM 101	English Composition: Writing, Speaking, Thinking I (3-0-3)
	Elective	(Science) (3-0-3)
*	Math 138	General Calculus I (3-0-3)
	CS 107	Computing as a Career (1-0-1)

2nd Semester: (16 credits)

	CS 113	Introduction to Computer Science (3-0-3)
	IS 217	Advanced Website Development (3-0-3)
	IS 265	Introduction to Information Systems (3-0-3)
	HUM 102	English Composition: Writing, Speaking, Thinking II (3-0-3)
	Elective	(Science with Lab) (3-1-4)
	PE	(Physical Education) (0-1-1)

SECOND YEAR:
1st Semester: (16 credits)

	IS 218	Building Web Applications (3-0-3)
	IS 247	Designing the User Experience (3-0-3)
	IT 310	E-commerce Technology (3-0-3)
*	Math 105	Elementary Probability and Statistics (3-0-3)
	PE	(Physical Education) (0-1-1)

2nd Semester: (16 credits)

	IS 344	Computing Applications in Business (3-0-3)
	IS 373	Web Standards (3-0-3)
{	HUM 211	The Pre-Modern World (3-0-3) ***or***
	HUM 212	The Modern World (3-0-3) ***or***
	Hist 213	The Twentieth-Century World (3-0-3)
{	EPS 202	Society, Technology, and the Environment (3-0-3) ***or***
	Econ 201	Economics (3-0-3)

		Elective	(General Elective) (3-0-3)
		CS 207	Computing and Effective Communication (1-0-1)

THIRD YEAR:
1st Semester: (18 credits)

		IS 322	Mobile Applications: Design, Interface, Implementation (3-0-3)
		IS 331	Database Design Management and Applications (3-0-3)
		IS 350	Computers, Society and Ethics (3-0-3)
{		Eng 352	Technical Writing (3-0-3) ***or***
		Eng 340	Oral Presentations (3-0-3)
		IS 390	Requirements Analysis and Systems Design (3-0-3)
		Elective	(General Elective) (3-0-3)

2nd Semester: (15 credits)

		IS 392	Web Mining and Information Retrieval (3-0-3)
		IS 375	Evaluating the User Experience (3-0-3)
		CS 356	Introduction to Computer Networks (3-0-3)
		Elective	(Social Science GUR) (3-1-4)
		Elective	(General Elective) (3-0-3)

FOURTH YEAR:
1st Semester: (16 credits)

		IS 421	Advanced Web Applications (3-0-3)
		IS 465	Advanced Information Systems (3-0-3)
{		IE 492	Engineering Management (3-0-3) ***or***
		Mgmt 390	Principles of Management (3-0-3)
		Elective	(HSS Capstone Seminar) (3-0-3)
		Elective	(General Elective) (3-0-3)
		CS 407	Professional Development in Computing (1-0-1)

2nd Semester: (15 credits)

{		CS 491	Senior Project (3-0-3) ***or***
		IS 491	Senior Project (3-0-3) ***or***
		IT 491	IT Capstone Project (3-0-3)
		IS 333	Social Networking: Application and Interface Design (3-0-3)
		IS 455	Information Systems Management (3-0-3)
		Elective	(Upper Lit/Phil/Hist/STS elective) (3-0-3)
		Elective	(General Elective) (3-0-3)

Electives

BS WIS majors are encouraged to take technical electives within the College of Computing Sciences, 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 College of Computing Sciences.

Note

*** Math:** Math 111 and Math 333 are highly recommended to replace Math 138 and Math 105, 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 (Statistics), Math 344 (Regression Analysis), Math 334 (Operations Research) and Math 443 (Statistical Methods), all of which require Math 333 as a prerequisite.

Curriculum Overview

Following is an overview of the curriculum.The full curriculum is in the next section.

Core Web Courses

Semester	Course #	Title
1	IS 117	Introduction to Website Development
2	IS 217	Advanced Website Development
3	IS 218	Building Web Applications
4	IS 373	Web Standards
5	IS 322	Mobile Applications: Design, Interface, Implementation
6	IS 392	Web Mining and Information Retrieval
7	IS 421	Advanced Web Applications
8	IS 333	Social Networking: Apps and Interface Design

Core Information Systems Courses

Semester	Course #	Title
2	IS 265	Introduction to Information Systems
3	IT 310	E-Commerce Technology
3	IS 247	Designing the User Experience
4	IS 344	Computing Applications in Business
5	IS 390	Requirements Analysis and Systems Design
6	IS 375	Evaluating the User Experience
7	IS 465	Advanced Information Systems
7	IE 492	Engineering Management (Project Management)
8	IS 455	Information Systems Management
8	IS 491	Senior Capstone Project

Technical Foundation Courses

Semester	Course #	Title
1	CS 100	Roadmap to Computing
2	CS 113	Introduction to Computer Science
5	IS 331	Database Design, Management and Applications
6	CS 356	Introduction to Computer Networks

Career Building Courses

Semester	Course #	Title
1	CS 107	Computing as a Career
4	CS 207	Computing and Effective Communication
7	CS 407	Professional Development in Computing

Catalog and curricula information approved by the relevant academic department.

Telecommunications Management Technology: Offered by the Department of Engineering Technology

UNDERGRADUATE COURSES:

TMT 301 - Digital Electronics for Telecommunications (2-2-3)
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.

English: Offered by the Department of Humanities. See Humanities course list for faculty.

UNDERGRADUATE COURSES:

Eng 095 - General Skills in English as a Second Language (4.5-1-5)
Pre-requisite: None. Intended for students in need of extensive practice in speaking, listening, reading, and writing in English prior to enrolling in HSS 099S. **Effective From: Spring 2009**

Eng 200 - Communicating in Organizations (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Eng 301 - Advocacy and the Law (3-0-3)
Prerequisite: Eng 300, SS 300, HUM 101 and two from among HUM 102, HUM 211, HUM 212 and Hist 213 or their equivalents. 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. **Effective Until: Fall 2004**

Eng 302 - Communication Theory (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Eng 333 - Cybertext (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Eng 336 - Advanced Composition (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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, animaation and video) and venues (print and electronic), in several iterations. **Effective From: Spring 2009**

Eng 339 - Practical Journalism (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Eng 340 - Oral Presentations (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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

mate-rial and audience analysis. **Effective From: Spring 2009**

Eng 346 - Journalism in American History (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Explores how the media - defined as print as well as electronic media (television, radio and online modes of communication)have influenced different events and social movements at various points in time. Topics will include the role of William Randolph Hearst's newspapers in creating support for the Spanish-American War; press coverage of the women's suffrage movement; the role of television in ending the Vietnam war. **Effective From: Spring 2011**

Eng 347 - Technical, Professional and Scientific Writing for Publication (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Fall 2010**

Eng 348 - Literary Journalism (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Students will read and analyze the works of literary journalists from the 18th century to the present day. Close reading and analytical writing as well as some journalistic writing. **Effective From: Fall 2009**

Eng 349 - Advanced Journalism Skills (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Through hands-on writing and reporting supervised by the instructor, students learn competencies needed in various journalistic specialties. Special focus on how to cover science and technology, social issues, culture and the arts, sports, business and consumer news. Particular emphasis on copy-editing. **Effective From: Spring 2009**

Eng 350 - The Newsroom (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Students will work closely with the university's newspaper advisor in order to write news and feature stories, commentaries and critiques for publication in the university newspaper, The Vector. Students will finish the course with a portfolio of work that they can present to prospective employers or graduate schools. This is an advanced journalism course. **Effective From: Fall 2009**

Eng 351 - Online Journalism (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. A study of how news is covered on the World Wide Web, and the impact of online news on society and politics. History of news online. Differences between print, broadcast and online-what are the strengths and weaknesses inherent to each medium? Analysis of the websites of different news organizations-from the New York Times to CNN to special interest e-zines to blogs. **Effective From: Spring 2009**

Eng 352 - Technical Writing (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Eng 353 - Composing Documents for Print (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Eng 353A - Electronic Publishing Lab (0-3-2)
Prerequisites: HUM 101, and two from among HUM 102, HUM 211, HUM 212 and Hist 213 or their equivalents; Eng 352 and Eng 353. Seminar and laboratory-based course designed for PTC majors; open to others with appropriate backgrounds and interests and permission of instructor. Follow up of Eng 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, present information for technical and commercial use. Projects involve use of html editors, graphical software, and NJIT networks. **Effective Until: Fall 2005**

Eng 354 - Composing Documents for the Web (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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 Eng 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. **Effective From: Spring 2009**

Eng 355 - Television News Writing and Production (3-1-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. This course consists of lectures and hands-on practice with the basics of television news writing and production and a field trip to a television station. After learning the fundamentals, the class will then begin its own news production by refining the video taped "packages" and integrating them into a studio newscast they will write and produce while guided by the instructor and with technical support from the staff of Instructional Technology and Media Services. The semester culminates in a final program that can be delivered to the campus community through ITMS's cable network. **Effective From: Spring 2009**

Eng 356 - Technical Writing in Distributed Environments (3-0-3)
Prerequisites: HUM 101 and two from among HUM 102, HUM 211, HUM 212 and Hist 213 or their equivalents. Prepare distance-learning students to communicate technical information in collaborative computer systems. Uses both real-time and asynchronous communication tools in tasks that involve problem solving, rhetoric, information design, writing teams, audience awareness, and ethical considerations. ENG 356 will satisfy the ENG 352 Technical Writing requirement for distance learning students whose academic majors require ENG 352. **Effective From: Fall 2003 Until: Summer1 2004**

Eng 360 - Collaborative Communication: Community and Global Perspectives (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. The central focus is on the challenge for cooperative communication to solve local and global problems. Examines how technological advances have altered the way we gather resources to solve problems. Today's information is too vast, too diverse, and changes too rapidly to be used to solve social dynamics problems in traditional ways. Using the resources of all available technology--e-mail, video conferencing, satellite communications, etc.--the goal is to bring all stakeholders together in order to build consensus and/or solve problems. **Effective From: Spring 2009**

Eng 364 - Theory of Rhetoric (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Eng 369 - Creative Writing (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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, dia-logue; meter, rhyme, figurative language; audience analysis, ethos, and narrative theory. Students write, edit and critique their own work with the aim of publication. **Effective From: Spring 2009**

Eng 490 - Co-op Work Experience I (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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 **Effective From: Spring 2013**

Eng 491 - Co-op Work Experience II (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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 **Effective From: Spring 2013**

Eng 496 - Senior Project-Communication and Media (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

R350:254 - Literature and Politics in the Third World (3)
For more details go to Rutgers Catalog.

GRADUATE COURSES:

Eng 500 - English for International Graduate Students I (3 credits)
Practice in listening and conversational English for students whose native language is not English. Level: Low Intermediate **Effective Until: Fall 2011**

Eng 502 - English for International Graduate Students (3 credits)
Practice in writing to improve sentence structure, grammar, vocabulary, and organization. For technical writing, see Eng 541. Level: High Intermediate.

Eng 503 - Advanced English for International Teaching Assistants (3 credits)
Practice in public speaking for international TAs and other international students who want to improve their oral presentation skills. Also covers teaching techniques and pronunciation. Level: Advanced.

Eng 505 - Advanced Spoken English for International Graduate Students (3 credits)
Designed to improve English pronunciation; accent reduction. Level: Advanced.

Eng 507 - Advanced Conversation and American Culture (3 credits)
Practice in conversation in English at an advanced level. The goal is to help students gain the cultural knowledge and speaking skills to increase participation in American life. Level: Advanced.

Eng 521 - Technical Written and Oral Communication (3 credits)
Develops skill in oral and written technical communication on a professional level. Three areas are emphasized: 1) analyzing professional and technical communication situations; 2) achieving clear, effective oral and written communication; and 3) developing awareness of variations in professional communication across cultures. For some assignments, students will work on projects from courses in their own fields. The approach is practical; course format is that of a workshop. Non-native speakers of English may take this course.

Eng 598 - Special Topics in ESL: Understanding Research Articles in Information Systems (3 credits)
Develops skills in reading journal articles in Information Systems efficiently and with understanding. Includes practice in writing about journal articles. Helpful for CIS 675 and CIS 677.

Eng 599 - University Teaching Methods/Communication Skills (3 credits)
Provides ideas, strategies, and techniques to help teaching assistants with their teaching assignments and to enhance their professional communication and interpersonal skills. Includes practical information on classroom management, the culture of the American classroom, diversity issues, and leadership skills. **Effective Until: Fall 2005**

Eng 601 - Advanced Professional and Technical Communication (3 credits)
Provides the foundation and direction for all Professional and Technical Communication coursework. This course introduces students to the profession and the academic discipline of technical/professional communication. Modules include bibliographic research; usability analysis; working in teams; report writing; visual thinking; communicating with new technologies; and technical writing style. **Effective Until: Fall 2005**

Eng 603 - Cultural and Technological Change (3 credits)
Prerequisite or corequisite: ENG 601. Examines the complex ways in which technology constructs and is constructed by society, with emphasis on interrelationships between technology and communication. Discussions focus on how technological change is expressed in social and political movements, literature, art, architecture, and philosophy and how they, in turn, influence the future direction of technology. **Effective Until: Fall 2005**

Eng 604 - Communication Theory and Research (3 credits)
Prerequisite or corequisite: ENG 601 . Reviews the major theories of communication and provides strategies for research in the field of Professional and Technical Communication. The course focuses on these research methods: problem statement and hypothesis formulation derived from theory; research design and data generation; existing information sources and their

acquisition; and analytic techniques. Students develop analytic methods necessary to create a well-considered thesis proposal. **Effective Until: Fall 2005**

Eng 605 - Elements of Visual Design (3 credits)
Prerequisite or corequisite: ENG 601 . Provides an understanding of and competency in the visual presentation of information. Course integrates theories of design, techniques of composition, and technologies of electronic and print publishing. Modules include both design principles and hands-on practice in visual literacy, layout and design, and graphic tools. **Effective Until: Fall 2005**

Eng 606 - Advanced Online Design (3 credits)
Prerequisites: Eng 605 Elements of Visual Design. This course will focus on online visual communication strategies and community building. The course will cover: multimedia, usability heuristics, navigation theory, contemporary design practices and online community building. Students will be required to create a multidimensional online community and to participate in team-building by collaborating on the MSPTC newsletter. **Effective Until: Summer 2005**

Eng 610 - Creating Hypertext: User and Task Analysis (3 credits)
Prerequisite: ENG 605 or equivalent . Covers the complex tasks needed to create nonlinear material: audience assessment, task analysis, scenario development, and evaluation. Students complete the life cycle of planning, implementing, testing and revising a nonlinear writing project. This is a writing intensive course that focuses on creating effective goal-oriented online products. **Effective Until: Fall 2005**

Eng 612 - Theory and Practice of Text Encoding (3 credits)
Prerequisite: ENG 605 or equivalent . In the beginning, IBM created "Script," a series of low-level commands that formatted text on a page. Then came Generalized Markup Language (GML) a series of macros for Script. Today we have Standard Generalized Markup Language (SGML) Hypertext Markup Language (HTML) and Extensible Markup Language (XML), all of which rely on the same basic concepts. Students will learn XHTML in order to gain a solid understanding of the theory of text encoding, while looking into the past (when technical writers wrote the code behind the text) and into the future (when VoiceXML enables unified messaging in a single interface). Each student will also create a website. **Effective Until: Fall 2005**

Eng 613 - Multimedia Presentations (3 credits)
Prerequisite: ENG 605 or equivalent . There are many ways to create presentations with short films, voice recordings, animations, photos, graphics, narrative, etc. The presentations can 'live' in a variety of ways - on the web, on CD, doing the email rounds, or appearing at a formal board meeting. We will experiment with as many multimedia programs as possible and during our experimentation we will uncover the bugs that go along with making multimedia presentations. We will also consider the balance between content and style - how much is TOO much? Each student will create several presentations. **Effective Until: Fall 2005**

Eng 620 - Proposal Writing (3 credits)
Prerequisite or corequisite: ENG 601 . Provides an understanding of and practice in proposal writing for corporations, foundations, and government agencies. Students build skills to create a range of persuasive documents including proposals for research grants, responses to requests for proposal, and government proposals. **Effective Until: Fall 2005**

Eng 622 - Working in Teams (3 credits)
Prerequisite or corequisite: ENG 601 . Uses case studies and simulations to provide both the theoretical foundations and the hands-on practice needed to work effectively in and among heterogeneous corporate groups. Includes collaborative writing, interviewing, and conflict resolution, and computer-mediated group work. **Effective Until: Fall 2005**

Eng 624 - Professional and Technical Editing (3 credits)
Prerequisite or corequisite: ENG 601 . Presents the theory and practice of editing professional and technical writing. Topics include correctness and conciseness, hard copy and on-line editing, editing graphics, document management, editor-author relationships, and ethical considerations in editing. Students edit writing samples from a variety of technical fields. **Effective Until: Fall 2005**

Eng 626 - Hypertext Design Studio (3 credits)
Prerequisite: ENG 605 or equivalent. Integrates language, image, linking and thinking in a studio approach to advanced HTML projects. Students work in computer laboratory with instructor on designing individual projects using current audio and video design applications. **Effective Until: Fall 2005**

Eng 631 - Communication and Environmental Problem Solving (3 credits)
Prerequisite or corequisite: ENG 601. Develops critical thinking on ecological issues for problem solving by integrating technical information, human values, and communication with environmental change. Students combine theory, research and models, case studies, visual thinking, and scientific inquiry for application in individual decision-making course project. **Effective Until: Fall 2005**

Eng 632 - Content Management, Manuals and On-Line Help (3 credits)
Prerequisite or Corequisite: ENG 601. The three skills that technical writers most often need are an ability to elicit information from recalcitrant SMEs (Subject Matter Experts), the ability to put this information on paper(user manuals) and the ability to put it online in a Help system. This class will focus on the development of skills and abilities that will enable Help system developers to gather, translate and manage information for end users. Students will use theory and practical applications such as RoboHelp and Forehelp to develop an on-line Help module in this course. **Effective Until: Fall 2005**

Eng 640 - Health Communication (3-0-3)
This course will focus on the use of communication strategies to inform and influence individual and community decisions regarding health. The course will cover: the multidimensional nature of health communication, research in health communication, behavioral theories in health communication, rhetorical theories in health communication, legal and ethical concerns in health communication, the communication of risk and uncertainty, and the design of health campaigns. Students will be required to (a) research and prepare a health communication strategy for use in a specific context and (b) to design an accompanying print or hypertext document to be used in that context. **Effective Until: Fall 2005**

Eng 642 - Corporate Communication (3 credits)
Prerequisite or corequisite: ENG 601 . Develops communication skills for modern global corporate and business markets. Business documents may include mission/vision statements, business plans, financial statements/plans, marketing plans, and corporate policies and procedures. **Effective Until: Fall 2005**

Eng 650 - Web Based Training Design (3 credits)
Prerequisite or corequisite: ENG 601 and ENG 605 . Web-based Training (WBT) is at the forefront of the recent 'e-learning' boom. However, while WBT use is on the rise, specific skills and tools are required to ensure a successful WBT implementation. Based on proven instructional design concepts, this course provides the student with the skills necessary to create effective web-based training programs. **Effective Until: Fall 2005**

Eng 698 - Selected Topics in Professional and Technical Communication (3 credits)
Prerequisite or corequisite: ENG 601 **Effective Until: Fall 2005**

Eng 700 - Project in Professional and Technical Communication (3 credits)
Prerequisites: approval of graduate advisor, and completion of core courses. Demonstrates ability to conceive and execute an extended writing project with professional graphics and to make an oral and visual presentation of the work. Based on experiential research (internship, co-op, work experience) student submits a proposal, develops a project (e.g., guidebook, manual, online documentation, website, video, CD-ROM) and completes a paper describing the theory and methodology supporting the project application. With graduate advisor, student selects a faculty advisor, faculty reviewer, and external reviewer. **Effective Until: Fall 2005**

Eng 701 - Thesis in Professional and Technical Communication (6 credits)
Prerequisites: approval of graduate advisor; completion of core courses. Demonstrates ability to conceive and execute an extended writing project with professional graphics and to make an oral and visual presentation of the work. The completed written thesis should warrant publication in a technical journal. Thesis Committee consists of program-approved faculty advisor, one other faculty member, and external reviewer. A student must register continuously for a minimum of 3 credits per semester until thesis in completed. Total will be limited to 6 credits. **Effective Until: Fall 2005**

Eng 725 - Independent Study in Professional and Technical Communication (3 credits)
Prerequisite: approval of graduate advisor and supervising faculty.Allows development of areas of specialization for Master's Project or for areas of study in communication in which one or more students may be interested but which are not of sufficiently broad interest to warrant a regular course offering. **Effective Until: Fall 2005**

Entrepreneurship: Entrepreneurship

UNDERGRADUATE COURSES:

Entr 410 - New Venture Management (3-0-3)
Prerequisites: Mgmt 390, Mrkt 330, Fin 315. Provides an understanding of the process of start up and early stage management of new, technology based, small firms. Emphasis is on recognizing, evaluating and deciding on a new business idea, as well as preparation for and management of the start up process. Preparation and execution of a new business plan.

Entr 420 - Financing New Venture (3-0-3)
The course is organized around three fundamental issues that entrepreneurs need to understand: 1) how innovations evolve over time, 2) how and whys some innovations are successful and some are not and 3) how one manages a new venture that was formed to develop new technologies. It is intended to help students understand the issues associated with a new venture and to develop a business plan to launch a technology based firm.

Entr 430 - Entrepreneurial Strategy (3-0-3)
Prerequisites: HRM 301, Mrkt 330, MIS 345, Fin 315, Acct 317, OM 375, Mgmt 491. 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 (3-0-3)
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. **Effective From: Summer 2014**

Enviromental Engineering: Offered by the Department of Civil and Environmental Engineering. See Civil Engineering course list for faculty.

UNDERGRADUATE COURSES:

EnE 262 - Introduction to Environmental Engineering (3-1-3)
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. **Effective From: Fall 2006**

EnE 360 - Water and Waste Water Engineering (3-0-3)
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 (3-0-3)
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 485 - Special Topics in Environmental Engineering (3-0-3)
The study of new and/or advanced topics in an area of environmental engineering not regularly covered in any other EnE 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. **Effective From: Spring 2010**

EnE 491H - Honors Research Experience in Environmental Engineering (3-0-3)
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.

GRADUATE COURSES:

EnE 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

EnE 610 - Hazardous Site Operations (3 credits)
Course consists of overview of OSHA regulations and NIOSH standards concerning toxicological hazards and medical surveillance requirements, and recognition and monitoring of site hazards. Site layout, design of engineering control to minimize exposure, risk assessment, and modeling will also be presented. Students will receive a certification for the 40-hour OSHA Hazardous Waste Operation training. **Effective Until: Fall 2011**

EnE 620 - Environmental Chemodynamics (3 credits)
The overall objective of this course is to introduce students to concepts, mechanisms, and models used to describe the transport of chemicals in the environment. Concepts and models presented in the first six weeks are applied to the air-water, sediment-

water, and soil-air interfaces during the rest of the term. **Effective Until: Fall 2004**

EnE 660 - Introduction to Solid and Hazardous Waste Problems (3 credits)
Prerequisite: EnE 663. (May be taken concurrently.) Introduction to solid waste disposal. Industrial and urban sources of solid waste and conventional methods of waste disposal. Application of engineering principles related to these topics.

EnE 661 - Microbiology for Environmental Engineers (3 credits)
Prerequisite: EnE 663. (May be taken concurrently.) Biological and microbiological principles applied to environmental and sanitary engineering. Bacteriological examinations in the laboratory of water and wastewater. **Effective Until: Fall 2011**

EnE 662 - Site Remediation (3 credits)
Prerequisite: EM 631. Can be taken concurrently with EM 631. Examines site remediation from start to finish. Includes regulations, cleanup standards, remedial investigations, feasibility studies, risk assessment, and safety. Examines established and innovative cleanup technologies such as incineration, containment, bioremediation, vapor extraction and ground water recovery.

EnE 663 - Water Chemistry (3 credits)
Prerequisite: undergraduate general chemistry. The ability to analyze and solve a wide range of chemical equilibrium problems in water chemistry is developed.

EnE 664 - Physical and Chemical Treatment (3 credits)
Prerequisite: EnE 663. Physical and chemical operations and processes employed in the treatment of water and wastewater. Topics include gas transfer, coagulation, flocculation, solid-liquid separation, filtration, and disinfection.

EnE 665 - Biological Treatment (3 credits)
Prerequisites: EnE 663, EnE 661. (May be taken concurrently.) Principles of evaluation and control of water pollution that describe aerobic treatment processes: oxidation ponds, trickling filters, and activated sludge. Anaerobic digestion and sludge handling and disposal as well as biodegradability study techniques for various wastes.

EnE 666 - Analysis of Receiving Waters (3 credits)
Prerequisites or corequisites: EnE 663 and EnE 661. Ecological responses of various types of receiving waters to municipal and industrial waste loadings. Mathematical models for water quality prediction and planning.

EnE 667 - Solid Waste Disposal Systems (3 credits)
Prerequisite: EnE 663. Review and evaluation of design criteria, methods, and equipment employed in handling and disposal of industrial and municipal solid wastes. Emphasis is on hazardous toxic waste, resource recovery, and regulatory constraints.

EnE 668 - Air Pollution Control (3 credits)
Prerequisite: EnE 663 or physical chemistry. The nature of air pollution, its effect on the public, and legal and engineering remedies. **Effective Until: Fall 2011**

EnE 669 - Water and Wastewater Analysis (3 credits)
Prerequisite: EnE 663. (May be taken concurrently.) Measurement of parameters of interest in water and wastewater quality studies is performed in the laboratory. Specific project requiring analysis, interpretation, and recommendations will be a major part of the work. **Effective Until: Fall 2011**

EnE 670 - Advanced Processes in Water Pollution Control (3 credits)
Prerequisite: EnE 669. Detailed laboratory experiments using unit operations of sedimentation, coagulation and flocculation; chlorination, filtration, aeration, sludge treatment and digestion. Aspects of pilot plant design and layout are considered. Design parameters discussed in prerequisite courses are developed by advanced bench-scale laboratory procedures. Advanced design and synthesis are considered. **Effective Until: Fall 2011**

EnE 671 - Environmental Impact Analysis (3 credits)
Prerequisite or corequisite: EnE 663. A graduate course dealing with physical aspects of the environment. Overview of environmental problems, federal and state standards, methodology for developing impact statements, case studies based on recent experience, basis for assessment and decision making.

EnE 672 - Stormwater Management (3 credits)
This course provides a comprehensive study of stormwater management with emphasis on design practices. Topics include regulatory framework, an overview of structural and non-structural BMPs, groundwater recharge analysis, estimate of runoff, and design of detention basin and drainage systems. **Effective From: Spring 2006**

EnE 673 - Sustainability and Life Cycle Analysis (3-0-3)
The course provides a systematic foundation for the connection between evolving technology and human activity impacts on

natural systems by emphasizing the sources of environmental degradation and energy use and strategies to reduce risk and promote sustainability. The course provides hands-on experience with life cycle assessment computer tools and approaches. The course emphasizes relationships between industrial activities and regional and global natural systems-physical, chemical and biological-focusing on the importance of sustainability goals and practices. **Effective From: Spring 2009**

EnE 700 - Environmental Engineering Project (3 credits)
Prerequisite: student must have sufficient experience and/or graduate courses in major field to work on the project. Subject matter to be approved by the department. Permission to register must be obtained from the project advisor. Extensive investigation, analysis, or design of environmental engineering problems not covered by regular graduate course work is required. A student with an exceptional project in EnE may, upon his/her own initiative and with the approval of his/her advisor, substitute the work of this course as the equivalent of the first 3 credits for EnE 701 Master's Thesis.

EnE 701 - Master's Thesis (6 credits)
The thesis is to be prepared on a subject in the student's major field approved by the department. Approval to register for thesis must be obtained from the thesis advisor. A student must register for a minimum of 3 credits per semester. Credit will be limited, however, to the 6 credits indicated for the thesis.

EnE 702 - Special Topics in Environmental Engineering (3 credits)
Prerequisite: advisor's approval. Topics of special current interest in environmental engineering.

EnE 720 - Environmental Chemodynamics (3)
Introduction to concepts, mechanisms and models used to describe the transport of chemicals in the environment. Concepts and models are applied to air-water, sediment-water and soil-air interfaces. **Effective From: Spring 2005**

EnE 725 - Independent Study I (3 credits)
Prerequisite: written permission from department chairperson plus courses to be prescribed by the supervising faculty member. Covers areas of study in which one or more students may be interested but which is not of sufficiently broad interest to warrant a regular course offering.

EnE 726 - Independent Study II (3 credits)
Prerequisite: written permission from department chairperson plus courses to be prescribed by the supervising faculty member. Covers areas of study in which one or more students may be interested but which is not of sufficiently broad interest to warrant a regular course offering.

EnE 727 - Independent Study III (3 credits)
Prerequisite: written permission from department chairperson plus courses to be prescribed by the supervising faculty member. Covers areas of study in which one or more students may be interested but which is not of sufficiently broad interest to warrant a regular course offering.

EnE 760 - Applied Environmental Soil Chemistry (3 credits)
Prerequisites: EnE 663, Math 651 or equivalent. Understanding of physical and chemical processes occurring in soils as well as the chemical and physical properties of subsurface soil environments. Emphasizes current research on the subsurface environment. **Effective Until: Fall 2011**

EnE 790 - Doctoral Dissertation (Credits as designated)
Required of all students working toward the doctoral degree. A minimum of 36 credits is required. The student must register for at least 6 credits of dissertation per semester until 36 credits are reached; registration for additional credits may be permitted beyond the 6, with the approval of the advisor, up to a maximum of 12 credits per semester. If the student has not completed the dissertation after completion of 36 credits, continued registration of 3 credits per semester is required.

EnE 791 - Graduate Seminar (3 credits)
Seminar in which faculty or others present summaries of advanced topics suitable for research. Students and faculty discuss research procedures, thesis organization, and content. Students present their own research for discussion and criticism. Required of all doctoral students registered for EnE 790 unless requirement is waived, in writing, by the dean of graduate studies.

Environmental Policy Studies: Offered by the Department of Chemistry and Environmental Science

UNDERGRADUATE COURSES:

EPS 202 - Society, Technology, and the Environment (3-0-3)
Prerequisite: HUM 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. **Effective From: Spring 2007**

EPS 312 - Technology and Policy in Contemporary America (3-0-3)
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. **Effective From: Fall 2008**

EPS 313 - Environmental History and Policy (3-0-3)
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. **Effective From: Fall 2008**

EPS 360 - Ethics and the Environment (3-0-3)
Prerequisites: HUM 101, HSS 202 or their equivalents; two from HSS 211, HSS 212, Hist 213 or their equivalents. 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. Honors Note: See HSS 101. **Effective From: Fall 2008**

EPS 362 - Environmental Economics (3-0-3)
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. **Effective From: Fall 2008**

EPS 380 - Policy Issues in the Coastal Environment (3-0-3)
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. **Effective From: Fall 2008**

EPS 381 - Field Techniques and Research (3-0-3)
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. **Effective From: Fall 2008**

GRADUATE COURSES:

EPS 601 - Research Methods for Environment & Sustainability Policy (3 credits)
Introduces the research methods necessary to conduct studies in environmental and sustainability policy. Topics covered include literature review, problem identification, hypothesis testing, and quantitative methods of data analysis and problem solving. Students are required to implement and present their independently designed projects.

EPS 602 - Research Analysis for the Social and Policy Sciences (3 credits)
Prerequisite: EPS 601. Distribution of social, political, economic and health-related data in both samples and populations using a general linear model with residuals. Test hypotheses using both the Fisher and Neyman-Pearson criteria. Use of software such as SPSS, Microsoft Excel and Resampling Stats. to develop and test models using correlation, regression and ANOV techniques.

EPS 606 - Technology Forecasting and Management Planning (3 credits)
Prerequisite: quantitative background in science, social science, or engineering. Basic forecasting techniques such as regression analysis, scenario generating, Delphi conferencing, and morphological analysis with particular case studies and problems pertaining to the forecasting of technological development. The relation of technological forecasting to the management process and the understanding of the technological development process. Demonstration of techniques and application to the contemporary fields of technological importance such as energy, communications, transportation, housing, and computers. **Effective Until: Fall 2011**

EPS 609 - Environmental Risk Assessment (3 credits)
Methodology to assess the social and economic risks to present-day environmental resources of air and water; cost-benefit and trade-off analysis; technical characteristics of materials such as half-life, decomposition rates, and temperature sensitivity; and probabilities of various environmental situations.

EPS 612 - Introduction to Environmental Policy Studies (3 credits)
Introduction to six areas essential to a comprehensive understanding of environmental policy: concept of environmental policy; tools (law, economics, planning, science, engineering, ethics) for environmental policy; the U.S. perspective (NEPA, clean air and water acts, CERCLA); the international perspective (Club of Rome models, 1972 UNEP, 1992 Rio); industrial perspective (pollution prevention/life cycle engineering, privatization); and the local perspective (New Jersey DEP, NGOs, local industry, shoreline.) Same as MIP 612.

EPS 613 - Environmental History and Policy (3 credits)
Explores the dialogue between humanity and the environment in the United States, as well as its global implications. Surveys fundamental themes of history and policy from an environmental perspective: colonial development, independence, western expansion, industrialization, urbanization, and the rise of a consumer society. Gives special attention to the emergence of an environmental perspective: wilderness appreciation, the conservation movement, public health, the rise of the environmental movement since the 1960s, environmental science, and the legislative and regulatory process.

EPS 614 - Environmental Economics & Management (3 credits)
Overviews the complex and dynamic interactions between the economy and the environment from biological, economic, and institutional perspectives and investigates various strategies for resolving conflicts in resource management and pollution control. Topics include the basic principles of risk assessment, cost benefit analysis, and cost-effectiveness analysis in environment management and assessment of contemporary environment politics in air and water pollution control and waste and toxics management. **Effective From: Fall 2012**

EPS 615 - The Politics of Science (3 credits)
Geopolitical context in which scientific discovery and governmental science policy have been formulated since World War II: social construction and the constituencies that have a stake in its outcome; military influence on science policy priorities; and legislative obstacles to various science policy objectives. **Effective Until: Fall 2011**

EPS 616 - Global Problem Solving in Science, Technology, and the Environment (3 credits)
Developing policy for the global era. Analyses and theories on political concept of sovereign nation states; the earth as one integrated economy, technology, science, politics and ecology; multinational corporations; worldwide patterns of capital and labor migration; energy flows; technology transfer; and impact of modernization and development on ecology. **Effective Until: Fall 2011**

EPS 622 - Sustainable Politics & Policy (3 credits)
Identifies the origins of the concept of sustainability development and institutional efforts to implement strategies at various geopolitical scales: international, national, regional, and local. The course introduces tools to measure progress toward sustainability through the use of metrics such as ecological footprint analysis and life-cycle analysis. Other topics include steady-state economics, sustainable systems of production and consumption, and sustainability transitions.

EPS 630 - Technology, Engineering and Civilization (3 credits)
Technological development and technical innovation dating from the ancient world, medieval Europe, to the modern era, with emphasis on Western civilization. Comparisons of the United States, Europe, China and Japan. Major themes include the role of the military and war, proto-industrialization and industrial revolution, technology transfer, emergence of engineering as an occupational class, and the place of the United States as the world's premier technological nation. **Effective Until: Fall 2011**

EPS 634 - Professional Ethics (3 credits)
Professional ethics: its source, range, and limits. Ethical thought and behavior in Western tradition and culture as they apply to business, engineering, and government. By studying both theoretical arguments and practical, real-life case studies, students learn to recognize, analyze and evaluate the ethics of personal professional decisions about work, careers, and policies. **Effective Until: Fall 2011**

EPS 638 - Physical Geography (3)
Understanding the interaction between humans and the physical environment is important to the formulation of sound environmental policy. The course examines processes that shape the physical environment, the influence of human activities on these processes and the physical environment, and the application of this information to solving environmental problems.

EPS 642 - Urban Environmental Policy Studies (3 credits)
Critical evaluation and formulation of environmental policy as it affects urban setting. History and theory of environmental policy. How the U.S. legal structure shapes environmental regulation and its administration. Shifting environmental policy paradigms. Case study analyses focusing on urban settings. **Effective Until: Fall 2011**

EPS 644 - The Rhetoric of Environmental Policy (3 credits)
Introduces students to the major types of rhetorical analysis as well as assures that students can analyze and write technology policy that is informed by core rhetorical principles of that analysis.

EPS 651 - Introduction to Urban and Environmental Health (3 credits)
Health problems associated with the social and psychological factors found in urban areas and health problems stemming from contamination of air, water, food, the work place and other special environments. Policies required to promote healthful living behavior and those required to regulate negative externalities.

EPS 660 - Ethics and Environmental Policy (3 credits)
Contemporary environmental problems from the perspective of ethics or moral philosophy. Is there a moral obligation to preserve or protect the natural environment? What are the ethical presumptions and values underlying environmental policy? Are traditional theories of moral philosophy applicable to contemporary environmental problems, or is a new conception of the relationship between humanity and nature needed?

EPS 698/EPS 699 - Special Topics in Environmental & Sustainability (3 credits each)
Course considers advanced topics of special or current interest related to environmental and sustainability policy. **Effective From: Fall 2012**

EPS 701 - Master's Thesis (6 credits)
Prerequisite: matriculation for the master's degree, advisor's and departmental approval. Projects involving fieldwork, experimental, or theoretical investigation carried out under the supervision of a designated member of the departmental faculty. The completed thesis should be of a quality as to warrant publication, in whole or in part, in a professional journal. A minimum of 3 credits per semester is required until completion.

EPS 702 - Special Topics (3-0-3)
Prerequisite: Approval of graduate advisor in Environmental Science. Topics of current interest in the field of environmental policy. Doctoral level course. **Effective From: Spring 2006**

EPS 711 - Environmental Policy: Corporate Approach and Organization (3 credits)
Explores corporate and business advocacy approaches to influencing and responding to environmental policy and regulation from organizational, historic and strategic perspectives. **Effective Until: Fall 2011**

EPS 712 - Advanced Studies in Environmental & Sustainability Policy (3 credits)
Evaluates strategies to reduce energy and material throughput including eco-efficiency relocalization of production and consumption, and green consumerism. Also considered are debates surrounding innovative policies to foster work-time reduction, to develop alternative measures of well-being, and to include societal values shifts. **Effective From: Fall 2012**

EPS 714 - Environmental and Natural Resources Economics (3 credits)
Examines environmental regulation of firms and natural resource use with emphasis on the theoretical foundations required for public policy. Students focus primarily on the application of economic tools to improve environmental quality.

EPS 725 - Independent Study I (3 credits)
Prerequisite: matriculation for the master's degree, advisor's and departmental approval. Projects not within the scope of existing courses are carried out under the supervision of a designated member of the departmental faculty.

EPS 726 - Independent Study II (3 credits)
Prerequisite: matriculation for the master's degree, advisor's and departmental approval. Projects not within the scope of existing courses are carried out under the supervision of a designated member of the departmental faculty.

EPS 761 - Ethics and Environmental Policy II (3 credits)
Presents a detailed investigation of the ethical bases of environmental policy decisions. Examines both theoretical philosophical arguments and practical case studies. **Effective Until: Fall 2011**

Environmetal Science : Offered by the Department of Chemistry and Environmental Science

UNDERGRADUATE COURSES:

EvSc 125 - Fundamentals of Environmental Sciences (3-0-3)
Prerequisites: Chem 125 with grade C or better, R120:101 with grade C or better. 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. **Effective From: Fall 2013**

EvSc 325 - Energy and Environment (3-0-3)
Prerequisites: Chem 125 with a grade C or better and Phy 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. **Effective From: Spring 2012**

EvSc 335 - Environmental Law (3-0-3)
Prerequisite: Hum 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. **Effective From: Fall 2012**

EvSc 375 - Environmental Biology (3-0-3)
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. **Effective From: Spring 2006**

EvSc 381 - Geomorphology (3-0-3)
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. **Effective From: Fall 2010**

EvSc 385 - Environmental Microbiology (3-0-3)
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. Traditional lectures and exams will be supplemented with discussions of experimental design and data interpretation by reading current research articles. **Effective From: Spring 2006**

EvSc 391 - Research and Independent Study (3-0-3)
Provides an opportunity to work on a research project under the individual guidance of a member of the department. **Effective From: Fall 2008**

EvSc 416 - Environmental Toxicology (3-0-3)
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. **Effective From: Spring 2006**

EvSc 484 - Environmental Analysis (2-2-3)

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. **Effective From: Fall 2006**

EvSc 492H - Honors Research and Independent Study II (3-0-3)
Provides an opportunity to work on a research project under the individual guidance of a member of the department. **Effective From: Fall 2008**

GRADUATE COURSES:

EvSc 592 - Graduate Work Experience (3 additive credits)
Prerequisite: permission of the associate chairperson for environmental science and the Division of Career Development Services. Provides on-the-job reinforcement of environmental science assignments. Projects are developed by the co-op office in consultation with the associate chairperson for environmental science. Cannot be used for degree credit.

EvSc 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

EvSc 600 - Environmental Science Seminar (Non-credit)
Prerequisite: graduate standing. Current environmental topics of interest to the environmental professional are presented. Required every semester for environmental science graduate students receiving departmental or research-based awards and for all doctoral students.

EvSc 602 - Special Topics in Environmental Science I (3 credits)
Prerequisite: approval of graduate advisor in environmental science. Topics of current interest in the environmental field.

EvSc 603 - Hazardous Waste Operations and Emergency Response (3 credits)
Explores the safe operation of hazardous waste sites as well as emergency responses to hazardous releases. Overview of OSHA regulations and NIOSH standards concerning toxicological hazards and medical surveillance requirements. Emphasis on recognition and monitoring of site hazards. A written health and safety plan, and participation in a group problem involving a simulated hazardous site entry using actual protective equipment is required. Course satisfies the regulatory compliance mandates to meet 29 CFR 1910.120 for OSHA, with certification valid for one year.

EvSc 610 - Environmental Chemical Science (3 credits)
Prerequisite: graduate standing. Principles of physical, inorganic and organic chemistry are applied to understanding the origins of environmental pollutants, their transport, distribution and decomposition pathways.

EvSc 611 - Hazardous Waste Management (3 credits)
Prerequisite: graduate standing. An overview of hazardous waste management; case histories; legislation and regulations; treatment, disposal and cleanup technologies; sampling and analysis methodology; persistence and fate in the environment; emergency response procedures.

EvSc 612 - Environmental Analysis (3 credits)
Prerequisite: graduate standing. 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 613 - Environmental Problem Solving (3 credits)
Prerequisite: graduate standing. This course is designed to study solutions for current environmental problems. Students are asked to respond to an imaginary Request for Proposal (RFP) in writing and before a team of technical experts at an oral presentation. Solutions proposed in student RFPs must reflect knowledge of environmental science and technology in current use.

EvSc 614 - Quantitative Environmental Risk Assessment (3 credits)
Prerequisite: graduate standing. Applications ofquantitative risk assessment concepts to the management of environmental problems.

EvSc 615 - Global Environmental Problems (3 credits)
Prerequisite: graduate standing. With an understanding that environmental problems are not restricted by geographical boundaries, relationships of the earth's temperature balance, global air circulation patterns, global energy needs, and control and remediation technologies are studied.

EvSc 616 - Toxicology for Engineers and Scientists (3 credits)

Prerequisite: graduate standing. The general principles of toxicology are presented and applied 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 617 - Mass Spectrometry and Interpretation of Mass Spectra (3 credits)
Prerequisite: CHEM125 and CHEM126 or equivalent. Historical background, fundamentals and mechanics of operation for components incorporated into modern Mass Spectrometers: vacuum system, ion sources, mass filter, ion detection, plus computer operation and data collection. Explanation and interpretation of mass spectra and fragmentation patterns are a fundamental theme throughout the course. Lecture material includes principles of operation and appropriate applications for modern types of mass spectrometers: magnetic sector, quadrupole, time of flight, ion trap, FT-ICR. Theory and applications of electron impact, chemical, electrospray, and other ionization techniques including atmospheric sampling are covered. High resolution analysis using magnetic sector and FT - ion cyclotron instruments. Analytical applications in environmental, petroleum and biochemical analysis and applications and coupling of mass spectrometry with other instruments (GC, LC, AES,) are illustrated.

EvSc 624 - Environmental Analysis Methods and Laboratory (3 credits)
Basic theory, methods, instruments, and data interpretation for chemical analysis of environmental samples are described in lectures and used in the laboratory; sampling; sample preparation; quality assurance, chain of custody. Instrument methods and uses include: UV-VIS, FTIR, AA, HPLC, GC, Ion Chromatography, and Mass Spectrometry as applied to environmental samples.

EvSc 625 - Social Dimensions of Risk (3 credits)
Low-probability/high consequence events involving terrorism, food safety, and extreme weather offer ample evidence the prevalent approaches of economics and statistics are not able to deal with the complex ways that risk permeates modern societies. This course treats risk analysis as a broad interdisciplinary activity and draws on the full range of the social sciences to explore the multifaceted way that risk infuses itself into the fabric of contemporary affairs. **Effective From: Spring 2007**

EvSc 626 - Hydrogeology (3 credits)
This course covers the principles of ground water flow, advanced water cycle properties, aquifer flow and aquifer recharge. Contaminant migration and remediation methods are discussed. Basic groundwater chemistry and quality is covered. **Effective From: Spring 2008**

EvSc 627 - Environmental Microbiology (3 credits)
Prerequisites: R120:101, R120:102, (General Biology I and II) or permission of instructor. This course offers an overview of 1) basic microbiology: biochemical principles, cell structure organization, microbial nutrition and growth, 2) the important microbes involved in environmental microbiology and address the environments where they are found, and 3) how they are detected and monitored, and their effects on humans, and the environment. Traditional lectures and exams are supplemented with discussions of current research articles. **Effective From: Fall 2010**

EvSc 700 - Master's Project (3 credits)
Prerequisite: graduate standing and approval of the graduate advisor in environmental science. Written report requiring experimental or theoretical research, or an extensive literature analysis. Registration must be approved by an advisor. Students must continue to register for 3 credits each semester until completion and a written report is accepted. Only a total of 3 credits will count toward the degree.

EvSc 701 - Master's Thesis (3 credits)
Prerequisite: matriculation for a master's degree in environmental science. Approval to register for the thesis must be obtained from the advisor. Original research under the supervision of a designated faculty member. The final product must be a written thesis approved by three faculty members: the student's primary advisor, another from the program and one other faculty member. Once registration for thesis has begun, a student must continue to register for a minimum 3 credits per semester until at least 6 credits have been completed and a written thesis is approved. Only a total of 6 credits will count toward the degree.

EvSc 702 - Special Topics in Environmental Science II (3 credits)
Prerequisite: approval of graduate advisor in environmental science. Topics of current interest in the environmental field.

EvSc 711 - Advanced Environmental Analysis (3 credits)
Prerequisite: EvSc 612 or equivalent. Analysis of complex environmental samples is studied, from the acquisition of representative samples, through sample handling, chain of custody, sample storage, analytical method selection, analysis and data handling. Collection and analysis of samples from air, water, soil, and biological systems will be discussed. Emphasis on the study of current literature.

EvSc 712 - Hazardous Substance Management (3-0-3)
Prerequisites: Graduate standing. The course material comprises an overview of hazardous materials and hazardous waste management and control in an industrial setting. The course examines the technical approaches utilized in the control,

remediation, and prevention of hazardous substances and waste. It also includes the major technical elements of federal regulations that govern operations involving the handling of hazardous materials. **Effective From: Fall 2012**

EvSc 717 - Mass Spectrometry and Mass Spectral Interpretation (3 credits)
Prerequisite: CHEM125 and CHEM126 or equivalent. Chem 717 and Evsc 617 are comprised of Chem/Evsc 617 plus a research project: Research projects usually comprise experimental and mass spectrometry interpretation studies. These can be performed at NJIT or in the students corporate mass spectrometry facility. Projects may also include theory, data interpretation or literature reviews pertinent to a current active area in mass spectrometry research. Projects should be approved or in consult with the instructors.

EvSc 725 - Independent Study I (3 credits)
Prerequisite: written permission from the Associate Chairperson for Environmental Science plus courses prescribed by the supervising faculty member (who is not the student's thesis advisor). This special course covers areas of study in which one or more students may be interested, but which are not sufficiently broad to warrant a regular course offering. Students may not register for this course more than once with the same supervising faculty member.

EvSc 726 - Independent Study II (3 credits)
See description for EvSc 725.

EvSc 790 - Doctoral Dissertation (Credits as designated)
Required of all students working toward the degree of Doctor of Philosophy. A minimum of 36 credits is required. Approval of dissertation advisor is necessary for registration. Candidates must register for at least 6 credits of dissertation per semester until 36 credits are reached, and 3 credits per semester thereafter until a written dissertation is approved.

EvSc 791 - Graduate Seminar (Non-credit)
Required of all environmental science graduate students receiving departmental or research-based awards and all doctoral students. The student must register each semester until completion of the degree. Outside speakers and department members present their research for general discussion.

Financial Management: Offered by the School of Management

UNDERGRADUATE COURSES:

Fin 218 - Financial Markets and Institutions (3-0-3)
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. **Effective From: Fall 2009**

Fin 315 - Fundamentals of Corporate Finance (3-0-3)
Prerequisites: Acct 115, or Acct 117. 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. **Effective From: Fall 2010**

Fin 401 - Securities in Financial Markets (3-0-3)
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. **Effective From: Fall 2005**

Fin 402 - Financial Risk Measurement and Management (3-0-3)
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. **Effective From: Fall 2005**

Fin 403 - Financial Statement Analysis (3-0-3)
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. **Effective From: Fall 2005**

Fin 404 - Financial Management Using ERP Systems (3-0-3)
Enterprise Resource Planning (ERP) systems are covered in-depth as tools for increasing a firm's profitability, reducing its costs, and for improving its competitiveness. ERP platforms from PeopleSoft and Microsoft as used throughout the course to demonstrate financial management using integrated, firm wide information systems. **Effective From: Fall 2005**

Fin 416 - Advanced Corporate Finance (3-0-3)
Prerequisite: 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. **Effective From: Summer 2008**

Fin 422 - International Finance (3-0-3)
Prerequisite: 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 (3-0-3)
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 (3-0-3)
Prerequisites: Fin 315 and Math 135 (or Math 138, Math 111, Math 113). 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. **Effective From: Fall 2009**

Fin 485 - Special Topics in Finance (3-0-3)
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. **Effective From: Fall 2009**

R390:315 - Investments (3)
For more details go to Rutgers Catalog.

R390:329 - Finance (3)
For more details go to Rutgers Catalog.

R390:386 - Futures and Options (3)
For more details go to Rutgers Catalog.

GRADUATE COURSES:

Fin 516 - Principles of Financial Management (3 credits)
Fundamentals of financial management divided into two segments: investment and corporation finance.

Fin 600 - Corporate Finance I (3 credits)
This course introduces concepts and analytical tools to identify and solve Financial Management problems. After introducing the corporation, the course focuses on how firms invest in real assets (capital budgeting) and how they raise money to pay for assets (financing). Practical problems in valuing bonds, stocks and other investments will be based on the time value of money. The trade-off between risk and return will be introduced with the Capital Asset Pricing Model. **Effective From: Fall 2009**

Fin 610 - Global Macro Economics (3 credits)
Fin 610 is an introductory graduate course for entering master's students that will also be taking other core Master's courses such as accounting. The course introduces various concepts relating to macroenomics and the financial environment from both a theoretical and institutional perspective. Thus fiscal and monetary policy and actions are covered but are taught using a macroeconomic model that helps identify how particular actions affect the money and goods economies as well as specific financial institutions. **Effective From: Spring 2010**

Fin 618 - Public and Private Financing of Urban Areas (3 credits)
Ties government's budget, tax policy, allocation of resources between public and private sectors, with the structure, development, and growth needs of urban metropolitan areas. Focuses on problems of poverty, transportation, land-use, economic base, relation between central cities and suburban areas, and alternative engineering and economic solutions. Same as MIP 618 and Tran 604.

Fin 624 - Corporate Finance II (3 credits)
Fin 600 is a prerequisite. The trade-off between risk and return will be examined in the context of historical analysis, portfolio optimization, the Capital Asset Pricing Model and other alternative models. The course will begin with the understanding of the Modigliani and Miller results and introduce bankruptcy, taxes, information asymmetries and other market imperfections. Financial options, put-call parity and option pricing will be introduces. **Effective From: Fall 2009**

Fin 626 - Financial Investment Institutions (3 credits)
Prerequisite: Fin 600. Introduces the role of banking institutions and investment banks in the domestic and international money market and capital environment to the financial managers. Covers instruments and services of financial intermediaries that are crucial to business management. Discussions range from the financial services and facilities of regional banks to money-center banking institutions. Alternatives of project financing, lending requirements and regulations, project financing, and role of intermediaries in local and international transactions. Focuses on the private placement procedures of all types of securities in the capital market and the unique role undertaken by the investment banking firms. Provides an insight about the public offering process for existing and venture capitalized firms.

Fin 627 - International Finance (3 credits)
Prerequisite: Fin 600. Examines financing of exports and imports, managing multicurrency working capital, international aspects of capital budgeting, cost of capital and their relationship with political, economic, and financial risk. Explores financial innovations and their impact on the firm's financial strategy and performance of overall productivity. Discusses the tax consequences and principal-subsidiary relationship of the multinational enterprise. Introduces international money and capital markets, instruments, derivatives, and institutions.

Fin 630 - Applied Business Econometrics (3 credits)
Introduces methodological development of quantitative tools essential to modern managers. Includes sampling distribution, hypothesis testing, nonparametric statistics, and simultaneous regression models. Centers on application setting with statistical results providing insights into management decisions.

Fin 631 - Working Capital Management and Credit Analysis (3 credits)
Prerequisite: Fin 516. Optimal management of a firm's working capital, such as cash, marketable securities, receivables, and inventories with an emphasis on the institutional background and environmental modeling. Deals with cash flow analysis, the assessment of financial needs, and selecting the appropriate domestic and international sources for meeting a firm's credit needs.

Fin 632 - Financial Valuation of Technology-Based Companies (3 credits)
Prerequisite: Fin 516. Concentrates on techniques and procedures of assessing, managing, and forecasting value of alternative corporate and business level strategies of companies with emphasis on technology-based companies. These strategies include new product introduction, joint venture agreements, new market entries, and capital expenditures.

Fin 634 - Mergers, Acquisitions, and Restructuring (3 credits)
Prerequisite: Fin 600. Focuses on identifying and evaluating potential and international companies for mergers and acquisitions as well as structuring of deals. The financial, social and managerial implications of these changes in corporate ownership will be examined. Topics are: financing M&As, deal structuring, tax implications, valuation, broker/finder agreements, merger negotiations, and post-merger integration.

Fin 641 - Derivatives Markets (3 credits)
Prerequisites: FIN 600. This course introduces students to futures, options, and other derivative securities. Topics include option valuation models, principles of forward and futures pricing, structure of markets for derivative securities, and strategies for hedging and speculation. **Effective From: Spring 2011**

Fin 642 - Derivatives and Structured Finance (3 credits)
Prerequisites: Finance 641. This is a second course in the instruments created by modern financial engineering. It continues the study of derivatives from Fin 641 (Derivatives Markets), covering additional types of options and of underlying assets. The second part of the course is devoted to structured finance, including securities backed by mortgages and other types of assets. **Effective From: Spring 2010**

Fin 643 - Term Structure of Interest Rates (3-0-3)
Prerequisites: FIN 642(Derivatives and Structure Finance), Math 605 (Stochastic Calculus). This course provides the student with a basic understanding of models of the term-structure of interest rates and the pricing of derivatives on bonds and other interest-rate-based securities. Topics covered include arbitrage-free pricing principles, continuous-time interest-rate models, no-arbitrage term structure models, multifactor models, forward measure approach, market models and model calibration. **Effective From: Spring 2010**

Fin 644 - Credit Risk Modeling (3-0-3)
Prerequisites: FIN 643 (Term Structure of Interest Rates), Math 605 (Stochastic Calculus). This course covers types of credit risk, measurement of credit risk, and methods for changing exposure to credit risk using credit derivatives. Current models for pricing credit derivatives will be analyzed and applied. **Effective From: Fall 2011**

Fin 650 - Investment Analysis and Portfolio Theory (3 credits)
Prerequisite: FIN 600. This is a basic course in the theory and practice of investing. We will study in depth why and how to form portfolios of securities. A significant amount of mathematical and statistical analysis will be used in answering these questions. Theories of asset pricing based on the relationship between risk and return will be included. We will also discuss criteria for selecting specific securities in different asset classes, such as, stocks, bonds, and derivatives. **Effective From: Spring 2011**

Fin 655 - Financial Innovations and Market Failures (3-0-3)
Prerequisites: Fin 600. This reading intensive course introduces concepts and problems from derivative markets, entrepreneurial finance, and financial market failures (including financial bubbles). The course focuses on valuation of futures and options (including real options), strategy and incentives for new finance, and information asymmetry and market failures, especially financial market bubbles. **Effective From: Spring 2013**

Fin 660 - Financial Planning and Decision Making (3 credits)
Prerequisite: Fin 624. This course introduces the in-depth qualitative and quantitative analysis of the short-term and long-term investment and financing decisions in an uncertain environment. The course emphasizes a quantitative analysis (simulation model) and case studies that deal with actual business decisions and challenges. Students are assigned to competing financial management teams in order to develop financial planning and decision making expertise.

Fin 700 - Seminar in Theory and Research in Financial Management (3 credits)
Prerequisites: Fin 624 or Fin 626. Only open to those students who do not do a thesis. The theory and applied tools of financial management. Presented in seminar format with several students working as a team to analyze and resolve an issue in financial management.

Fin 701 - Thesis in Financial Management (6 credits)
Prerequisites: Fin 624 or Fin 626; waived with approval of the assistant dean for graduate programs. Examines:What is research? Why do research? What are the objectives of research? Covers the need for research, criteria for good research and research design, concept of measurement, sampling design, primary data collection, experimentation and simulation, statistical and other types of analysis, and reporting of research findings.

Fine Arts: Fine Arts

UNDERGRADUATE COURSES:

FA 285 - Contemporary Aesthetics (3-3-3)
Prerequisite: AD 161 & 162, Arch History I, II & III or equivalents. A critical examination of issues affecting artists in the digital age. Topics include traditional vs. information age media, relationships between art and its audience, art as sociopolitical commentary, and interactive modes of communication. Course entails illustrated lectures, readings, museum visits, student presentations, participation, research papers. Attendance at lectures outside of class may be required to complete assignments. **Effective From: Fall 2009**

FA 286 - Case Studies in Industrialized Art (3-0-3)
Prerequisites: AD 111, 112, 150, 161, 162. Lab-based course examining contemporary art as it pertains to the application of tools and technologies in its creation. Considered are impacts of media and mode of delivery through graphic case study models looking at key benchmarks in technology-based art in the 20th and 21st centuries. Emphasis on digital, interactive, and time-based media. Required coursework includes research papers, multimedia projects, gallery visits, presentations. **Effective From: Spring 2010**

Forensic Science:

UNDERGRADUATE COURSES:

FOS 301 - Introduction to Forensic Science (3-0-3)
Emphasizes the recognition, identification, individualization, and evaluation of physical evidence by applying the natural sciences law to law-science matters. Covers basic principles, types of evidence, and the role of forensic science in criminal and civil investigations.

FOS 310 - Criminal Investigation (3-0-3)
Presents the rules and procedures of preliminary and follow-up investigations, the art of inter-rogation, recording of statements, confessions, and the collection and preservation of physical evidence at the crime seen. Examines methods used in scientific interpretation of evidence and the preparation of criminal cases for trial.

FOS 311 - Criminal Law (3-0-3)
Prerequisite: HSS 101, HSS 202 or their equivalents; two from HSS 211, HSS 212, HSS 213 or their equivalents. Introduction to the scope, purpose, and definitions of substantive criminal law. Covers criminal liability, major elements of statutory and common law crimes and -offenses, and significant defenses. Analyzes the behavioral principles that apply to criminal cases and the criminal law system as a means to influence human behavior.

FOS 312 - Forensic Principles of Evidence (3-0-3)
Prerequisite: HSS 101, HSS 202 or their equivalents; two from HSS 211, HSS 212, HSS 213 or their equivalents. Introduction to forensic evidence and its relationship to the criminal justice system: rules, pre-trial and trial techniques emphasizing the procedure, evidentiary, tactical, and ethical process; admissibility and standards; witnesses, testimony, search and seizure, confessions, and eye witness identifications.

French: Offered by the Department of Classical and Modern Languages and Literatures at Rutgers-Newark. See Classics course list for faculty

Freshmen Seminar: Freshmen Seminar

UNDERGRADUATE COURSES:

Frsh Sem - Freshman Seminar (1-0-0)
Addresses issues related to a successful college life during weekly seminars. Topics include time management, study skills, interpersonal relationships, wellness, multicultural issues and career decision making. Freshman Seminar is a graduation requirement for all first-time, full-time freshmen.

Geology: Offered by the Department of Geological Sciences at Rutgers-Newark

UNDERGRADUATE COURSES:

R460:103 - Planet Earth (3)
For more details go to Rutgers Catalog.

R460:104 - Planet Earth Laboratory (1)
For more details go to Rutgers Catalog.

R460:106 - Environmental Geology (3-0-3)
For more details go to Rutgers Catalog.

R460:206 - Environmental Geology (3)
For more details go to Rutgers Catalog.

R460:207 - Environmental Geology Laboratory (1)
For more details go to Rutgers Catalog.

R460:309 - Geomorphology (3)
For more details go to Rutgers Catalog.

R460:311 - Geologic Field Problems (3)
For more details go to Rutgers Catalog.

R460:320 - Structural Geology (4)
For more details go to Rutgers Catalog.

R460:321 - Mineralogy (4)
For more details go to Rutgers Catalog.

R460:406 - Applied Geophysics (3)
For more details go to Rutgers Catalog.

R460:427 - Hydrogeology (3)
For more details go to Rutgers Catalog.

GRADUATE COURSES:

R460:577 - Seminar in Environmental Geology (3 credits)
For more details go to Rutgers Catalog.

History: Offered by the Federated History Department of NJIT and Rutgers-Newark

UNDERGRADUATE COURSES:

Hist 125 - Mapping Human History (3-0-3)
An introduction to the relationship of time and space in human history, using selected case studies drawn from a wide range of historical periods and places. Students learn to read and use maps, with a particular emphasis on the critical examination of evidence.

Hist 213 - The Twentieth-Century World (3-0-3)
Prerequisite: HUM 101 and HUM 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 three credits of the GUR in Cultural History. **Effective From: Fall 2011**

Hist 310 - Co-op in Law, Technology, Culture & History I (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 311 - Co-op in Law, Technology, Culture & History II (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 334 - Environmental History of North America (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 341 - The American Experience (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 343 - African-American History I (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 344 - African-American History II (3-0-3)
HUM 102 and one from among HUM 211, HUM 212, HIST 213, R510:200-- 299, R512:200--299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 345 - Communication through the Ages (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. Modes of communication, ancient and modern, in their social and cultural context?from cave painting 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. **Effective From: Spring 2013**

Hist 351 - Ancient Greece and the Persian Empire (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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.). **Effective From: Spring 2013**

Hist 352 - The Hellenistic States and the Roman Republic (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. The political and cultural developments of the Hellenistic states and their influence on the Republic of Rome to 30 B.C. **Effective From: Spring 2013**

Hist 359 - History of the Middle East I (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better The political, cultural, and institutional developments in the Middle East from the Parthians to the capture of Constantinople by the Ottoman Turks. Four periods will be analyzed: the Parthian, the Sassanid Persian, the Caliphate, and the Seljuk and Ottoman Turks. **Effective From: Spring 2013**

Hist 360 - History of the Middle East II (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. The political, cultural, and institutional developments in the Middle East from the capture of Constantinople by the -Ottoman Turks to the impact of the Arab-Israeli conflict on the world today. **Effective From: Spring 2013**

Hist 361 - The Founding of the American Nation (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 362 - Sex, Gender, and the Law in American History (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 363 - The United States as a World Power (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 364 - American Law in the World (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 365 - Comparative Colonial History (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 366 - Gender, Race and Identity in American History (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 367 - International Law and Diplomacy in History (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 368 - Comparative Economic History (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. A comparative analysis of the history of economic development, with particular attention to industrialization, shifting patterns of global trade, and changing labor markets. Topics include the Industrial Revolution, the rise of the world economy, the transformation of non-Western economies, labor migration, and newly industrializing countries. **Effective From: Spring 2013**

Hist 369 - Law and Society in History (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 370 - Legal issues in the History of Media (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better.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. **Effective From: Spring 2013**

Hist 372 - Contemporary Europe (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. European society in the 20th century, Nationalism, imperialism, totalitarianism, movements toward European unity, and prominent cultural developments. **Effective From: Spring 2013**

Hist 373 - The Rise of Modern Science (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 374 - Modern Russian Civilization (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. Russia under the last tsars, the 1917 upheavals, rise of the Soviet state to world power under Lenin, Stalin, and others, until the collapse of the communist dictatorship. **Effective From: Spring 2013**

Hist 375 - Legal Issues in Environmental History (3-0-3)

Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better.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. **Effective From: Spring 2013**

Hist 377 - Cities in History (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 378 - Medicine and Health Law in Modern America (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 379 - History of Medicine (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better.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. **Effective From: Spring 2013**

Hist 380 - History of Public Health (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. Shiftings 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. **Effective From: Spring 2013**

Hist 381 - Germs Genes & Body: Sci. & Tech. in Modern Medicine (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. Examines how science and technology came to play critical roles in the rise of modern medicine. Readings, lectures, and discussion 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. **Effective From: Spring 2013**

Hist 382 - War and Society (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 383 - The Making of Modern Thought (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 385 - Technology and Society in European and World History (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 386 - Technology in American History (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 388 - Britain in the 20th Century (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. A survey of British history from the death of Queen Victoria to 1964 with emphasis on the social and political trans-formation resulting from Britain's declining economy and world position. Topics include: the causes and impact of the two World Wars, the transition from liberal democracy to welfare state, the turn from Empire to Europe, social and economic trends as well as foreign -relations. **Effective From: Spring 2013**

Hist 390 - Historical Problems of the 20th Century through Film (3-0-3)
Prerequisites: Hum 101, Hum 102 and one from among Hum 211, Hum 212, and Hist 213 or their equivalents R510:200 through 299 or R512:200 through 299 or their equivalents with a grade of C or better. 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. **Effective From: Spring 2013**

Hist 401, 402 - Independent Studies in History (1-0-1, or 2-0-2, or 3-0-3)
Prerequisites: HUM 101, HUM 102 and one from among HUM 211, HUM 212 and HIST 213 or their equivalents with a grade of C or better in addition to a junior or senior standing; and before registering, permission from one of the following: NJIT history department chairperson, associate chairperson or history 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 to this COOP Experience **Effective From: Spring 2013**

Hist 489 - Seminar-Readings (3-0-3)
prerequisites: Completion of the GUR in English (3 credits), CUltural History (6 credits), Basic Social Sciences (6 credits) 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. **Effective From: Fall 2012**

Hist 489H - Senior History Honors Seminar: Readings (3-0-3)
Prerequisites: HUM 101, HUM 102 and one from among HUM 211, HUM 212 and HIST 213 or their equivalents with a grade of C or better. Limited to senior history majors who are enrolled in the Albert Dorman Honors College or who receive permission from the undergraduate history advisor. Meets with 510:489 but includes more advanced readings. **Effective Until: Fall 2007**

Hist 490 - Seminar Research (3-0-3)
Prerequisites: Hist 489. In this continuation of the two-semester seminar sequence, students research, outline, and write a substantial paper they design in conjunction with the professor. **Effective From: Fall 2012**

Hist 490H - Senior History Honors Seminar: Research (3-0-3)
Prerequisites: HUM 101, HUM 102 and one from among HUM 211, HUM 212 and HIST 213 or their equivalents with a grade of C or better. Limited to senior history majors who are enrolled in the Albert Dorman Honors College or who receive permission from the undergraduate history advisor. Meets with 510:490 but includes more rigorous research and writing requirements. **Effective Until: Fall 2007**

R510:201-202 - History of Western Civilization (3,3)
For more details go to Rutgers Catalog. **Effective Until: Fall 2007**

R510:249 - An Introduction to China (3)
For more details go to Rutgers Catalog.

R510:317 - History of the Caribbean (3)

For more details go to Rutgers Catalog.

R510:321 - Military History of the Western World (3)
For more details go to Rutgers Catalog.

R510:325 - History of Mexico and Central America (3)
For more details go to Rutgers Catalog.

R510:333 - History of Imperialism (3)
For more details go to Rutgers Catalog.

R510:334 - 20th-Century Fascism (3)
For more details go to Rutgers Catalog.

R510:337 - The History of Iran (3)
For more details go to Rutgers Catalog.

R510:338 - The Ottoman Empire (3)
For more details go to Rutgers Catalog.

R510:340 - Women in European History (3)
For more details go to Rutgers Catalog.

R510:346 - Medieval Legal History (3)
For more details go to Rutgers Catalog.

R510:355 - Traditional China: Institutions and Society (3)
For more details go to Rutgers Catalog.

R510:356 - History of the People's Republic of China (3)
For more details go to Rutgers Catalog.

R510:361 - The Near and Middle East (3)
For more details go to Rutgers Catalog.

R510:364 - Contemporary Issues in Puerto Rican History (3)
For more details go to Rutgers Catalog.

R510:366 - History of Poland (3)
For more details go to Rutgers Catalog.

R510:369 - Modern Eastern Europe (3)
For more details go to Rutgers Catalog.

R510:370 - History of Modern Ukraine (3)
For more details go to Rutgers Catalog.

R510:373 - The English Novel in History (3)
For more details go to Rutgers Catalog.

R510:379 - Colonialism and Decolonization (3)
For more details go to Rutgers Catalog.

R510:380 - History of the Mass Media in Europe (3)
For more details go to Rutgers Catalog.

R510:394 - The Peoples and Cultures of Central Asia (3)
For more details go to Rutgers Catalog.

R510:399 - Tudor-Stuart England (3)
For more details go to Rutgers Catalog.

R510:401 - Topics in European History (3)
For more details go to Rutgers Catalog.

R510:402 - History of Spain and Portugal (3)
For more details go to Rutgers Catalog.

R510:403 - Topics on Social History (3)
For more details go to Rutgers Catalog.

R510:404 - Topics in Intellectual History (3)
For more details go to Rutgers Catalog.

R510:433 - Topics in Islamic History (3)
For more details go to Rutgers Catalog.

R510:435 - Topics in Medieval and Early Modern History (3)
For more details go to Rutgers Catalog.

R510:458 - Topics in Women's History (3)
For more details go to Rutgers Catalog.

R510:461 - Topics in Comparative History (3)
For more details go to Rutgers Catalog.

R510:497 - Honors Project: History (3)
For more details go to Rutgers Catalog.

R510:499 - Individual Study in Historical Research, Non-American(BA) (null)
For more details go to Rutgers Catalog.

R512:201-202 - Development of the United States (3,3)
For more details go to Rutgers Catalog. **Effective Until: Fall 2007**

R512:303 - Topics in the History of Newark (3)
For more details go to Rutgers Catalog.

R512:311 - Colonial America (3)
For more details go to Rutgers Catalog.

R512:318 - Labor History (3)
For more details go to Rutgers Catalog.

R512:330 - History of American Immigration (3)
For more details go to Rutgers Catalog.

R512:337 - History of the Family in the United States (3)
For more details go to Rutgers Catalog.

R512:343 - The Creation of the American Republic (3)
For more details go to Rutgers Catalog.

R512:344 - The Democratic Age in American History: 1820 - 1880 (3)
For more details go to Rutgers Catalog.

R512:349 - Antebellum Reform Movements (3)
For more details go to Rutgers Catalog.

R512:367 - The Age of the Corporation: 1880?1920 (3)
For more details go to Rutgers Catalog.

R512:368 - Modern America (3)
For more details go to Rutgers Catalog.

R512:369 - America in World War II and the Postwar Period (3)
For more details go to Rutgers Catalog.

R512:371 - Contemporary America (3)

For more details go to Rutgers Catalog.

R512:383 - United States Foreign Policy in the Era of the Cold War (3)
For more details go to Rutgers Catalog.

R512:402 - Topics in American Intellectual History (3)
For more details go to Rutgers Catalog.

R512:403 - Topics in American Political History (3)
For more details go to Rutgers Catalog.

R512:404 - Topics in American Business and Economic History (3)
For more details go to Rutgers Catalog.

R512:405 - Topics in the History of Science (3)
For more details go to Rutgers Catalog.

R512:408 - Topics in American Social and Cultural History (3)
For more details go to Rutgers Catalog.

R512:410 - Topics in the History of American Foreign Policy and Diplomacy (3)
For more details go to Rutgers Catalog.

R512:438 - Internship: Administration of Historical Manuscripts (3)
For more details go to Rutgers Catalog.

R512:452 - Topics in Legal History (3)
For more details go to Rutgers Catalog.

R512:462 - Topics in Recent American History (3)
For more details go to Rutgers Catalog.

R512:472 - Topics in Afro-American History (3)
For more details go to Rutgers Catalog.

R512:473 - Topics in Women's History (3)
For more details go to Rutgers Catalog.

R512:499 - Readings in American History (3)
For more details go to Rutgers Catalog.

GRADUATE COURSES:

Hist 620 - City and Disease in History (3 credits)
Explores the dynamic interaction between the growth of cities and changes in the experience and location of disease. Presumes the intertwining of these two historical developments in the birth of a distinctly urban identity, one predicated on the notion that the modern city is somehow inherently diseased. Focuses on the New York and Newark metropolitan areas in the nineteenth and twentieth centuries. Among the topics considered are epidemic outbreaks, quarantines, the technology and organization of sanitation and hygiene, the professional formation of public, industrial and occupational medicine, and medical and popular responses to immigration.

Hist 622 - Culture and Science in the History of American Medicine (3 credits)
Provides an overview of American medical history and a familiarity with the theoretical and practical ramifications of different approaches to the complex relationships between medicine, science, and culture. Topics include: the extent to which medicine is or has been scientific; reasons why science has been considered so important to medicine's professional culture; and the degree to which medicine's professional culture has been shaped by science as well as other factors, such as economic and political self-interest, technology, class, race, gender, and other kinds of cultural values.

Hist 624 - Technology, Environment and Medicine in World History, 1500-1900 (3 credits)
Examines the interrelationship between the emerging modern world system and changes in technology, environment, and medicine, with particular emphasis on European overseas expansion and its impact in non-Western regions.

Hist 626 - Social History of American Medicine Since 1800 (3 credits)

Topics include the practices of 19th-century regular medicine; the relation between medical concepts and mainstream social thought; the treatment of women's health; antebellum alternative healers and alternative politics; the triumphs of late 19th- and early 20th-century medical therapeutics; the emergence of medicine as big business; medicine and racism; the emergence of nursing as a profession; modern medicine in an international perspective; New Age healing; the AIDS crisis and AIDS activism; and contemporary debates on the future of health care in the United States.

Hist 628 - Gender, Science and Technology in the Modern World (3 credits)
Introduction to a wide range of political and cultural analyses of science and technology, with an emphasis on recent feminist critiques of science. Explores the questions of scientific neutrality; the gendering of scientific knowledge; the relationship between science, technology, and capitalism; the role of science in international politics; and why science has not freed women.

Hist 630 - History of the Body in Modern Western Culture (3 credits)
Considers medical or scientific history primarily in terms of implications for bodily experience in everyday life. Begins with grand narratives of historical shifts in bodily perceptions and practices, and proceeds to more focused narratives of changing bodily experience, engaging key distinctions between genders, classes, and species as well as perceptions of pain and internal bodily structure. Materials will be drawn from early modern and modern Europe, as well as more recent bodily experience in the United States.

Hist 632 - Technology, Culture and History (3 credits)
Treats the relationship between technology and cultural values in a variety of historical and geographical settings, from early modern Japan to twentieth-century America. Examines the ways in which cultural ideals, conceptions, and preconceptions serve to influence the rate and manner of technological change, as well as the ways in which technology affects social and cultural life.

Hist 634 - Environmental History of North America (3 credits)
Explores the dialogue between humankind and the environment in North America over the course of the last four centuries. Examines the latest and most interesting work done in the new field of environmental history to see what such a perspective has to offer.

Hist 635 - History of Technology, Environment and Medicine: Theory and Method (3 credits)
A team-taught course which surveys the methods employed in the three fields. Explores the interdisciplinary nature of each field, and the value of interdisciplinary scholarship.

Hist 637 - Global Environmental History (3 credits)
This course takes a global view of human interaction with the natural world, mixing broad themes such as colonialism and industrialization with detailed case studies in an effort ot understand the ways that people and the environment have mutually shaped one another. Because environmental change often transcends national boundaries, this course places important subjects in environmental history such as disease, agriculture, pollution, and environmentalism into a global and transnational context.
Effective From: Fall 2010

Hist 638 - Social History of Communication (3 credits)
Treats selected themes in the history of communication in different social and cultural contexts, from the ancient world to the twentieth century. Topics include: orality, proto-literacy, and literacy in ancient and medieval cultures; printing and the development of print culture in the early modern world; the ?communication revolution? of the late 19th and early 20th centuries; and historiographical debates over the role of communication technologies in society.

Hist 640 - The Urban Environment (3 credits)
Examines the role of the economy, culture, and technology in shaping the urban environment. Makes extensive use of Newark and the New York metropolitan area, including field observations and local research. In addition to other topics, explores in detail spatial relationships, the role of transportation, and the development of suburbia.

Hist 642 - The History of Health and International Development (3 credits)
This course examines the history of western efforts to promote health and nutrition in the 'developing world" from the beginnings of tropical medicine. We will trace this history through its many permutations from the establishment of colonial health services to the development of the Global Programme on AIDS. In doing so, we will explore the various economic and political interests and underlying cultural assumptions that have shaped the development of ideas and practices associated with international health and development.

Hist 644 - War, Technology and Society, 1500-1914 (3 credits)
Examines key themes in the interrelationship between warfare, technology and society from the beginnings of modern warfare until World War I. Primary emphasis placed on the historical connections between violent conflict, the technical means by which it is carried out, and the socio-political environment within which wars take place. The effect of technology upon war and considerations of the effect of war on technological change and development. Samples the rich tradition of thought and ideas

produced by philosophers and theorists on these themes.

Hist 645 - American Legal History to 1860 (3 credits)
Readings and discussion on the legacy of common law after the Revolution; the emergence of legal instrumentalism; and the evolution of tort, contract, and damages in the context of industrialism and economic growth. **Effective From: Fall 2010**

Hist 650 - History of American Conservatism (3 credits)
This course examines postwar American conservatism through classic works and contemporary studies. Topics include the rise of conservatism, groups under the conservative umbrella, and the rise of the right as related to key events in postwar history (Cold War, McCarthysim, the '60s, the suburbs and urban change). Course interrogates postwar conservatism with respect to American political and intellectual history and in relation to histories of gender, race, class, sexuality, place and religion. **Effective From: Fall 2010**

Hist 652 - Topics in the History of Technology (3 credits)
Selected topics in the history of technology. **Effective From: Fall 2010**

Hist 653 - Topics in European Intellectual & Cultural History (3 credits)
Examination of issues and methods in European intellectual and cultural history, with a consideration of some leading problems in the field. **Effective From: Fall 2010**

Hist 654 - Topics in American Intellectual & Cultural History (3 credits)
Examination of issues and methods in American intellectual and cultural history, with a consideration of some leading problems in the field **Effective From: Fall 2010**

Hist 655 - Topics in American Urban and Ethnic History (3 credits)
Examination of issues and methods in American urban and ethnic history, with a consideration of some leading problems in the field. **Effective From: Fall 2010**

Hist 656 - Topics in the History of Health (3 credits)
Selected topics in the history of Health. **Effective From: Fall 2010**

Hist 657 - Topics in Environmental History (3 credits)
Selected topics in environmental history. **Effective From: Fall 2010**

Hist 658 - Topics in American Legal History (3 credits)
Readings and discussion on the growth of legal formalism, the evolution of substantive due process, changes in legal education and the legal profession, and the evolution of private law. **Effective From: Fall 2010**

Hist 660 - The Enlightenment in Britain (3 credits)
The 18th century was the age of the Enlightenment. Great Britain became a unified polity and the most powerful imperial force in the world. We examine the Enlightenment in Britain against the backdrop of war and empire, imperial consumer culture, the growth and significance of sociability and politeness, representations of gender, the writing of cultural history, social uses of science/technology, print culture, and competition among varying notions of ethnic identity. **Effective From: Fall 2010**

Hist 661 - Problems & Readings in European History since 1850 (3 credits)
Introduction to the major historiographical problems and recent literature in European history since 1850. **Effective From: Fall 2010**

Hist 662 - Prob. & Read: Hist/US Foreighn Policy and Diplomacy (3 credits)
Examination of issues and methods in American diplomatic history, with a consideration of some leading problems in the field. **Effective From: Fall 2010**

Hist 663 - Problems & Readings in American History, 1492-1789 (3 credits)
Introduction to the major historiographical problems and recent literature in American history rom 1492 to 1789. **Effective From: Fall 2010**

Hist 664 - Problems and Readings in American History, 1789-1865 (3 credits)
Introduction to the major historiographical problems and recent literature in American history from 1789 to 1865. **Effective From: Fall 2010**

Hist 665 - Problems & Readings in American History, 1865-1914 (3 credits)
Introduction to the major historiographical problems and recent literature in American history from 1865 to 1914. **Effective From: Fall 2010**

Hist 666 - Problems & Readings in American History, 1890-1945 (3 credits)
Introduction to the major historiographical problems and recent literatue in American history from 1890 to 1945. **Effective From: Fall 2010**

Hist 667 - Problems & Readings in American History, 1945-Present (3 credits)
Introduction to the major historiographical problems and recent literature in American history since 1945. **Effective From: Fall 2010**

Hist 701 - Master's Thesis (6 credits)
Prerequisite: permission of graduate history advisor. For students writing a master's thesis in the history of technology, environment and medicine.

Hist 702 - Master's Essay (3 credits)
For those who don't write a 6 credit thesis, the 3 credit Master's Essay caps the M.A./M.A.T. A substantial work done with an advisor, may be: 1. Interpretive historical essay based on primary source research. 2. Narrative history based on primary source research. Prereq: R510:504, R510:505, or R510:506. 3. Historiographical essay. 4. Content-focused curriculum design, either a course or significant portion thereof. 5. Design for an historical museum exhibition/other work in public history. Prereq: R510:565 **Effective From: Fall 2010**

Hist 725, Hist 726, Hist 727 - Independent Study in History (3 credits)
Prerequisites: permission of graduate history advisor and course instructor.

Hist 791 - Seminar in History of Technology, Environment and Medicine (Non-credit)
Faculty, students and invited speakers present and discuss current topics of research in history, technology and medicine.

R510:520 - Topics in the History of Technology (3 credits)
For more details go to Rutgers Catalog.

R510:525 - Colloquium in the History of Women (3 credits)
For more details go to Rutgers Catalog.

R510:526 - Problems and Readings in Afro-American History (3 credits)
For more details go to Rutgers Catalog.

R510:547 - Comparative World Colonialism (3 credits)
For more details go to Rutgers Catalog.

R510:548 - Topics in the History of the American Environment (3 credits)
For more details go to Rutgers Catalog.

R510:559 - Cities in Change I (3 credits)
For more details go to Rutgers Catalog.

R510:560 - Cities in Change II (3 credits)
For more details go to Rutgers Catalog.

R510:566 - American Historiography (3 credits)
For more details go to Rutgers Catalog.

R510:569 - American Legal History to 1860 (3 credits)
For more details go to Rutgers Catalog.

R510:570 - Topics in American Legal History (3 credits)
For more details go to Rutgers Catalog.

R510:571 - Introduction to Historical Method (3 credits)
For more details go to Rutgers Catalog.

R510:572 - Philosophy of History (3 credits)
For more details go to Rutgers Catalog.

R510:576 - Problems and Readings in American History, 1492-1789 (3 credits)
For more details go to Rutgers Catalog.

R510:577 - Problems and Readings in American History, 1789-1865 (3 credits)
For more details go to Rutgers Catalog.

R510:581 - Problems and Readings in American History, 1865-1912 (3 credits)
For more details go to Rutgers Catalog.

R510:583 - Problems and Readings in American History, 1912-1945 (3 credits)
For more details go to Rutgers Catalog.

R510:585 - Problems and Readings in American History, 1945 to Present (3 credits)
For more details go to Rutgers Catalog.

R510:618 - Seminar: Teaching of History (3 credits)
For more details go to Rutgers Catalog.

R510:669 - Business and Government in the Twentieth Century I (3 credits)
For more details go to Rutgers Catalog.

R510:670 - Business and Government in the Twentieth Century II (3 credits)
For more details go to Rutgers Catalog.

R510:695 - Individual Studies in History (3 credits)
For more details go to Rutgers Catalog.

R510:696 - Advanced Individual Studies in History (3 credits)
For more details go to Rutgers Catalog.

Humanities: Humanities

UNDERGRADUATE COURSES:

HUM 099 - English Composition: Reading, Writing, Speaking I (3-0-3)
Prerequisite: None. Focuses on developing the reading and writing skills necessary for success in a college curriculum. Emphasizes structuring and organizing effective sentences and paragraphs; drafting and revising; preparing summaries; building vocabulary; developing grammatical fluency; formulating a thesis, and other steps toward writing expository essays. Mandatory writing workshops are held in conjunction with the course work. **Effective From: Spring 2009**

HUM 099S - English Composition: Reading, Writing, Speaking I (6-0-6)
Prerequisites: None, unless placement test result requires ENG 095. The first course of the two-semester composition sequence HUM 099S-HUM 100-SL. Intended for students 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. **Effective From: Fall 2011**

HUM 100 - English Composition: Reading, Writing, Speaking II (3-0-3)
Prerequisite: HUM 099S. The second course of the two-semester sequence, HUM 099S-HUM 100SL. Focuses on essay writing strategies, clear expression, correct syntax, grammar and diction; basic organizational principles, researching ideas, documenting reference sources, reading longer, more complex material, determining flaws in an argument, and presenting group oral reports. Mandatory weekly writing labs are held in conjunction with course work. The sequence HUM 099-HUM 100 satisfies the English GUR. **Effective From: Fall 2005 Until: Fall 2008**

HUM 101 - English Composition: Writing, Speaking, Thinking I (3-0-3)
Entrance is determined by placement test score or completion of Hum 099 with a grade of C or better. Focuses on developing written and oral communication skills; emphasizes writing expository and research essays; preparing oral reports; drafting, revising, editing; evaluation and proper documentation of source material; using rhetorical strategies such as narration and argument. **Effective From: Spring 2009**

HUM 102 - English Composition: Writing, Speaking, Thinking II (3-0-3)
Prerequisite: HUM 101 with a grade of C or better. Focuses on enhanced written and oral communication skills; emphasizes reading and interpretation of literary forms; critical analysis; methods of research using print and on-line sources; report writing and writing about literature. **Effective From: Spring 2009**

HUM 211 - The Pre-Modern World (3-0-3)
Prerequisite: HUM 101 and HUM 102 with a grade of C or better. 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 three credits of the GUR in Cultural History. **Effective From: Fall 2011**

HUM 212 - The Modern World (3-0-3)
Prerequisite: HUM 101 and HUM 102with a grade of C or better. 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 3 credits of the Cultural History GUR. Honors Note: See HUM 101. **Effective From: Fall 2011**

HUM 251 - Ethical Issues in Business (3-0-3)
Prerequisite: HUM 101 with a grade of C or better. 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? **Effective From: Spring 2009**

HUM 325 - Humanities Special Topics (3-0-3)

Prerequisite: Varies according to topic. The study of new and/or advanced topics in an area of the humanities, not regularly covered in any other HUM, LIT, ENG OR HSS course at the 300-level. 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. **Effective From: Spring 2009**

GRADUATE COURSES:

HUM 100-SL - English Composition: Reading, Writing, Speaking II (3-0-3)
Prerequisite: Completion of HUM 099S with a grade of C or better. The second course of the two-semester ESL composition sequence HUM 099S-HUM 100-SL. Continues strengthening English language proficiency, at a more advanced level, with work in vocabulary building, grammar, editing, as well as oral presentations. Includes longer, more complex readings; practice in determining flaws in arguments; writing longer, more substantive text-based essays. Introduction to information literacy. Weekly tutorials. The sequence HUM 099S-HUM 100SL satisfies the English Composition GUR. **Effective From: Fall 2011**

usys 702 - Evolution American Metropolis (3-0-3)
This course introduces the morphological and cultural evolution of the US metropolis, historical and economic, political, geographic, contemporary perspectives. The emphasis is on the intersection of social, and environmental conditions that gave rise to distinct urban areas and that have influenced urban populations for over three centuries. A chronological overview of the settlement, growth, decline and revitalization of American cities is combined with detailed case studies. **Effective From: Fall 2011**

usys 792 - Dissertation Research (3-0-3)
Prerequisites: Permission of Track Director. For students admitted to the Doctor of Philosophy Program in Urban Systems who have not yet passed the qualifying examination. Research is carried out under the supervision of designed Urban Systems faculty. If the student's research activity culminates in doctoral research in the same area, up to a maximum of 6 credits may be applied to the 24 credits required under USYS 790. **Effective From: Fall 2011**

Humanities and Social Sciences: Offered by the Department of Humanities and Social Sciences.

UNDERGRADUATE COURSES:

HSS 099 - English Composition: Reading, Writing, Speaking I (3-0-3 additive credit)
The first course of the two-semester sequence, HSS 099-HSS 100. Focuses on the reading, writing and speaking skills necessary for success in a university curriculum. Emphasizes reading strategies, understanding main ideas, classifying ideas according to their importance, inferring meaning, vocabulary development, preparing written and oral summaries, developing a thesis, and other steps toward writing expository essays including a research essay. Mandatory weekly writing labs are held in conjunction with the course work. **Effective Until: Summer 2005**

HSS 099S - English Composition: Reading, Writing, Speaking I (6-0-6 additive credit)
The first course of the two-semester sequence, HSS 099S-HSS 100S. Intended for students for whom English is a second language. Focuses on the reading, writing and speaking skills necessary for success in a university curriculum, while strengthening English language proficiency. Emphasizes reading strategies, understanding main ideas, vocabulary development, grammar, developing a thesis, organizing an essay, and writing different kinds of expository essays, including a research essay. Mandatory weekly writing labs are held in conjunction with the course. **Effective Until: Summer 2005**

HSS 100 - English Composition: Reading, Writing, Speaking II (3-0-3)
Prerequisite: HSS 099. The second course of the two-semester sequence, HSS 099-HSS 100. Focuses on essay writing strategies, clear expression, correct syntax, grammar and diction; basic organizational principles, researching ideas, documenting reference sources, reading longer, more complex material, determining flaws in an argument, and presenting group oral reports. Mandatory weekly writing labs are held in conjunction with course work. The sequence HSS 099-HSS 100 satisfies the English GUR. **Effective Until: Summer 2005**

HSS 100S - English Composition: Reading, Writing, Speaking II (3-0-3)
Prerequisite: HSS 099S. The second course of the sequence, HSS 099S-Hss 100S. Continues the development of English language proficiency at a more advanced level and focuses on essay writing strategies, clear expression, correct syntax, grammar and diction, basic organizational principles, research ideas, documenting reference sources, reading longer complex material, and presenting oral reports. Mandatory weekly writing labs are held in conjunction with the course work. The sequence HSS 099S-HSS 100S satisfies the English GUR. **Effective Until: Summer 2005**

HSS 101** - English Composition: Writing, Speaking, Thinking (3-0-3)**
Provides instruction in written and oral communication in the context of the first-year curricula. Emphasizes critical thinking as essential in producing effective expository writing, with readings and writing assignments drawn from the Humanities, Engineering, and the Social and Natural Sciences. Placement in this course is based on performance on standardized composition and reading tests. This course satisfies the English GUR. Note: Special Honors sections are available; permission of Honors College or Humanities Department required. **Effective Until: Summer 2005**

HSS 202** - Society, Technology, and Environment (3-0-3)**
Prerequisite: HSS 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. **Effective Until: Fall 2006**

HSS 211** - The Pre-Modern World (3-0-3)**
Prerequisite: HSS 101. Compares and contrasts world cultures prior to 1400. 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 three credits of the GUR in Cultural History. **Effective Until: Summer 2005**

HSS 212 - The World and the West (3-0-3)
Prerequisite: HSS 101. The central theme is changing global relations between 1400 and 1900. 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 3 credits of the Cultural History GUR. Honors Note: See HSS 101. **Effective Until: Summer 2005**

HSS 251 - Ethical Issues in Business (3-0-3)
Prerequisite: HSS 101. 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. **Effective Until: Summer 2005**

HSS 401- 402 - Independent Studies in Humanities (3-0-3)
Prerequisites: HSS 101; completion of the Cultural History GUR (6 credits); permission of instructor. Pursue areas of special interest in humanities not covered in regular electives. Students are assigned readings and write reports under the guidance of a member of the humanities faculty. **Effective Until: Summer 2005**

HSS 403 - Humanities Senior Seminar - Literature (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Completion of either the Lit/Hist/Phil/STS or the Open Elective in Humanities and Social Science, with a grade of C or better. 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. **Effective From: Spring 2009**

HSS 404 - Humanities Senior Seminar - History (3-0-3)
Prerequisites: HUM 102 and one one from among HUM 211, HUM 212 and HIST 213 or their equivalents, all with a grade of C or beter. Completion of either the Lit/Hist/Phil/STS or Open Elective in Humanities and Social Science, with a grade of C or better. 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. **Effective From: Fall 2012**

HSS 405 - Humanities Senior Seminar - Philosophy (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better; completion of either the Lit/Hist/Phil/STS or the Open Elective in Humanities and Social Science, with a grade of C or better. 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. **Effective From: Spring 2009**

HSS 406 - Humanities Senior Seminar - English (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better; completion of either the Lit/Hist/Phil/STS or the Open Elective in Humanities and Social Science, with a grade of C or better. 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. **Effective From: Spring 2009**

HSS 407 - Humanities Senior Seminar - Theater (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better; completion of either the Lit/Hist/Phil/STS or the Open Elective in Humanities and Social Science, with a grade of C or better. 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. **Effective From: Spring 2009**

HSS 408 - Humanities Senior Seminar - Science, Technology, and Society (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better; completion of either the Lit/Hist/Phil/STS or the Open Elective in Humanities and Social Science, with a grade of C or better. 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. **Effective From: Spring 2009**

HSS 409 - Humanities Senior Seminar - Social Science (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Basic Social Sciences (6 credits) and either the Lit/Hist/Phil/STS (3 credits) or the Open Elective in Humanities and Social Science (3 credits). The remaining 300-level course may be taken as a co-requisite of the seminar. 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. **Effective From: Summer 2007**

HSS 491- HSS 499** - Humanities Senior Seminar - Honors (3-0-3)**
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better; completion of either the Lit/Hist/Phil/STS or the Open Elective in Humanities and Social Science, with a grade of C or better. The subjects are announced at the time of registration. Each seminar is limited to 16 students. These courses satisfy the Capstone Seminar in Humanities and Social Science Electives GUR for students enrolled in the honors college only. **Effective From: Spring 2009**

**** Special Honors sections are available; permission of Honors College or Humanities Department required.

Human Resource Management : Offered by the School of Management. See Management course list for faculty.

UNDERGRADUATE COURSES:

HRM 301 - Organizational Behavior (3-0-3)
Prerequisite: upper division 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 (3-0-3)
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 305 - Supervision and Employee Relations (3-0-3)
The nature of supervision, particularly at the first line. Qualifications, duties, and responsibilities of supervisors. Planning the job, making work assignments, progressing, and controlling employees. Techniques of employee relations, such as conducting job instruction, maintaining discipline, appraising performance, and handling grievances. The supervisor's interrelationships with upper management and labor union representatives. The conference method and case study techniques are utilized.

HRM 310 - Managing Diversity in Organizations (3-0-3)
Analyzes issues that arise in managing a diverse work force. After examining the demographic environment of contemporary organizations, significant attention is paid to developing strategies to recruit, train, motivate, and retain employees with diverse personal characteristics. While the emphasis is on developing broad-based interpersonal skills, the impact of federal and state laws and regulations is also studied. In addition, students examine the implications of technological developments for managing a diverse population (e.g., the use of new technologies in retaining the differently abled).

HRM 311 - Job and Work Environments (3-0-3)
Prerequisite: HRM 301. The effect of job and work environments on the individual and on the organization. Covers fit between the worker and the workplace including issues such as: the micro environment of job layout and design, physical conditions of the workplace, the social environment of work, and macro environments of the workplace within a regional context.

HRM 407 - Social Insurance and Employee Benefits (3-0-3)
Prerequisites: Econ 265 and Econ 266, or SS 201. The causes of economic insecurity in an urban, industrial society and the personal and social consequences. Social Security, unemployment insurance, workers compensation, public assistance, and other government programs. Private programs of employee benefits. Analysis of trends in coverage, benefits, and benefit levels, and the impact of demographic, economic, and technological developments on the viability of present and proposed programs.

HRM 411 - Employee Training and Development (3-0-3)
Prerequisite: HRM 303. Training and development is studied from the standpoint of employee contributions to gaining competitive advantage, with an emphasis on firms in technology-intensive industries. Topics include needs analysis, skills utilization, design and delivery of training programs, manpower planning, and employee development.

HRM 415 - Organizational Design and Development (3-0-3)
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 (3-0-3)
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. **Effective From: Fall 2009**

GRADUATE COURSES:

HRM 601 - Organizational Behavior (3 credits)
Analysis of key organizational components; individual perception; learning ability; conflict resolution models; group processes in decision making; motivation; problem diagnosis, and the organization as the mechanism for joining into a coherent productive system. Organizational assessment for innovation, leadership styles, and environmental interaction.

HRM 605 - Managing High Performance Work Teams (3 credits)
Developing and managing high performance is central to fostering the innovation and process improvements that are necessary to respond to competitive pressures. This course covers all aspects of building and managing high performance work teams. Case studies and experimental learning are used to reinforce theory and established best practices.

HRM 606 - Human Resource Management (3 credits)
Management of human resources in business, industry, and government; developing personnel programs including wage and job classification, training, employee and labor relations, and accident prevention. Particular attention is directed to cases and roles involving both line and staff managers.

HRM 607 - Personnel and Evaluation Research (3 credits)
Focuses on the assessment and improvement of personnel systems. Emphasis is on the use of diagnostic tools in problem identification, developing action plans, and assessing outcomes of HRM interventions. Special attention is given to survey methodology and to the use of assessment tools in conducting personnel research. Databases and statistical software packages are used in project work.

HRM 608 - Behavioral Issues in Transportation Studies (3 credits)
Behavioral science concepts and principles such as perception, learning, motivation, and information processing as they relate to: transportation, consumer use of mass transit, automobiles, ridesharing and intelligent transportation systems. Same as Tran 608.

HRM 609 - Employee Development and Training (3 credits)
Key concepts in training including needs analysis, curriculum design and delivery, managing external consultants, and the evaluation of off-site training programs are introduced to gain understanding of the training function in organizations. Emphasis is on the impact of technological changes on employee skills utilization and development; training as a means of sustained competitive advantage for technology-based organizations; and the effects of technological advances on the design and delivery of training programs.

HRM 610 - Seminar on Leadership Skills (3 credits)
Leadership theory and research is used to provide a foundation for developing leadership skills in work organizations. This course covers all aspects of leadership properties and processes. Concepts and theory are reinforced with case studies and experiential learning exercises. Topics include charismatic leadership, forming and realizing a vision, motivating and socializing followers, conflict resolution, negotiation, power and authority, and values and ethics.

HRM 616 - Job Analysis and Design (3 credits)
Analyzing and designing jobs in work organizations, particularly technology-based organizations. Principles of job analysis and job design are applied to the allocation of tasks in organizations. Draws upon theory and research from industrial and organizational psychology, organizational sociology, social psychology, industrial engineering and occupational medicine.

HRM 630 - Managing Technological and Organizational Change (3 credits)
Managing planned and unplanned change in organizations. The change process is studied in relation to technology-driven changes in the workplace and to other environmental factors. Focuses on planned and unplanned systemic change, such as downsizing, re-engineering, mergers, and acquisitions. **Effective From: Spring 2011**

HRM 640 - Cultures in Organizations (3 credits)
Prerequisite: HRM 601. Cultures and subcultures in organizations are studied from an ethnographic perspective. Managerial and professional cultures are studied as are engineering and R&D cultures. Organizational cultures are also studied in detail using case studies, with an emphasis on understanding culture as a control mechanism in modern organizations.

HRM 650 - Human Resource Information Systems (3 credits)
Information systems as a tool in improving human resource functions in organizations. Emphasis is on the design of information systems and their applications to HRM problems. The course is applications oriented. A technical MIS background is not required.

HRM 655 - Theory and Research in Organizational Behavior (3 credits)

Prerequisite: permission of the instructor. Survey of theory and empirical research on the behavior of individuals in organizations. Foundation in theories and concepts of organizational behavior, organizational psychology, and social and individual psychology. Read critically and evaluate classic works in these areas.

HRM 660 - HRM Issues in Technology-Based Organizations (3 credits)
Prerequisite: HRM 606. An interactive course that emphasizes the special problems faced by organizations that include a high percentage of technically trained professional employees. Linkages between HRM functions are examined and then built upon to develop a strategic plan for the firm's human resources. Special attention is directed toward the needs of technology-based organizations such as building technical skills aimed at maintaining competitive advantage; managing innovation; assessing employee skills bases company-wide; cross training; and fostering organizational learning. Case studies and comparative analyses are used extensively.

HRM 662 - Organizational Diagnosis and Development (3 credits)
A problem-oriented approach to organizational development with a focus on improving work group and organizational performance. Diagnostic tools are introduced as a means of problem definition. Attention then turns to structural and process issues in organizational development. Issues with respect to technology and structure are also examined. Emphasis is primarily on the internal organization. Representative topic areas include self-managed work teams, empowerment strategies, work group structures and technologies, and conflict resolution strategies. Development also covers quality of work life issues.

HRM 670 - Advanced Issues in Resource Management (3 credits)
Prerequisite: permission of the instructor. A research-based course that studies current issues in HRM. Course is designed for students in the Rutgers-Newark Ph.D. program.

HRM 685 - Cross Cultural Management Studies (3 credits)
Provides insight into the institutional fabric and social and communication behavior of other cultures to better understand problems arising from cultural aspects of managing and doing business in various countries. Focus will be with the manager acting in various cultural environments, not restricted to the traditional human resource function at corporate headquarters. Cultural differences and technologies are also examined.

HRM 693 - Employment Relationships and the Law (3 credits)
Legal issues in government regulation of labor-management relations: selection and designation of bargaining agents; administration and enforcement of collective bargaining agreements; activities of unions and employers in labor disputes; and laws regulating wages, hours, and benefits.

HRM 700 - Project in Human Resource Management (3 credits)
Prerequisites: matriculation and advisor's approval. Comprehensive proposal for a program of human resource management; or a major component of a management program applied to an organization chosen by the student, including a design for recruitment, selection, OSHA, benefits services, and/or training program with an evaluation procedure. Another alternative is a comprehensive evaluation of existing human resource programs, including human resource plans and personnel operations requiring cost-benefit analysis. Students select an acceptable organization on which to base their proposal plans.

HRM 701 - Thesis in Human Resource Management (6 credits)
Prerequisites: matriculation for the master's degree, adequate graduate courses in the field of proposed research, and research advisor's approval. Thesis may be developmental experience at an appropriate professional level, or a scholarly research paper providing useful data and/or conclusions for other professionals interested in further study. A student must register for a minimum of 3 credits per semester. Credit will be limited, however, to the 6 credits indicated.

Industrial Design: Offered by the School of Art + Design

UNDERGRADUATE COURSES:

ID 155 - Drawing for Design (0-6-3)
Concerned with drawing as a means of communication, this course exposes the student to techniques, mediums and materials used to represent concepts quickly and effectively. Free hand, isometric and perspective drawing will be explored as well as basic applications of both dry and wet medium and graphic composition. **Effective From: Fall 2007 Until: Fall 2011**

ID 156 - Drawing for Design II (0-6-3)
Prerequisite: ID 155. This course will implement and build the skills acquired in ID 155 as well as introduce common graphic techniques used in the industrial design profession such as, shade, shadow, transparency and background. Students will explore mediums such as colored pencil, marker, painting, collage, pastel, pen and digital media. The course will also concentrate on advanced graphic composition and explore drawing and graphics as a means of "story-telling". **Effective From: Spring 2008 Until: Fall 2011**

ID 160 - Principles of 3D Form I (0-4-3)
No prerequisite required. Through a series of abstract drawings and models, this course will explore the elements, relationships and visual organizations of which the three-dimensional world is comprised. Students will create abstract linear, planar and volumetric forms that focus on balance, order, scale and proportion. **Effective From: Fall 2007 Until: Fall 2011**

ID 161 - Principles of 3D Form II (0-4-3)
Prerequisite: ID 160. This course will build on the three-dimensional vocabulary acquired in ID 160. Functionality and ergonomics will be added to the discussion as a means of moving from the sculptural to the useful without compromising aesthetics. **Effective From: Spring 2008 Until: Fall 2011**

ID 163 - Design Fundamentals I (0-8-4)
No prerequisite required. This course exposes the students to the fundamental processes, techniques and mehtods involved in the design process with a concentration on skill building. Through a series of focused exercises, students will inspire, nurture and execute their ideas through research, drawing and model making. Students will explore new ways of seeing, engaging and manipulating their environment. **Effective From: Fall 2007 Until: Fall 2011**

ID 164 - Design Fundamentals II (0-8-4)
Prerequisite: ID 163. This course is a continuation of ID 163 where skills will be further honed and developed. Exercises will broaden in scope and complexity with a focus on research and creative problem solving methodologies. **Effective From: Spring 2008 Until: Fall 2011**

ID 201 - Human Factors/Ergonomics (3-0-3)
Prerequisite: Sophomore level or higher. 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. **Effective From: Spring 2008 Until: Spring 2009**

ID 203 - Past, Present and Future of Design (3-0-3)
Prerequisite: 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. **Effective From: Fall 2007**

ID 216 - Modeling and Prototyping (3-0-3)
Prerequisite: Sophomore level or higher. Corequisite: ID 263. 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. **Effective From: Spring 2011**

ID 217 - Modeling and Manufacturing (3-0-3)
Prerequisite: ID 216. Corequisite: ID 264. 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. **Effective From: Spring 2011**

ID 220 - Color and Surface (3-0-3)
Prerequisite: Sophomore level or higher. The physics, physiology and psychology of color will be discussed as well as experiments with the application of hue, texture and pattern on two-dimensional surfaces and three-dimensional objects. Studies and observations in function, behavior, style and meaning as it pertains to color and surface treatment will be emphasized. **Effective From: Spring 2008 Until: Fall 2011**

ID 263 - Industrial Design Studio I (0-8-4)
Prerequisite: AD 111 and AD 112. Pre/Corequisite: AD 150. 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. **Effective From: Spring 2011**

ID 264 - Industrial Design Studio II (0-8-4)
Prerequisite: AD 150 and ID 263. 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. **Effective From: Spring 2011**

ID 301 - Industrial Design Specialization (3-0-3)
Prerequisite: Co-registration in ID 363 (or higher) or INT 363 (or higher) with 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. **Effective From: Fall 2010**

ID 302 - Design Elective - Specialization (3-0-3)
Prerequisite: Junior level or higher. This studio based elective course will expose the student to one of many specialties within the Industrial Design profession including industry-specific design explorations and case studies such as furniture, product, toy, sneaker, lighting, exhibit, tabletop, transportation, apparal, etc. **Effective From: Spring 2009 Until: Fall 2011**

ID 310 - Ethnographic and Marketing Research (3-0-3)
Prerequisite: 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. **Effective From: Fall 2008**

ID 312 - Mechanics and Electronics (3-0-3)
Prerequisite: Junior level or higher. 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. **Effective From: Spring 2009**

ID 330 - Human Ecology in Culture (3-0-3)
Prerequisite: Junior level or higher. This course will take an anthropological view of the objects, experiences and environments that represent the cultures we belong to and interact with. Value systems, beliefs and rituals, as well as design semantics and semiotics will be explored within various cultures and subcultures. The student will explore the meanings, perceptions and symbolisms applied to the fashions, technologies and tools comprising the human ecology. **Effective From: Fall 2008 Until: Fall 2011**

ID 340 - Materials and Processes (3-0-3)
Prerequisite: 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. **Effective From: Spring 2009**

ID 341 - Sustainable Materials and Processes (3-0-3)
Prerequisite: 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. **Effective From: Spring 2009**

ID 363 - Industrial Design Studio III (0-8-4)
Prerequisite: 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. **Effective From: Fall 2008**

ID 364 - Industrial Design Studio IV (1-12-5)
Pre and Co-requisite: ID 216, ID 363, AD201. 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. **Effective From: Spring 2012**

ID 370 - New Product Testing (3-0-3)
Prerequisite: AD 201 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. **Effective From: Fall 2012**

ID 401 - Design Elective (3-0-3)
Prerequisite: Senior level. Students will be able to select from various seminar/lecture options; industry-specific design explorations; case studies of living industrial designers; seminars with industrial designers of stature; performative strategies of industrialized products from architecture to automobiles; cost-control and estimating production costs of the designed product; advanced portfolio design and presentation techniques. **Effective From: Fall 2009 Until: Fall 2011**

ID 402 - Design Elective (3-0-3)
Prerequisite: Senior level. Students will be able to select from various seminar/lecture options; industry-specific design explorations; case studies of living industrial designers; seminars with industrial designers of stature; performative strategies of industrialized products from architecture to automobiles; cost control and estimating production costs of the designed product; advanced portfolio design and presentation techniques. **Effective From: Spring 2010 Until: Fall 2011**

ID 410 - Professional Practice and Ethics (3-0-3)
Prerequisite: 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. **Effective From: Fall 2009**

ID 461 - Pre-Comprehensive/Thesis Research ((1.5-0-1)
Prerequisite: Senior level. This course allows students to identify what type of project they wish to design in the Comprehensive/Thesis Studio. Projects are expected to be ambitious, worthwhile, and innovative. Students must validate the feasibility of their selection through intensive research into the history of their selected project, its current practitioners, ethnographic research, ergonomic research, marketing successes and deficiencies, evaluation of existing performance date, etc. Effective **Effective From: Fall 2009 Until: Fall 2011**

ID 463 - Industrial Design Studio V (0-12-5)
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. **Effective From: Fall 2009**

ID 464 - Industrial Design Studio V (1-12-5)
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 presentaion materials are expected to be exhibitable quality. **Effective From: Fall 2013**

Industrial Engineering: Offered by the Department of Industrial and Manufacturing Engineering

UNDERGRADUATE COURSES:

IE 101 - Introduction to Industrial Engineering (1-1-1)
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 (1-2-2)
Prerequisites: CIS 101, FED 101C and FED 101D. Areas of graphical communication germane to manufacturing and production are stressed. Provides mathematical and practical knowledge of graphical standards necessary to meet the requirements of today's industrial engineering practices. Introduction to the use of up-to-date software for computer-aided graphics, databases, spreadsheet, general programming, statistical analysis. Also, ProEngineer, Database, Lotus, Fortran/C/ Pascal, and SAS.

IE 224 - Production Process Design (2-2-3)
Prerequisite: 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 (zero credits)
Prerequisites: 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 (3-0-3)
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 (3-0-3)
Prerequisite: 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 (3-0-3)
Prerequisite: 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 (2-2-3)
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 (3-0-3)
Prerequisite: 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 degree credits)
Prerequisites: IE 310, 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 **Effective From: Spring 2013**

IE 436 - Cost Analysis and Engineering Economics (3-0-3)
Prerequisite: 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 (3-0-3)
Prerequisite: Math 222 or equivalent. 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 (3-0-3)
Prerequisites: IE 331, Math 222 or their equivalent. 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 (3-0-3)
Prerequisite: 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 (1-3-2)
Prerequisite: senior standing. Introduction to senior design project. Selection of specific system design for the project, establishment of initial contacts, preliminary collection and analysis of system data. Concepts of system design analysis emphasizing simulation modeling and analysis, model verification, and model validation.

IE 444 - Senior Project II (2-2-3)
Prerequisite: IE 443. Senior design project, in which the concepts of industrial engineering systems, principles, and procedures are integrated and applied in industrial projects or case studies.

IE 445 - Idustrial Simulation (2-2-3)
Prerequisites: CIS 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 (3-0-3)
Prerequisite: 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 (2-2-3)
Prerequisites: CIS 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 (3-0-3)
Prerequisite: 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 (2-2-3)
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 (2-2-3)

Prerequisite: 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 (2-2-3)
Prerequisites: 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. **Effective From: Spring 2009**

IE 456 - Introduction to Industrial Hygiene (3-0-3)
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 - Production Planning and Control (3-0-3)
Prerequisites: IE 221, IE 439, junior or senior standing. 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 (3-0-3)
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 (3-0-3)
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 (2-1-3)
Prerequisite: 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. **Effective From: Spring 2010**

IE 466 - Material Handling and Facilities Layout (3-0-3)
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 (3-0-3)
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 (3-0-3)
Prerequisite: 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 (3-0-3)
Prerequisite: 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 (3-0-3)
Prerequisite: 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 (3-0-3)
Prerequisites: 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 481H - Investigations in Industrail Engineering I (3-0-3)
Prerequisites: junior or senior standing, permission of the IE faculty advisor, enrolled in Honors College. Same as IE 481, but investigation is in more comprehensive and in greater depth.

IE 482 - Investigations in Industrial Engineering II (3-0-3)
Prerequisites: IE 481, permission of the IE faculty advisor. Further individual investigations, a continuation of IE 481.

IE 482H - Investigations in Industrial Engineering II (3-0-3)
Prerequisites: IE 481, permission of the IE faculty advisor. Further individual investigations, a continuation of IE 481H.

IE 492 - Engineering Management (3-0-3)
Prerequisite: 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.

IE 492H - Engineering Management (3-0-3)
Prerequisite: junior or senior standing and enrolled in Honors College. Same as IE 492, but topics are treated more comprehensively and in greater depth.

GRADUATE COURSES:

IE 501 - Fundamentals of Industrial Engineering (3 credits)
Basic concepts of industrial engineering for students who lack an undergraduate degree in the discipline, including: manufacturing processes, work methods and measurement concepts, basics of human factors, quality control, facilities design, production planning, operations research tools, and simulation models.

IE 590 - Graduate Co-op Work Experience I (3 additive credits)
Prerequisites: permission from the industrial engineering program director and the Division of Career Development Services. Cooperative education internship providing on-the-job reinforcement of academic programs in industrial engineering. Work assignments and projects are developed by the co-op office in consultation with the industrial engineering program director. Work assignments are related to student's major and are evaluated by faculty coordinators in the IE department. Course cannot be applied toward degree credit.

IE 591 - Graduate Co-op Work Experience II (3 additive credits)
Prerequisite: permission from the industrial engineering program director and the Division of Career Development Services. Course cannot be applied toward degree credit.

IE 592 - Graduate Co-op Work Experience III (3 additive credits)
Prerequisites: graduate standing and permission from the industrial engineering program director, and the Division of Career Development Services. Course cannot be applied toward degree credit.

IE 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

IE 601 - Measurement Methods for Performance Analysis of Operations (3 credits)
Prerequisite: undergraduate mathematics for management science, or EM 602. Quantitative study of various analytical methods for designing and evaluating systems employed in the management of complex enterprises such as decision-making, efficiency measurement, and methods for obtaining optimal system performance.

IE 603 - Behavioral Science in Engineering Organization (3 credits)
Prerequisite: undergraduate probability and statistics, or EM 503. A study of scientific research on human behavior in organizations. Processes and problems of communication in engineering activities; line-staff and supervisor-subordinate relationships; formal and informal organizations; organization models; and technical and social structure of organizations.

IE 604 - Advanced Engineering Statistics (3 credits)
Prerequisite: IE 331 (see undergraduate catalog for description) or equivalent. The foundations of modern quality improvement, scientific basis of quality engineering, probability, statistical inference, statistical experimental design issues such as randomized blocks, factorial design at different levels, application to factorial design, building models, and implementation and critique of Taguchi's contributions. Statistical software is used in the data analysis.

IE 605 - Engineering Reliability (3 credits)
Prerequisite: statistics. Concepts of modern reliability applied to practical industrial problems: statistical concepts, reliability through design, reliability through testing, analysis of reliability data, and the organization and management of a reliability program. Offered alternate years.

IE 606 - Maintainability Engineering (3 credits)
Prerequisite: statistics. Factors affecting maintainability design applied to military and industrial problems: statistical concepts; maintainability prediction, allocation, and demonstration; availability, system and costeffectiveness; provisioning; optimal maintenance policies; and management of a maintainability program.

IE 608 - Product Liability Control (3 credits)
Product liability and the effect of legal doctrines on minimizing hazards of design and manufacture. Use of actuarial techniques and legal precedents applicable to design, manufacturing, advertising, and marketing problems: warranties, notices, disclaimers, definition of liability, use of expert witnesses, reliability prediction and analysis methods, safety engineering concepts, and design review. A review of government regulations for safety and protection, as well as mandatory and voluntary standards will also be included.

IE 609 - Advanced Analytical Engineering Statistics (3 credits)
Prerequisite: IE 604. An extension of the techniques of engineering statistical analysis to industrial applications. Emphasis is placed on the design of experiments and analysis of tests for multivariate level problems.

IE 610 - Transportion Economics (3 credits)
Prerequisite: undergraduate course in economics. Principles of engineering economy. Costs of highway and public transportation facilities. Economic comparisons and evaluations. Financing approaches, tax allocation theory. Programming highway and public transit improvements. Same as Tran 610.

IE 614 - Safety Engineering Methods (3 credits)
Prerequisites: introductory course in statistics and industrial or construction management. Application of selected safety engineering methods to detect, correct, and prevent unsafe conditions and procedures in future practice. Methods selected are from safety management and programs; loss prevention; fire protection; systems safety; the design of buildings and other facilities; and the design of products, machinery, and equipment. Engineering problems in designing and constructing a hazard-free environment.

IE 615 - Industrial Hygiene and Occupational Health (3 credits)
Prerequisites: one year of college physics and one semester of college chemistry or biology. Introduction to industrial hygiene. Recognition, evaluation and control of human exposure to noise, heat, bio-hazards, chemicals, radiation, and improper lighting. Government standards, field measurements, work practices, engineering designs, and the effects of excessive exposure on worker health and productivity.

IE 618 - Engineering Cost and Production Economics (3 credits)
Prerequisite: IE 502 or equivalent. Cost management of operational activities. Focuses on capital investment decision making and efficient resource utilization to achieve cost-effective operations. Topics include alternative investment evaluation, budgeting activity based costing, quality costs, life cycle management and relevant behavioral science. These are considered in the context of manufacturing and service industry application.

IE 621 - Systems Analysis and Simulation (3 credits)
Prerequisites: IE 331, IE 466 (see undergraduate catalog for descriptions), or equivalent or department approval. The application of well-integrated systems approach, systems and systems engineering in the system life cycle, system design process, mathematical tools and techniques applied to systems analysis, design for operational feasibility, systems engineering management, modeling techniques including simulation, application of discrete simulation techniques to model industrial systems, design of simulation experiments using software, output data analysis.

IE 622 - Simulation and Risk Analysis in Operations Management (3 credits)
Prerequsites: IE 331 (see undergraduate catalog for description) or equivalent. Introduction to the concepts, methodologies and applictions of simulation in operations management. Foundations of simulation, Monte Carlo approaches, simulation models using spreadsheets, generating probabilistic outcomes using random number generation techniques, applying risk analysis software to spreadsheets for various decisions making. Variety of applications in operations management, finance and marketing. Software to develop models of practical operations management applications, is provided.

IE 623 - Linear Programming (3 credits)
Prerequisite: EM 602 or introductory course in operations research. Principles, methodology, and practical applications of linear programming to complex problems in production and marketing, simplex techniques, duality theory, parametric analysis, Wolfe and Dantzig's decomposition methods, ellipsoid method, and Karmakar's method.

IE 624 - Heuristic Methods (3 credits)
Prerequisites: EM 503 or equivalent. Techniques and concepts used to develop intelligent decision support systems. Application of rules called heuristics and models of reasoning to solve problems in engineering design and manufacturing. Topics include set theory, fuzzy subset theory, decision theory, logic, inference expert systems and single and multi-fault diagnostics.

IE 641 - Operations Analysis (3 credits)
Prerequisites: EM 602 and computer programming experience. Management systems and business behavior using industrial models. Special attention is given to the interaction of individual elements that make up the total system.

IE 642 - Network Flows and Applications (3 credits)
Prerequisite: EM 602 or equivalent. Theories, algorithms, computation complexity, and application of networks, shortest path, network flow, and minimum cost flow problems. Models of industrial service systems as network problems.

IE 643 - Transportation Finance (3 credits)
Prerequisite: undergraduate course in economics. Balance sheets and income statements. Asset and liability management, sources and costs of debt and equity financing. Financial performance measures in the private sector (airlines, railroads, trucking and bus companies). Financing issues associated with the public sector (highways and mass transit). Equity and efficiency in pricing. Subsidy allocation formulae. Innovative financing schemes in the public sector. Same as Tran 643.

IE 644 - Application of Stochastic Modeling in Systems Control (3 credits)
Stochastic processes applied to control of various types of systems: Markov chains, queueing theory, storage theory applications to measure performance of flexible manufacturing systems, telecommunication and distributions networks and similar service systems. Knowledge of probability theory and linear algebra is essential.

IE 650 - Advanced Topics in Operations Research (3 credits)
Prerequisite: introductory course in operations research or equivalent. Current topics in deterministic models of operations research: linear programming, large scale decomposition, integer programming, dynamic programming, and nonlinear programming. Emphasis on optimization techniques for solving mathematical programming problems.

IE 651 - Industrial Simulation (3 credits)
Prerequisite: introductory course in statistics/simulation or instructor's permission. Statistical design and analysis of Monte Carlo simulation experiments from an engineering view. Examples are provided with emphasis on industrial and manufacturing applications of simulation modeling. Markovian processes simulation, random number generation, mathematical programming, heuristics and decision theory.

IE 652 - Facilities Location and Plant Layout (3 credits)
Prerequisite: introductory course in operations research or instructor's approval. Basic con-cepts of facilities location and plant layout. Quantitative and qualitative tools needed in industrial engineering, including single and multiple facilities location problems, site selections and allocation models, use of Duality theory in location and plant layout problem, and computerized layout planning.

IE 653 - Facility Maintenance (3 credits)
Prerequisite: EM 501 or equivalent. Intended for those individuals who manage the functioning and maintenance of physical facilities. Emphasis on planning and control of facilities use, maintenance, utility management, managerial control, budgets and costs, personnel administration, legal and safety, flexibility measurement, and design.

IE 659 - Supply Chain Engineering (3 credits)
Coordination of product manufacturing and logistic activities across the global supply chain is studied. Focus is on supply chain design, implementation, and control. Topics include transportation and distribution networks, inventory control, demand planning, materials handling and warehousing, supply chain contracts, manufacturing flexibility, product design for responsiveness, and ERP systems. Supply chain analytics concepts and relevant case studies are introduced. **Effective From: Fall 2007**

IE 661 - Man-Machine Systems (3 credits)
Prerequisite: human factors engineering. Analysis of integrated man-machine systems: physical and psychological effects of systems of deterministic and conditional responses of individuals and groups, and the resulting interaction between individuals, groups, and machine systems; also current research and development pertaining to man-machine systems.

IE 662 - Cognitive Engineering (3 credits)
Prerequisite: IE 355 or equivalent. The purpose of this course will be to introduce the application of human factors and cognitive psychology principles to the user interface design of information technology, including computer systems, groupware and communications, handheld devices and Internet applications, and automatic speech recognition interfaces. The course will provide grounding in the engineering design processes used to enhance the usability of products and services, and usability testing methods used by user interface designers. Secondly, major areas and design problems in human-computer interaction and Information Technology will be covered, with real world examples. The course would be appropriate for advanced undergraduates in engineering, computer science, and psychology.

IE 664 - Advanced Ergonomics (3 credits)
Prerequisite: IE 355 or equivalent. The course covers important topics for ergonomics, including functional anatomy of the human body, work physiology and body energy expenditure, and biomechanics for people at work. Commonly used analytical tools for ergonomics will be introduced in the course.

IE 665 - Applied Industrial Ergonomics (3 credits)
Prerequisites: IE 355 (see undergraduate catalog for description) or IE 699. Introduces the fundamentals and applications of industrial ergonomics for improving equipment, tool, workplace, and job design. Engineers, as well as safety and health professionals, will benefit from the course by understanding the design principles for human operators and current issues in industrial ergonomics, and a variety of evaluating methodologies for the design.

IE 669 - Human Design Factors in Engineering (3 credits)
Prerequisite: engineering statistics. Human factors research related to workplace and equipment design and development. Capabilities and limitations of the human sensory-motor system. Design of displays and resulting interaction between individuals, groups, environments and machine systems. Current research in engineering pertaining to the man-machine interface. Not for IE students who have had an undergraduate course in human factors.

IE 670 - Industrial Work Physiology (3 credits)
Prerequisite: IE 669 or equivalent. A study of human physiological responses to industrial environmental factors emphasizing knowledge of human anatomy and physiological tolerances: skeletal, muscle, and neuromuscular systems, evaluation of physical work capacity and performance, changes in circulation and respiration during work. Semester project under the instructor's supervision is also required.

IE 672 - Industrial Quality Control (3 credits)
Prerequisite: engineering statistics. The management of quality assurance: operational and statistical principles of acceptance sampling and process control; quality problems in production lines, and introduction to total quality management concepts.

IE 673 - Total Quality Management (3 credits)
Introduces the concept of total quality management as applicable to industrial systems. Presents methods for product quality improvement. Emphasis is on prevention through quality engineering and design, and goes beyond traditional statistical process quality control. Presentation of recent methods in supplier management, quality assurance, process control, and competitor analysis. Includes Taguchi methods and quality function deployment. Description of ISO 9000 and Baldridge Award.

IE 674 - Quality Maintenance and Support Systems (3 credits)
Prerequisites: probability and statistics, IE 331 (see undergraduate catalog for description) or equivalent. Consideration of factors necessary for cost effective maintenance and support of technical operating systems. Topics discussed include service organization and management, spare parts and logistics, quality assurance, ISO9003 training. Examples from automation, computer systems, clinical engineering, power, and transportation will be used to illustrate application areas.

IE 675 - Safety in Facility and Product Design (3 credits)
Prerequisite: IE 614 or equivalent. Application of safety principles to minimize the health and safety hazards in the design and manufacture of various products. Practical techniques for, and economic ramifications of, conformance with the many statutes enacted to assure safe workplaces and products.

IE 677 - Applied Statistics and Epidemiology for Hazard Analysis (3 credits)
Prerequisite: IE 604 or equivalent. Application of statistical concepts to the field of hazard analysis including: investigation of root causes of accidents, their patterns and trends; rules for systematic data analysis; determination of commonality factors; availability and use of customized computer software.

IE 681 - Interdisciplinary Seminar in Occupational Safety and Health (1 credit)
Prerequisite: OSHE students, or permission of instructor. This is a required course for students who receive the trainee scholarship from the Occupational Safety and Health Engineering Program sponsored by the National Institute for Occupational Safety and Health (NIOSH). Other graduate students are also welcome and encouraged to take the interdisciplinary seminar course. Students and residents in the ERC programs will be able to participate in an interdisciplinary course with students in industrial hygiene, occupational medicine and occupational safety.

IE 682 - Industrial Safety and Health Evaluation (3 credits)
Prerequisite: OSHE students, or permission of instructor. This is a required course for students who receive the trainee scholarship from the Occupational Safety and Health Engineering Program sponsored by the National Institute for Occupational Safety and Health (NIOSH). Other graduate students are also welcome and encouraged to take this site visit course. Upon completion of this course, students will be able to plan and conduct a walk-through evaluation of health and safety hazards in a workplace. Students will also understand the role of occupational health and safety disciplines in the recognition and prevention of occupational injury and illness.

IE 685 - Systems Safety (3 credits)
Prerequisites: applied probability/statistics and introductory safety. Safety decision making and systems engineering applications to safety, including planning, managing and conducting system safety programs.

IE 699 - Special Topics in Industrial Engineering (3 credits)
Prerequisite: approval from the industrial engineering graduate advisor. Special course given when interest in a subject area develops. Advanced notice of topics will be given before registration.

IE 701 - Master's Thesis (6 credits)
Prerequisites: matriculation for the master of science degree, thesis advisor's approval, and adequate graduate courses in the field of the proposed thesis. Candidates for the degree who choose this option must submit an acceptable thesis on an approved subject that contributes to the literature of the field, and preferably aids the candidate's present or potential, career. While original research may not always result, the thesis should provide a new conclusion or application. Approval to register for the thesis must be obtained from the thesis advisor. A student must continuously register for a minimum of 3 credits per semester until the thesis is completed. Total credit will be limited, however, to the 6 credits indicated for the thesis.

IE 704 - Sequencing and Scheduling (3 credits)
Prerequisite: IE 650 or equivalent. Advanced sequencing and scheduling for job shops, flow lines, and other general manufacturing and production systems are discussed in this course. Both deterministic and stochastic scheduling models are covered in detail. Heuristics and worst case analysis for unsolvable hard scheduling problems (NP-C problem) are introduced.

IE 705 - Mathematical Programming in Management Science (3 credits)
Prerequisites: IE 623 and IE 650. An advanced study of various mathematical programming techniques such as linear and non-linear, parametric, integer, stochastic and dynamic programming. Readings and discussions emphasize mathematical advances and applications in operations research.

IE 706 - A Queueing Approach to Performance Analysis (3 credits)
Prerequisite: IE 644 or equivalent. Newly developed techniques in the area of queueing networks that play a critical role in studying several aspects of discrete event stochastic systems such as FMS, computer-aided communication systems, transportation systems and service systems.

IE 725 - Independent Research (3 credits)
Prerequisite: approval from the industrial engineering program director. Program of study prescribed and approved by student's advisor. This special course covers areas in which one or more students may be interested but is not of sufficiently broad interest to warrant a regular course.

IE 753 - Airport Design and Planning (3 credits)
Prerequisite or corequisite: Tran 610 or EM 693. Planning of individual airports and statewide airport systems. Functional decision of air and landside facilities. Orientation, number and length of runways. Concepts of airport capacity. Passenger and freight terminal facility requirements. Airport access systems. FAA operating requirements. Financial, safety and security issues. Same as CE 753 and Tran 753.

IE 754 - Port Design and Planning (3 credits)
Prerequisite: Tran 610 or EM 693. Functional design of the water and landsides for general cargo, liquid and dry bulk, and container operations. Yard and storage systems. Port capacity in an intermodal network. Economic, regulatory, and environmental issues. Same as CE 754 and Tran 754.

IE 760 - Quantitative Methods in Human Factors (3 credits)
Prerequisite: IE 661. More advanced human factors engineering concepts analyzed quantitatively: systems modeling, control theory, human error, and decision making. Discussion of human factors, research design and data analysis. Operator/computer interaction is also emphasized.

IE 761 - Advanced Studies in Human Factors (3 credits)
Prerequisite: one year of graduate work in human factors or the equivalent. The course integrates various areas of graduate studies in human factors such as: work physiology, occupational safety, environment and human-machine systems. Detailed discussion of selected current papers covering theoretical review, experimental design, results, applications, and future research. Completion of semester project under instructor's guidance is mandatory.

IE 762 - Psychophysical Methods in Human Factors (3 credits)
Prerequisite: one year of graduate work in human factors or instructor's approval. This course considers various classical and modern psychophysical methods, signal detection theory, information theory, and human information processing applicable to advanced human factors/occupational safety research measurement and normative modeling.

IE 791 - Graduate Seminar (Non-credit)
A seminar in which faculty or others present summaries of advanced topics suitable for research. Discussion of research procedures, thesis organization, and content. Students engaged in research will present their own research for discussion and criticism. **Effective From: Fall 2005**

Information Systems: Information Systems

UNDERGRADUATE COURSES:

IS 117 - Introduction to Website Development (3-0-3)
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 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. **Effective From: Spring 2012**

IS 118 - Introduction to Software Application Tools (3-0-3)
This hands-on taught in a computer lab, introduces the general area of application development, including web and other software applications. This course will teach you about these tools through the use of the development of several applications. During this process you will learn about the general software development process, including the software development life cycle (SDLC), which covers gathering requirements, designing the application, application testing and implementation. **Effective From: Fall 2011**

IS 127 - Introduction to Web Systems Design (3-0-0)
This course provides a critical, hands-on introduction to Web-based Information Systems and Web systems design. Students will research 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 will design and develop different types of websites and web applications which will then be analyzed as to their usability in real public and private settings. **Effective From: Fall 2008 Until: Summer 2009**

IS 217 - Advanced Website Development (3-0-3)
Pre-requisites: IS 117 or equivalent. 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. **Effective From: Spring 2012**

IS 218 - Building Web Applications (3-0-3)
Prerequisites: CS 113 or 115, or other computing GUR. 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. **Effective From: Spring 2012**

IS 245 - Information Technology Systems: Hardware/Software (3-0-3)
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). **Effective From: Fall 2006**

IS 247 - Designing the User Experience (3-0-3)
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. **Effective From: Spring 2012**

IS 265 - Introduction to Information Systems (3-0-3)
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. **Effective From: Spring 2012**

IS 270 - Designing the Multimedia Experience (3-0-3)
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. **Effective From: Fall 2010**

IS 305 - Community Service Internship (0-2-1)
Prerequisite: IS 350. Increasingly, computer professionals are recognizing their ethical responsibility to provide advice and assistance that will improve the ability of government and social service agencies to use computers to serve the public. This course involves approximately 40 hours of internship in a community agency, arranged through the NJIT Cares Program. The interns will use their skills to improve the effectiveness of the use of computers at the agency. Bi-weekly progress reports will be submitted, with required meetings with the course supervisor, and a final report. **Effective From: Fall 2006**

IS 310 - Co-op Work Experience I (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 **Effective From: Spring 2013**

IS 322 - Mobile Applications: Design, Interface, Implementation (3-0-3)
Prerequisites: CS 113 or CS 115 or equivalent. 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. **Effective From: Spring 2012**

IS 331 - Database Design Management and Applications (3-0-3)
Prerequisite: completion of 100 level courses in the computing: CS 101 or CS 111 or CS 113 or CS 115 or IS 118 or BNFO 135. 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 and show how theses can be transformed into well designed databases. SQL will be extensively covered, and students will design 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 database and data warehouses. Hands-on experience will be gained by with actual database using industry-standard database management systems such as Oracle. **Effective From: Spring 2011**

IS 333 - Social Networking: Application and Interface Design (3-0-3)
Prerequisite: Completion of computing GUR, such as, IS 118, CS 101, CS 113, CS 115 or BNFO 135. In this intensely hands-on course, you will analyze existing social networking sites (Facebook, MySpace, LinkedIn, LISTSERV, etc.) in terms of usage and security implications, and identify design considerations for new application use. Working in teams, you will design and execute an implementation plan for add-on applications to an existing social networking site, manage the security settings and other aspects of these applications. This involves combining existing reusable components and developing the interface to these from the social networking sites. The team project will design solutions for an existing organization. **Effective From: Spring 2011**

IS 335 - Introduction to .NET Framework (3-0-3)
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. **Effective From: Spring 2007 Until: Spring 2012** **(Archived Versions)**

IS 344 - Computing Applications in Business (3-0-3)
Prerequisites: Acct 115 or Acct 117, and either CS 100, CS 113 or CS 115 or Department permission. 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. The modeling of 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. **Effective From: Spring 2011**

IS 347 - Designing the User Experience (3-0-3)
Prerequisite: None. 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. **Effective From: Spring 2011 Until: Fall 2011**

IS 350 - Computers, Society and Ethics (3-0-3)
Prerequisites: Completion of 100 level course in the computing sciences: CS 101 or CS 111 or CS 113 or CS 115 or IS 118 and one basic SS course, and HUM 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. Co-listed as STS 350.

IS 365 - Computer Applications to Commercial Problems (3-0-3)
Prerequisite: Completion of 100 level course in the computing sciences: CS 101 or CS 111 or CS 113 or CS 115 or IS 118. Covers design and implementation of commercial application software systems. Concepts of organization and management of data and files including file operations and organization of sequential access, relative access, indexed sequential access, virtual storage access and multi-key access methods. The COBOL language is used to illustrate these concepts and to implement application systems. The design and implementation of commercially oriented computer systems. Emphasis is placed on modern computers as a tool for solving business problems. The COBOL programming language will be extensively studied and utilized in developing the programming techniques for the solution of these problems. **Effective From: Fall 2006 Until: Fall 2011**

IS 373 - Web Standards (3-0-3)
Prerequisites: Completion of 100 level course in the computing sciences: CS 101 or CS 111 or CS 113 or CS 115 or IS 118. This course covers the standards that are emerging for formatting, accessing, displaying, transmitting and structuring information, including the standards and protocols existing and under development today. Topics include: Standards, Rationale, Pros and Cons, the Standards Process; Standards Bodies & Participating on Standards Bodies; How Companies Influence Standards; How Developers Incorporate Standards in their Programs; Planning for Emerging Standards; Company Policies Regarding Web Standards; Standards and Legal Issues. **Effective From: Fall 2010**

IS 375 - Evaluating the User Experience (3-0-3)
Prerequisites: Math 105, Math 333 or another course in statistics or social science research methods. Methods for identifying usability problems and for testing the relative merits of alternative designs for interactive systems. Following a review of usability heuristics, students read journal articles about and practice five different methods: semi-structured interviews, protocol analysis, cognitive walkthroughs, user surveys, and controlled experiments. **Effective From: Spring 2011**

IS 385 - Special Topics in IS (3-0-3)
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. **Effective From: Fall 2011**

IS 390 - Requirements Analysis and Systems Design (3-0-3)
Prerequisite: Completion of 100 level course in the computing sciences: CS 101 or CS 111 or CS 113 or CS 115 or IS 118. 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. **Effective From: Fall 2006**

IS 392 - Web Mining and Information Retrieval (3-0-3)
Prerequisites: Completion of 100 level course in computing sciences: CS 101 or CS 111 or CS 113 or CS 115 or IS 118. 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. **Effective From: Spring 2010**

IS 405 - Internship in Community Service (1-0-1)
Prerequisite: IS 305 or its equivalent, approval of the department, and permission of the Office of Service Learning and Career Development Services. This course involves approximately 40 hours of internship in a community agency, arranged through the NJIT Cares Program. The interns will use their skills to improve the effectiveness of the use of computers at the agency. Bi-weekly progress reports will be submitted, with required meetings with the course supervisor, and a final report. **Effective From: Fall 2006**

IS 410 - Co-op Work Experience II (3 additive credits)
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 **Effective From: Spring 2013**

IS 413 - Requirements for Emergency Management Information Systems (3)
Requirements analysis, interface design, and supporting functionality of information systems related to the complete preparedness lifecycle for emergency, disaster, and crisis situations for government bodies and/or private organizations. Components of the lifecycle-planning, mitigation, training, alerting, response, recovery, and assessment, are studied. Human and organizational behavior in this environment and how it influences system functionality and design of the user interface. Integration and coordination issues across the phases of the process. **Effective From: Fall 2006**

IS 421 - Advanced Web Applications (3-0-3)
Prerequisite: IS 118 or IT 202, or instructor permission. This course introduces the next generation of web application platform and web applications - Web 2.0 and Rich Internet Applications (RIAs). The course covers key attributes of RIA development, defines Service Oriented Architecture (SOA) and introduces different application development platform, design and development tools and languages supporting development and deployment of RIAs. The in-depth study of Microsoft.NET Framework and Silverlight will provide hands-on experience to develop and deploy RIAs. **Effective From: Spring 2012**

IS 431 - Database Design, Management and Applications (3-0-3)
Prerequisite: completion of 100 level course in the computing sciences: CS 101 or CS 111 or CS 113 or CS 115 or IS 118. Database system components; data modeling using the Entity-Relationship model, Semantic Object model, UML and other data models; Relational Database Management Systems-functionality and design concepts and applications; querying a database; Structured Query Language; functional dependencies and higher order normalization for relational database design; relation decomposition; overview of concurrency control and transaction management; database application design and management issues. Student projects involve the use of DBMS packages, including Oracle and Microsoft Access. **Effective From: Fall 2006 Until: Fall 2010**

IS 433 - Electronic Commerce Requirements and Design (3-0-3)
Prerequisites: IS 431 or CS 431 and IS 390 or CS 490. Introduces critical concepts emerging in the field of electronic commerce, such as business to consumer (B2C), business to business (B2B), supply chain management (SCM) systems, and peer to peer (P2P). The course provides concepts and practical skills for building effective, usable, and secure electronic commerce systems, offering a conceptual framework for the study of electronic commerce, as well as hands-on skills for building systems for electronic commerce. **Effective From: Fall 2006 Until: Fall 2011**

IS 441 - Geographic Information Systems (3-0-3)

Prerequisite: IS 431 or CS 431. Geographic Information Systems (GIS) allow individuals and organizations to pose, explore and answer a variety of public- and private-sector questions using spatial data. In this course the student will learn to identify, manipulate and analyze spatial data using state-of-the-art software. The course is project-driven and hands-on: students will define and address real problems using real data. The course will also cover selected topics in information visualization as they relate to the use of GIS. **Effective From: Fall 2006 Until: Fall 2011**

IS 447 - Designing the User Experience (3-0-3)
Prerequisite: IS 390. 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. **Effective From: Spring 2010 Until: Fall 2010**

IS 448 - Design Studio for Ubiquitous Computing (3-0-3)
Handheld devices, mobile and wireless technologies, 'smart spaces', wearables and other technologies are creating a ubiquitous computing environment that is moving application development off the desktop. This course explores recent developments in both the technical and Human Computer Interaction (HCI) side of ubiquitous computing. To put into practice what is being learned, the class will use scenario based usability engineering techniques to design various aspects of a ubiquitous computing application to be deployed at NJIT. **Effective From: Summer 2010**

IS 455 - Information Systems Management (3-0-3)
Prerequisite: Completion of 100 level course in the computing sciences: CS 101 or CS 111 or CS 113 or CS 115 or IS 118 or BNFO 135. The information systems function in an organization has a broad responsibility to plan, develop or acquire, implement, and manage an infrastructure of information technology, data, and enterprise-wide information processing systems. 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. Topics include the strategic uses of IS, enterprise computing architecture and infrastructure, software development management, organizational change, outsourcing, governance, risk management, and performance measurement. **Effective From: Spring 2011**

IS 461 - Systems Simulation (3-0-3)
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. **Effective From: Fall 2006**

IS 465 - Advanced Information Systems (3-0-3)
Prerequisites: IS 265, and either (IS 331 or CS 431) and either (Math 105 or Math 333). Design and programming concepts are presented for automation of management information systems. Includes the organization of files and techniques for processing information based upon organizational requirements and available hardware and software. Some case studies are presented. **Effective From: Fall 2011**

IS 475 - Evaluating the User Experience (3-0-3)
Prerequisite: a course in probability and statistics, or social science research methods. Methods for identifying usability problems and for testing the relative merits of alternative designs for interactive systems. Following a review of usability heuristics, students read journal articles about and practice five different methods: semi-structured interviews, protocol analysis, cognitive walkthroughs, user surveys, and controlled experiments. **Effective From: Fall 2006 Until: Fall 2010**

IS 485 - Special Topics in Information Systems (3-0-3)
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. **Effective From: Fall 2006**

IS 486 - Topics in Information Systems (3-0-3)
Prerequisites: Same as for IS 485. A continuation of IS 485. **Effective From: Fall 2006**

IS 488 - Independent Study in Information Systems (3-0-3)
Prerequisites: open only to students in the Honors Program who are IS majors and who have the prior approval of the department and the IS faculty member who will guide the independent study. Independent studies, investigations, research, and reports on advanced topics in IS. 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. **Effective From: Fall 2006**

IS 491 - Senior Project (3-0-3)
Prerequisites: IS 331, IS 431, or CS 431, 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. **Effective From: Spring 2011**

IS 491H - Honors Senior Project (3-0-3)
Prerequisites: IS 465 and senior standing in the Honors College. A course similar to IS 491, with a project of greater depth and scope. **Effective From: Fall 2006**

GRADUATE COURSES:

IS 500 - Introduction to Systems Analysis (3 credits)
Prerequisites: statistics and differential equations. Covers a wide variety of systems oriented approaches to solving complex problems. Illustrative examples are chosen from a wide variety of applications. Mathematical tools are only introduced to the extent necessary to understand the technique and its application to the problem. Topic areas include probabilistic and decision theory models, simulation, morphological analysis, cluster analysis, structural modeling, Delphi and dynamic system models. The role for the computer in applying these techniques to complex problems will be discussed. The student will be exposed to some of the fundamental controversies concerning the appropriateness or validity of systems approaches to human problem solving. **Effective From: Fall 2006 Until: Fall 2008**

IS 565 - Aspects of Information Systems (3 credits)
Co-requisite: CS 431 or permission of the department. Methods and models of supporting the management process; ethical issues pertaining to the construction, deployment, and impact of information systems on organizations and society; description, analysis, and design of information systems to assist problem solving and decision-making in a business environment. **Effective From: Fall 2006 Until: Fall 2008**

IS 590 - Graduate Co-op Work Experience I (3 additive credits)
Prerequisite: students must have the approval of the co-op advisor for the IS department. Provides on-the-job reinforcement and application of concepts presented in the graduate IS curriculum. Work assignments are identified by the co-op office and developed and approved by the IS department in conjunction with the student and employer. Students must submit, for IS department approval, a proposal detailing the nature of the intended work. A report at the conclusion of each semester's work experience is required. Credits for this course may not be applied toward degree requirements for either the bachelor's or master's in IS. **Effective From: Fall 2006**

IS 591 - Graduate Co-op Work Experience II (3 additive credits)
Prerequisite: students must have the approval of the co-op advisor for the IS department. Provides on-the-job reinforcement and application of concepts presented in the graduate IS curriculum. Work assignments are identified by the co-op office and developed and approved by the IS department in conjunction with the student and employer. Students must submit, for IS department approval, a proposal detailing the nature of the intended work. A report at the conclusion of the semester work experience is required. Credits for this course may not be applied toward degree requirements for either the bachelor's or master's in IS. **Effective From: Fall 2006**

IS 592 - Graduate Co-op Work Experience III (3 additive credits)
Prerequisites: graduate standing, and acceptance by the IS department and the Division of Career Development Services. Students must have the approval of the co-op advisor for the IS department. Provides on-the-job reinforcement and application of concepts presented in the graduate IS curriculum. Work assignments are identified by the co-op office and developed and approved by the IS department in conjunction with the student and employer. Students must submit, for IS department approval, a proposal detailing the nature of the intended work. A report at the conclusion of the semester work experience is required. Credits for this course may not be applied toward degree requirements for either the bachelor's or master's in IS. **Effective From: Fall 2006**

IS 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

IS 612 - Emergency Management Informatics (3 credits)
This course covers core aspects of Emergency Management (EM) as they relate to information systems and usage of associated

technologies. EM theory identifies four critical areas: 1) understanding & mitigating risk, 2) planning & preparedness, 3) reaction & response, 4) recovery & normalization. The role of informatics for each critical area will vary and is the basis for discussions and assignments. This course also focuses on innovative information systems approaches to EM in each area. Within the EM domain, business continuity (information processing and sharing during crisis situations), cyberterrorism, and international response are covered. **Effective From: Spring 2011**

IS 613 - Design of Emergency Management Information Systems (3 credits)
This course is concerned with the development of requirements, the design of the human interaction, and the supporting functionality of any Information System related to the complete preparedness lifecycle for emergency, disaster, and crisis situations for government bodies, non-profit, and/or private organizations that are concerned with business continuity. It also focuses on organizational behavior and its effects on the functionality of the system and the design of the human interface. **Effective From: Fall 2006**

IS 614 - Command and Control Systems (3 credits)
This course investigates the relevance and applicability of using of Command and Control (C2) models in organizational responses to both normal emergencies and catastrophic events. C2 refers to how leadership, authority, decision-making and coordination are assured within an organization, including distributed and virtual organizations. The course examines the functionality and properties of C2 systems in terms of matching requirements for these systems to the behavior of individuals, groups, and organizations during emergency conditions. It will address integrating systems and technologies within organizational emergency operations functions and processes to include business continuity and disaster response. **Effective From: Summer 2010**

IS 615 - Improvisation in Emergency Management (3 credits)
This course explores the continuum between planned and improvised behavior in emergency management. It introduces tools and techniques useful for understanding and supporting decision-making in emergencies, and enables learners to apply them in simulated emergency response scenarios. The focus is on decision making under time pressure, the influence of cognitive, policy and organizational factors, and the design and use of technologies to support planned and improvised decision making. **Effective From: Fall 2006 Until: Fall 2011**

IS 616 - Learning Methodologies and Training Technologies (3 credits)
This course provides an overview of learning methodologies and training technologies, with an emphasis on emergency management. It reviews theories and develops skills for the planning, evaluation and selection of traditional and new technology-driven learning and training methods. Course participants will review relevant research and learn how to choose the most effective training methodologies, technologies and content resources appropriate to the needs of different audiences. **Effective From: Fall 2007**

IS 617 - Social Dimensions of Risk (3 credits)
Low-probability/high consequence events involving terrorism, food safety, and extreme weather offer ample evidence the prevalent approaches of economics and statistics are not able to deal with the complex ways that risk permeates modern societies. This course treats risk analysis as a broad interdisciplinary activity and draws on the full range of the social sciences to explore the multifaceted way that risk infuses itself into the fabric of contemporary affairs. **Effective From: Spring 2007 Until: Fall 2008**

IS 623 - Qualitative Research on Information Systems (3 credits)
Prerequisites: IS 350 (or equivalent covering basics of research in IS) or IS 675. A review of major qualitative research methods in Information Systems research, including interviews, content analysis, participant observation (ethnography), case and field studies, group techniques, and selected other methods. Students read and make experiential use of articles providing examples of the use of these methods in the IS journal literature. **Effective From: Fall 2006 Until: Fall 2011**

IS 631 - Enterprise Database Management (3 credits)
Prerequisites: Undergraduate course in database or design and management, or permission of instructor. This course provides an understanding of the issues as well as hands-on experience in managing database systems as an essential organizational resource. Students will obtain a conceptual foundation of database design and explore the implications for organizational database usage. Students also will gain experience with enterprise database management systems, such as Oracle. This course introduces the design and management of enterprise-wide database systems. Topics include: (1) data modeling and database design; (2) database implementation with SQL; (3) database access standards for enterprise database systems; (4) multidimensional databases, online analytic processing (OLAP) and data warehousing, customer relationship management (CRM); and (5) web-based enterprise database systems. **Effective From: Fall 2011**

IS 634 - Information Retrieval (3 credits)
Prerequisites: IS 631 or CS 631; working knowledge of an object-oriented programming language. Modern information retrieval systems, such as web search engines, empower users to easily access information on the web. The course covers the concepts and principles of information retrieval systems design, including web crawling, automatic indexing, vector space modeling, retrieval algorithms, digital libraries, text mining, information extraction, and document warehousing. These techniques are essential for

building web systems, text databases, document processing systems, and other advanced information management systems. **Effective From: Fall 2006**

IS 658 - Multimedia Systems (3 credits)
Prerequisite: CS 601 or CS 602 or experience in an object-oriented programming language. Multimedia software systems incorporate various media, such as text, images, video and audio, to provide rich experiences for users. This is a course in the design, implementation and evaluation of multimedia systems. The course has three major content areas and goals: (1) multimedia data types-the goal being to understand the development and use of various multimedia data types; (2) usability and user modeling-the goal being to incorporate theories of human perception and cognition into the design and evaluation of multimedia systems; and (3) multimedia design and software tools-the goals being to plan and develop multimedia projects and to be aware of ways in which multimedia is being used in the public and private sectors. Students will also develop familiarity with one multimedia authoring package. **Effective From: Summer 2010**

IS 663 - System Analysis and Design (3 credits)
This course develops the skills necessary to analyze, design and manage the development of effective enterprise-scale information systems solutions incorporating contemporary methods and effective organizational and global project management practices. It focuses on technical business systems analysis and design techniques, and covers key software engineering principles, methods and frameworks, including process models, agile and lean principles, project and risk management, estimation, requirements elicitation and analysis, modeling, system and software architecture, design patterns, and quality systems. Students will actively participate in discussions, review selected articles, participate in team exercises and collaborate on projects involving analysis and prototyping of applications addressing real-world problems and integrating current and emerging technologies. **Effective From: Summer 2010**

IS 675 - Information System Evaluation (3 credits)
Theoretical perspectives and methodological approaches to evaluate information systems within the context of the user and organizational environment. Topics include qualitative techniques such as protocol analysis and interviews; quantitative techniques such as sample surveys and controlled experiment; cost-benefit analysis, and analyses of data gathered by these approaches by methods such as regression, correlation, and analysis of variance. Emphasis on the application of these approaches to improve functionality, interface, and acceptance of information systems in organizations. **Effective From: Fall 2006 Until: Fall 2008**

IS 676 - Requirements Engineering (3 credits)
Corequisites: IS 663 or CS 673 or equivalent project experience in the field. Requirements engineering is one of the all-important beginning stages of the systems development life cycle. Revealing and understanding the system's requirements is a crucial component of success for developing new computing systems or adjusting existing applications. This course covers the theory, principles, and practical application of the methodologies and tools for requirements engineering. The focus is development of large software systems and the integration of multiple systems into a comprehensive, domain dependent solution. All aspects of requirements engineering including the knowledge and skills needed to elicit and analyze requirements, translate these requirements into technical specifications, verify that the requirements accurately capture the system requirements, and manage software requirements through the system development cycle will be covered. Students will actively participate in discussions, labs and exercises, and prepare operational requirements and technical specifications for real-world problems. We will spend a considerable amount of time interacting and learning through discussion of assigned readings and other material. **Effective From: Summer 2010**

IS 677 - Information System Principles (3 credits)
This course introduces the field of Information Systems; the study of how people and organizations should use information technologies effectively. We examine the major areas in the field, analyzing the major issues, trends and problems. We survey the role of information systems in organizations and how these systems support organizational objectives and organizational structure, as well as providing competitive business advantages. We discuss basic concepts such as the systems point of view, the organization of a system, the nature of information and information flows, as well as how people process information and related cognitive concepts. We also examine various types of information system applications such as e-commerce, supply chain, decision support, and enterprise systems. And, finally, we also consider critical ethics issues including privacy, personalization and security. **Effective From: Summer 2010**

IS 678 - IT Service Management (3 credits)
Prerequisites: Prior coursework or industry experience in Information Systems, or permission of instructor, otherwise we do not recommend taking IS 678 in the first semester. This course introduces the Information Technology Infrastructure Library (ITIL) fundamentals of the service management life cycle-service strategy, service design, service transition, service operation, and continual service improvement. ITIL provides a comprehensive, consistent, and coherent framework of best practices for IT Service Management (ITSM), which promotes a quality approach for achieving business effectiveness and efficiency in the use of information systems. This course presents the basic terminology and an overview of the functions and processes for each of the life cycle phases as they apply to IT Management. Although ITIL is originally presented as an approach for designing IT processes, we can expand this view and apply it to the design of other business services. Possible semester-long contexts are

the processes of an educational services provider or health care services provider. **Effective From: Spring 2013**

IS 679 - Information Systems Strategy (3 credits)
Prerequisites: IS 677 or MIS 645. This course explores issues and approaches in managing information systems in organizations and how they integrate, support, and enable various types of organizational capabilities. It takes a management perspective in exploring the acquisition, development and implementation of efficient and effective information systems. The course also addresses issues relating to defining a high-level technology infrastructure and the systems that support the operational, administrative and strategic needs of the organization. The course is focused on developing an intellectual framework that will allow leaders of organizations to critically assess existing infrastructures and emerging technologies as well as how these enabling technologies might affect organizational strategy. The ideas developed and cultivated in this course are intended to provide an enduring perspective that can help leaders make sense of an increasingly global and technology intensive business environment. **Effective From: Summer 2010**

IS 680 - Information Systems Auditing (3 credits)
Due to the dynamic nature of information technology, the need arises continually to redefine audit, control and security requirements and processes. Topics include the IS audit process, IT infrastructure and operations, information protection, disaster recovery and business continuity, IT service delivery and support, business application systems, and project management. Students gain practical experience with each by working through a series of sample Certified Information Systems Audit (CISA) exam questions. **Effective From: Summer 2010**

IS 681 - Computer Security Auditing (3 credits)
This course reflects the current emphasis on information security and security management in Fortune 500 corporations. Students will delve into information protection concepts, privacy impact analysis, computer crime, legal issues, controls and auditing systems, and firewall configuration. Students will have the opportunity to learn and perform evaluations on security infrastructures in a controlled environment in class labs by completing realistic security auditing projects and using vulnerability assessment tools to assess risks and evaluate security controls on networked infrastructures. **Effective From: Summer 2010**

IS 682 - Forensic Auditing for Computing Security (3 credits)
A computer forensics audit is the proper identification and collection of computer evidence. Computers are involved in security violations through crime or violations of policy, or being targeted by an attack. This course deals with the preservation, identification, extraction, documentation, reporting, acquisition, analysis and interpretation of computer data. Topics covered include evidence handling, chain of custody, collection, preservation, identification and recovery of computer data. In this hands-on course, you will conduct several labs where you will be taught to analyze, review and extract information from computer hard drives, and determine what and how the information could have been compromised. Computer Forensics Audit professionals become experts in e-discovery and preserving sensitive evidential matter. **Effective From: Summer 2010**

IS 683 - Web Systems Web Development (3 credits)
Students will gain experience in open source web development through an intensive hands-on project, applying real-world problem-solving skills to meeting information systems requirements. Students will learn Web development principles, as well as professionally relevant skills including industry standards, conventions, and procedures within large-scale programming projects. Also covered are the communication tools, technologies, and practices that individuals use to coordinate and collaborate within the open source software development community. **Effective From: Spring 2013**

IS 684 - Business Process Innovation (3 credits)
Prerequisites: Prior coursework or industry experience in Information Systems, or permission of instructor, otherwise we do not recommend taking IS 684 in the first semester. This course adopts a balanced approach to business process innovation (BPI) that includes both incremental improvement and re-engineering. It specifically examines the concept of a service-oriented architecture (SOA) and the use of web services as a way to enable scalable and adaptive business processes. Students will learn how to develop process maps using the Business Process Modeling Notation (BPMN) and design process improvements to achieve efficiency, effectiveness, compliance and agility objectives. The focus of the course is on ways in which information technology can be used to manage, transform and improve business processes. **Effective From: Spring 2013**

IS 685 - Enterprise Architecture and Integration (3 credits)
Prerequisites: None, but recommend completion of IS 663 or CS 673. The Enterprise Architecture (EA) describes an organization's IT strategy and operational structure. IS and IT professionals utilize the EA to analyze, design and integrate the (often heterogeneous) IT infrastructure and applications to most effectively support the enterprise and respond to risks. Students learn to develop an EA analysis which reflects its business strategies, capabilities, processes, and systems, metrics, information resources, and networking infrastructure. This enables students to determine the impact of IT solutions, by learning to deconstruct, analyze and configure IT systems in alignment with enterprise-wide business strategies. The course covers the industry standard The Open Group Architecture Framework (TOGAF) enterprise architecture framework and focuses on Enterprise Application Integration (EAI). **Effective From: Summer 2009**

IS 686 - Pervasive Computing: An HCI Perspective (3 credits)
This course examines Pervasive/Ubiquitous Computing, the trend toward increasingly ubiquitous connected computing devices in the environment - a trend being brought about by a convergence of advanced electronic, and particularly, wireless technologies and the internet. We do this from a Human Computer Interaction perspective looking at the current and future design of various systems. **Effective From: Fall 2006**

IS 687 - Transaction Mining and Fraud Detection (3 credits)
Pre-requisite: An undergraduate course in probability and statistics. Increasingly, all of our transactions are electronic. We use debit and credit cards (electronic transactions) instead of checks and cash at banks, restaurants, stores, and many other businesses. Evaluation of transactions to find risk includes detection of terrorists and money launderers. Every financial institution is legally required to monitor transactions to detect organized crime and terrorism. Mining transaction streams to find good or bad customers in a rapidly growing area of employment for IS graduates. This course will present methods that are being used to analyze and mine transactional data and the business applications of these methods. **Effective From: Summer 2010**

IS 688 - Web Mining (3 credits)
Web mining aims to discover useful information and knowledge from the Web hyperlink structure, page contents and usage logs. It has direct applications in e-commerce, Web analytics, information retrieval/filtering, personalization, and recommender systems. Employees knowledgeable about Web mining techniques and their applications are highly sought by major Web companies such as Google, Amazon, Yahoo, MSN and others who need to understand user behavior and utilize discovered patterns from terabytes of user profile data to design more intelligent applications. The primary focus of this course is on Web usage mining and its applications to business intelligence and biomedical domains. We learn techniques from machine learning, data mining, text mining, and databases to extract useful knowledge from the Web and other unstructured/semistructured, hypertextual, distributed information repositories. This data could be used for site management, automatic personalization, recommendation, and user profiling. Topics covered include crawling, indexing, ranking and filtering algorithms using text and link analysis, applications to search, classification, tracking, monitoring, and Web intelligence. Programming assignments give hands-on experience. A group project highlights class topics. **Effective From: Fall 2009**

IS 690 - Web Services and Middleware (3 credits)
Web services enable integration of web-based applications and feature sets to any other web-based system in a modular way. Middleware is a set of functionality positioned in between and enabling interoperability among different, distributed enterprise and other computing applications. This course provides an introduction to web services and middleware in the context of digital libraries - large scale multimedia information repositories. Students will gain hands on experience in developing their own web services managing a complex distributed computing platform. **Effective From: Spring 2010**

IS 698 - Special topics in Information Systems (3)
Special area course given when suitable interest develops. Advance notice of forthcoming topics will be given. **Effective From: Fall 2006**

IS 700 - Master's Project (3 credits)
An approved project involving design, implementation, and analysis, or theoretical investigation, under the guidance of a faculty member. Students are strongly advised to work with the faculty member to develop a project proposal during the semester prior to conducting the master's project. Approval to register for the project must be obtained from the faculty member advising the project.

IS 701 - Master's Thesis (6 credits)
An approved research-oriented project involving design, implementation, and analysis or theoretical investigation, carried out under the supervision of a faculty member who will be the thesis advisor. The thesis should be of such depth and caliber as to warrant publication in a technical or scientific journal. Approval to register for the thesis must be obtained from the thesis advisor. A student must register for a minimum of 3 credits per semester. Credit will be limited, however, to the 6 credits required for the thesis. Students are strongly advised to work with the thesis advisor to develop a thesis proposal during the semester prior to commencing the project.

IS 725 - Independent Study in Information Systems (3 credits)
Prerequisites: Graduate standing and department consent. **Effective From: Fall 2006**

IS 732 - Design of Interactive Systems (3 credits)
Design of interactive systems and human computer interfaces. Covers the current professional literature in this field and the knowns about design. Emphasizes application areas that have a great deal of cognitive variability and diverse user populations. Design interfaces for various applications. The impact of costs and operational practices upon user behavior and current research topics in interface design are covered. **Effective From: Fall 2006 Until: Fall 2008**

IS 735 - Social Media (3 credits)

Prerequisite: IS 675 or 764, or a graduate course in statistics (e.g., math 661) or quantitative research methods. Seminar style course that covers design and impact of computer-based systems for human communication, including email and IM, discussion boards, Computer-Supported Cooperative Work (CSCW), Group Decision Support Systems (GDSS), and Social Networking Systems. Topics include alternative design structures, impacts of primarily text-based group communication, and recent empirical studies of virtual teams, online communities, and systems used for social networking, including 3-D worlds such as Second Life and "micro blogging" systems such as Twitter. **Effective From: Spring 2013**

IS 754 - Measurement and Evaluation of Software Quality and Performance (3 credits)
Prerequisites: Ph.D. core courses, CS 630, CS 661. A study of the tools for the measurement of software products and the use of these tools in the evaluation of software quality and performance. Structural and functional models of algorithms, programs, and systems are presented to define the quantitative and subjective characteristics of computer products. Course includes the use of hardware and software tools, the study of simulation and analytic techniques, description of workloads and benchmarks for system evaluation, problems of scale, proof of program correctness, feature value analysis, and the design and interpretation of experiments. **Effective From: Fall 2006 Until: Fall 2008**

IS 762 - Computerized Information Systems for Planning and Forecasting (3 credits)
Prerequisite: IS 675. Capturing and processing of subjective and empirical data for use in planning and forecasting information systems and the incorporation of these facilities into information systems designs. Emphasis on conveying understanding of the limitations of various methods and techniques to meet various planning and forecasting objectives. Use of various techniques such as the Delphi method, structural modeling, cluster analysis and regression approaches. **Effective From: Fall 2006 Until: Fall 2008**

IS 763 - Qualitative Methods in IS Research (3)
Prerequisites: IS 675 or IS 350 (or an equivalent course) A review of major qualitative research methods in Information Systems research, including interviews, content analysis, participant observation (ethnography), case and field studies, group techniques, and selected other methods. Students read and make experiential use of articles providing examples of the use of these methods in the IS journal literature. **Effective From: Fall 2006 Until: Fall 2008**

IS 764 - Research Methods for Human-Centered Computing and Design (3 credits)
Prerequisites: None. This introductory seminar in human centered computing and design provides a survey of the methodological literature on qualitative research methods paired with appropriate article-length exemplars. We cover a variety of different research strategies including design science, action research, case study, qualitative data collection and analysis techniques, and scenario-based design. This course develops skills in designing and evaluating systems using qualitative methods. We also discuss writing and reviewing academic articles and research proposals. The course utilizes information systems as the primary domain but could be extended for students in other disciplines. **Effective From: Fall 2009**

IS 765 - Quantitative Methods in Information Systems Research (3 credits)
Prerequisite: Math 661 or equivalent. This course is a practical and project-oriented introduction to quantitative methods in information systems (IS) research. The focus of the course is on developing researchers' capability to select and implement appropriate statistical procedures for a variety of research questions and to interpret the results of these procedures. **Effective From: Fall 2010**

IS 766 - Philosophy of Information Science (3-0-3)
This seminar explores central issues in contemporary philosophy of science. We consider "scientific" progress in the computing sciences with a focus on information systems and human computer interaction theory. We discuss topics such as confirmation and disconfirmation of theories; falsifiability and pseudo-science; introduction; probability; and statistical inference, prediction, explanation and empirical equivalence. We read key works by philosophers such as Popper and Kuhn. We examine the notion of "design science" and contrast it with "natural science", and examine whether social science research should strive to emulate natural science methods. Readings will be tied into research within information systems and the computing sciences in general, looking at how scientific theories are tested or confirmed. **Effective From: Fall 2011**

IS 767 - Decision Support Systems (3 credits)
The design, implementation, and utilization of models and their software support systems for application in managerial decision making at the strategic, tactical, and operational levels. Topics include the perspective of decision-support systems, the management of large simulation models and documentation standards, combined hybrid simulation languages and their applications, financial modeling and financial modeling languages. Systems dynamics and its managerial applications at the strategic level; specialized modeling and analysis software packages for managerial decision making; and recent research in computer-aided tools for capturing group judgment, modeling, and decision-making are also discussed. **Effective From: Fall 2006**

IS 776 - IS Research Proposition (3 credits)
Prerequisite: Restricted to students in the doctoral program in Information Systems. Students must have an approved program of study and approval of a faculty advisor to register for this course, which precedes the dissertation proposal. Students enrolled in

this course will, develop a grant proposal following the NSF Grant Proposal Guide. Students are required to present their work in the IS Research Seminar. The completed proposal will be evaluated by a reviewing panel for approval. **Effective From: Summer 2010**

IS 786 - Special Topics (3 credits)
These seminars examine a special interest area of Information Systems in depth. Each seminar emphasizes recent work in the area selected. **Effective From: Summer 2010**

IS 787 - Information Systems PhD Seminar A (1 credit)
The seminar includes student presentations related to their research, faculty presentations, and occasional outside speakers. Its goal is to enable students to identify their research areas for the dissertation, and to obtain constructive feedback on their papers and research in progress. Two presentations are required of each student. Open to students in the PhD program in Information Systems. **Effective Until: Fall 2008**

IS 788 - Information Systems PhD Seminar (3 credits)
Prerequisite: restricted to students in the doctoral program in Information Systems (or students in the joint Rutgers- NJIT PhD in management who major in CIS). The seminar includes student presentations related to their research, faculty presentations, and occasional outside speakers. Its goal is to enable students to identify their research area for the dissertation, and to obtain constructive feedback on their papers and research in progress. Students are required to engage in a research internship under the direction of a faculty member, and to make at least three presentations, including at least one for a paper to be submitted to a professional meeting or journal. **Effective From: Spring 2007**

IS 790 - Doctoral Dissertation and Research (Credits as designated)
For PhD students who have completed the qualifying exam. Research and writing are carried out under the supervision of a designed graduate faculty member. The completed dissertation should be a substantial contribution to the knowledge of the topic under research, and of sufficient merit to warrant publication in a leading scientific or technical journal. **Effective From: Fall 2011**

IS 791 - Graduate Seminar (Non-credit)
A seminar in which faculty, students, and invited speakers will present summaries of advanced topics in information systems. In the course students and faculty will discuss research procedures, dissertation organization, and content. Students engaged in research will present their own problems and research progress for discussion and criticism. **Effective From: Spring 2007**

IS 792 - Pre-Doctoral Research (3 credits)
Prerequisite: permission from department chairperson. For students admitted to the doctoral program in IS who have passed the field exam or the qualifying examination. Research is carried out under the supervision of a designated faculty member. Students identify a research problem and prepare a plan to solve the problem. A maximum of 6 credits of IS 792 may be applied to the IS 790 requirement. **Effective From: Fall 2006**

IS 794 - Computer Science/Information Systems Colloquium (Non-credit)
Prerequisite: graduate standing with major in computer science. Colloquium in which national and international experts in the various fields of computer science are invited to present and discuss the results of their recent research. **Effective From: Fall 2006 Until: Fall 2008**

Management Information Systems: Offered by the School of Management

UNDERGRADUATE COURSES:

MIS 245 - Introduction to Management Information Systems (3-0-3)
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. **Effective From: Spring 2005**

MIS 246 - Tools and Technologies for the Digital Firm (3-0-3)
This course is designed to provide students with an introduction to the applications being used by digital firms, companies that rely extensively on the use of information technology to support all their functions and processes. Although function specific systems (e.g. accounting information systems, financial information systems) are introduced the emphasis is on enterprise wide systems such as those offered by SAP, Oracle and Peoplesoft. A basic introduction to the technologies underlying the applications used in business is also provided.

MIS 345 - Management of Information Systems (3-0-3)
Prerequisites: CIS 103 or CIS 113, MIS 246. Training managers or entrepreneurs to use and manage information systems. The evolution of the computer as a management information tool and a demonstration of how this tool can be used to improve both the effectiveness and efficiency of managers.

MIS 360 - Survey of E-Commerce Tools & Technologies (3-0-3)
Prerequisite: MIS 246. Covers the current technologies behind e-commerce solutions such as dynamic Web sites, database integration, server-side scripting, client-side scripting, and XML.

MIS 363 - Project Management for Managers (3-0-3)
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. **Effective From: Fall 2009**

MIS 376 - Information Systems and Operations Management (3-0-3)
This course will integrate information systems with operations management. The role information systems play in the operations management functions for both the goods and services sectors of a global economy. Topics to be covered are mission and strategy development, demand forcasting, capacity planning, facility location, process strategy, inventory management, project management and total quality management. The way information systems integrates these concepts with ERP, SCM, CRM and other business systems will be discussed. **Effective From: Spring 2005 Until: Spring 2009**

MIS 445 - Decision Support Systems and OLAP (3-1-4)
Prerequisites: MIS 345 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 463 - Systems Analysis and Design for Managers (3-0-3)
This course focuses on the analysis and development of systems to meet the increasing need for information within organizations. Topics include systems development life cycle, analysis and design techniques, information systems planning and project identification and selection, requirements collection and structuring, process modeling, data modeling, design of interface and data management, system implementation and operation, system maintenance, and change management implications of systems. **Effective From: Spring 2005**

MIS 485 - Special Topics in Management Information Systems (3-0-3)
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. **Effective From: Fall 2009**

GRADUATE COURSES:

MIS 545 - Management Information Systems (3 credits)
Tools and techniques of management information systems and how they can be used to improve the quality of management decisions. Includes computer-based solutions to management problems in office automation, budgeting, communications, and decision support, major features of hardware and software computer system components and how to design a system, and technical tools ranging from flowcharts and decision tables to automated design.

MIS 620 - E-Commerce Technologies (3 credits)
Intended to develop a basic understanding of the Internet and its underlying technologies as a foundation for e-commerce with an introduction to e-commerce applications. Addresses the technology for MIS managers to effectively manage the launching of e-commerce infrastructures. Covers data communication and networking, EDI, intranets and extranets, bandwidth and security issues.

MIS 625 - Management Strategies for E-Commerce (3 credits)
Prepares students for effective management of internet-based businesses and electronic commerce and oversight of global business activities in an increasingly competitive environment. Introduces Internet concepts and infrastructure. Examines current and proposed Internet services forming the basis of Internet commerce. Covers corporate intranets and extranets and their applications to corporate computing, seamless e-commerce, and other emerging services such as VPN. Issues are discussed, with special emphasis on security.

MIS 635 - Management of Telecommunications (3 credits)
A comprehensive review of current trends in telecommunications with an emphasis on the techniques required by non-technically trained managers to deal with hardware, software, and human interfaces. Specific areas to be covered include the types of telecommunication networks, common network operating systems, and network design strategies.

MIS 636 - Telecommunications: Policies and Regulations (null)
Familiarization with government regulations for all forms of telecommunications, including video and audio. Covers such aspects as the ways in which corporations manage and provide security for telecommunications. Covers briefly: major telecommunications policies and regulations that have made a major impact on the current environment; telecommunications regulations in a global environment.

MIS 645 - Information Systems Principles (3 credits)
The management of information processing resources, including: role of information processing, estimates of personnel resources and budgets, integration of corporate and MIS plans, organizational alternatives for MIS departments and support staffs, management of computer operations, equipment and general software acquisitions, intermediate and long-range MIS plans, integration of personal computers, minicomputers, and mainframes, and security and controls. **Effective From: Spring 2011**

MIS 648 - Decision Support Systems for Managers (3 credits)
Prerequisites: MIS 645. Covers the use of decision support systems to support management decision making in a real world environment. Topics include: establishing and measuring decision support systems success criteria, software tools, model management, elements of artificial intelligence, and statistics. Justification, design, and use of decision support systems. **Effective From: Spring 2011**

MIS 654 - Design of Accounting Information Systems (3 credits)
Management's need for information and design of systems to provide this information. Emphasis on designing controls to ensure that the system meets management's objectives. Comparison of management and technical aspects of information systems. Accounting information systems will be used as models, but the course will incorporate all functions within the organization and provide the student with tools needed to manage the system and safeguard the assets of the organization.

MIS 655 - Information Systems Audit, Control and Security (3 credits)
Emphasizes controls and how an auditor or a manager verifies that controls are in existence and are effective. Security and controls are complementary and should be included in an MIS system environment. Covers the internal controls that should be present in an information system given its environment.

MIS 665 - Introduction to Electronic Commerce (3 credits)
Examines the changes in business processes and organizations enabled by electronic commerce technologies and application. Develops an understanding of the new electronic marketplace based on fundamental economics of the digital economy. Investigates electronic economies, new organizational structures, information systems architectures, and decision analysis.

MIS 680 - Management Science (3 credits)
Introduction to the methodology of decision making applying the techniques of operations research and system analysis to managerial problems. Introduction to the concept of objective functions and constraints, concepts of value and utilities, optimization algorithms, networks and game theories. Elementary mathematical model linear production systems, inventory systems, multi-criteria decision making, project management and transportation planning. Topics will be discussed from the deterministic as well as scholastic points of view.

MIS 690 - Executive Information Systems (3 credits)
Provides decision makers a framework for designing and building systems to gain competitive advantage. Covers executive support systems, executive information systems, and group support systems.

MIS 701 - Thesis in Information Systems Management (6 credits)
Prerequisites: MIS 645, MIS 648, CIS 675, CIS 679 or waived with approval of the Dean. Examines what is research? Why do research? What are the objectives of research? Covers need for research, criteria for good research and research design, concept of measurement, sampling design, primary data collection, experimentation and simulation, statistical and other types of analysis, and reporting of research findings.

Information Technology: Offered by the Information Technology Committee

UNDERGRADUATE COURSES:

IT 101 - Introduction to Information Technology (3-0-3)
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. **Effective From: Fall 2013**

IT 102 - Advanced Programming for Information Technology (3-0-3)
Prerequisites CS 115. This course develops a broader and deeper understanding of the concepts and tools of IT providing a foundation for later work. It focuses on problem solving using object-oriented, event-driven, and networked programming. Topics include classes, objects, GUI's, events, sockets, client/server programming, multithreading, multimedia, exception handling and IO. A modern development environment and programming language are used to realize the concepts introduced. **Effective From: Summer 2011 Until: Fall 2011**

IT 114 - Advanced Programming for Information Technology (3-0-3)
Prerequisites CS 113 or CS 115. This course is a continuation of CS 113. 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 tress. 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 features of an object-oriented programming language are exploited throughout. **Effective From: Fall 2013**

IT 120 - Introduction to Network Technology (3-3-3)
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. **Effective From: Spring 2007**

IT 201 - Information Design Techniques (3-0-3)
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. **Effective From: Fall 2005**

IT 202 - Internet and Applications (3-0-3)
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. **Effective From: Fall 2013**

IT 220 - Wireless Networks (3-0-3)
Prerequisite: IT 120. 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 (3-0-3)
Prerequisite: IT 120. 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 (3-0-3)
Prerequisites: CS 113 or CS 111 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. **Effective From: Fall 2010**

IT 265 - Game Architecture and Design (3-0-3)
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. **Effective From: Spring 2007**

IT 266 - Game Modification Development (3-0-3)
Prerequisites: IT 102 or IT 114 or CS 116 or CS 114. 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. **Effective From: Spring 2012**

IT 276 - Game Development (3-0-3)
Prerequisites: IT 265 and IT 266, or, CS 265 and CS 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. **Effective From: Spring 2007**

IT 286 - Foundations of Game Production (3-0-3)
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. **Effective From: Fall 2009**

IT 287 - Advanced Game Production (3-0-3)
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. **Effective From: Fall 2009**

IT 302 - Advanced Internet Applications (3-0-3)
Prerequisites: IT 202 or IS 217. 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. **Effective From: Fall 2013**

IT 303 - Model View Controller Software Architecture (3-0-3)
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. **Effective From: Spring 2012**

IT 310 - E-commerce Technology (3-0-3)
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 (3-0-3)
Prerequisite: 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 **Effective From: Spring 2013**

IT 320 - Virtual Instrumentation (3-0-3)
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 (3-0-3)
Prerequisites: IT 230. 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. **Effective From: Spring 2012**

IT 331 - Privacy and Information Technology (3-0-3)
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. **Effective From: Fall 2009**

IT 332 - Digital Crime (3-0-3)
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. **Effective From: Fall 2009**

IT 335 - Introduction to .NET Framework (3-0-3)
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. **Effective From: Spring 2007**

IT 340 - Introduction to System Administration (3-0-3)
Prerequisite: IT 120. 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. **Effective From: Fall 2011**

IT 360 - Programming for Computer Graphics (3-0-3)
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 (3-0-3)
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. **Effective From: Fall 2009**

IT 386 - 3D Modeling and Animation (3-0-3)
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. **Effective From: Fall 2009**

IT 400 - Information Technology and the Law (3-3-3)
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. **Effective From: Spring 2007**

IT 411 - Co-op Work Experience (3-0-3)
Prerequisite: 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 **Effective From: Spring 2013**

IT 420 - Computer Systems and Networks (3-0-3)
Prerequisites: IT 120 and either CS 113 or CS 115. 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. **Effective From: Fall 2011**

IT 430 - Ethical Hacking for System Administrators (3-0-3)
Prerequisite: IT 420 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. **Effective From: Fall 2010**

IT 485 - Special Topics in Information Technology I (3-0-3)
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 (3-0-3)
Prerequisites: same as for IT 485. A continuation of IT 485.

IT 488 - Independent Study in Information Technology (3-0-3)
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 488H - Honors Independent Study in Information Technology (3-0-3)
Prerequisites: open only to Honors College 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 (3-0-3)
Prerequisite: IT 420. 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. **Effective From:**

Fall 2005

IT 491 - IT Capstone Project (3-0-3)
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.

IT 491H - Honors IT Capstone Project (3-0-3)
Prerequisites: senior standing in the Honors College and project proposal approval. Similar to IT 491, with a project of greater depth and scope.

GRADUATE COURSES:

IT 610 - System Administration (3 credits)
Prerequisite: Completion of the Bridge requirements for the MS in IT Administration and Security (or the equivalent). This course is an introduction to the skills needed for and tasks performed by a System Administrator. The course will cover administration of host and server systems in modern operating system environments. Topics to be covered include: user, configuration, and change management, shell scripting, monitoring and performance analysis, disaster mitigation and recovery, and auditing. **Effective From: Fall 2009**

IT 620 - Wireless Networks Security and Administration (3 credits)
Prerequisite: Completion of the Bridge requirements for the MS in IT Administration and Security (or the equivalent). This course introduces the fundamentals of wireless network security and administration. Topics include: wireless LAN vulnerabilities, passive and active wireless attacks, enterprise wireless hardware security, secure wireless authentication and communication, wireless intrusion detection and prevention systems, WiFi and cellular network management, location privacy, personal area network administration and security, mobile IP security, GSM, CDPD, 3G and 4G network security. The course provides both a theoretical foundation and hands-on experience in these areas. **Effective From: Fall 2009**

IT 635 - Database Administration (3 credits)
Prerequisite: Completion of the Bridge requirements for the MS in IT Administration and Security (or the equivalent). This course provides a broad overview of the tasks and techniques necessary to function as a Database Administrator (DBA)in a modern relational database environment. Students will learn the duties typically performed by a DBA, which include: user authorization, disaster planning and recovery, monitoring, performance analysis, database tuning, metadata maintenance as well as data modeling, analysis and database design. **Effective From: Fall 2009**

IT 640 - Network Services Administration (3 credits)
Prerequisite: Completion of the Bridge requirements for the MS in IT Administration and Security (or the equivalent). This course provides an introduction to the fundamentals of network services administration. It covers how web-based and domain-services operate, integrate and communicate. Topics include: fundamental technologies that underpin the web services paradigm, key standards necessary for their development, and how other critical domain services should be deployed. This course will enable students to gain skills necessary to plan, install, configure, secure and maintain web servers, DNS servers, email & print servers, resource sharing systems, and domain authentication systems. **Effective From: Fall 2009**

Interior Design: Offered by the School of Art + Design

UNDERGRADUATE COURSES:

INT 221 - Building & Interior Systems I (3-0-3)
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. **Effective From: Fall 2009**

INT 222 - Building and Interior Systems II (3-0-3)
Prerequisite: Phys 102. 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. **Effective From: Fall 2009**

INT 263 - Interior Design Studio I (1-9-4)
Prerequisites: AD 111, AD 112. Co/prerequisite: AD 150. Corequisite: INT 221. 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. **Effective From: Fall 2010**

INT 264 - Interior Design Studio II (1-9-4)
Prerequisites: AD 150, INT 263. Corequisite: INT 222. 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. **Effective From: Fall 2010**

INT 321 - Methods & Materials (3-0-3)
Prerequisites: AD 111, AD 112, AD 150 or Arch 334, AD 161, AD 162 and Arch 251. 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. **Effective From: Fall 2009**

INT 322 - Contract Documents (3-0-3)
Prerequisites: INT 321, INT 363. Co/prerequisite: Arch 282. 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. **Effective From: Fall 2010**

INT 350 - History of Furniture (3-0-3)
Prerequisite: AD 161 and AD 162 or equivalent; or Arch 251, 252 and 381. 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. **Effective From: Fall 2009**

INT 351 - Furniture Design (2-3-3)
Prerequisites: INT 264 or ID 264 or DD 364 or FA 264 or Arch 264. 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. **Effective From: Fall 2010**

INT 363 - Interior Design Studio III (1-12-5)
Prerequisites: INT 222, INT 264. CO/Prerequisites: 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. **Effective From: Fall 2010**

INT 364 - Interior Design Studio IV (1-12-5)
Prerequisites: INT 221, INT 222, INT 321, INT 363. Co/prerequisite: 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 coneptual, technical, aesthetic, and functional aspects of designs. **Effective From: Fall 2010**

INT 464 - Interior Design Studio V (1-12-5)
Prerequisites: ARCH 282, ARCH 337, INT 321, INT 322, INT 364; Co/prerequisite: 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. **Effective From: Spring 2012**

International Studies:

UNDERGRADUATE COURSES:

MR INTL - Study Abroad (12 maintenance-of-registrations credits)
Prerequisite: permission from the Office of International Students and Faculty. NJIT, through direct exchange agreements and through membership in an engineering educational exchange consortium, offers students the opportunity to study abroad for a semester or an academic year. Students may select any of the courses that meet their degree requirements with written approval from the academic advisor. Transfer credits will be awarded for pre-approved courses successfully completed at the end of the exchange period. Open to all majors.

GRADUATE COURSES:

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Italian: Offered by the Department of Classical and Modern Languages and Literatures at Rutgers-Newark. See Classics course list for faculty.

Jounalism, Writing, Media: Offered by the Department of English at Rutgers-Newark. See Rutgers English course list for faculty.

UNDERGRADUATE COURSES:

R570:201 - Journalism and Communications Media (3)
For more details go to Rutgers Catalog.

Literature: Offered by the Department of Humanities. See Humanities course list for faculty

UNDERGRADUATE COURSES:

LIT 320 - American Literature (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

LIT 321 - British Literature (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

LIT 330 - World Literature I: North America, Latin America and the Caribbean, Australia and Oceania (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Enhances understanding of other cultures and of past and contemporary global interactions. **Effective From: Spring 2009**

LIT 331 - World Literature II: Africa and the Middle East, Asia, and Europe (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Enhances the under-standing of other cultures and of past and contemporary global interactions. **Effective From: Spring 2009**

LIT 340 - Contemporary Literature (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

LIT 350 - Fiction (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Explores the short story and the novel from varied countries and eras. Emphasis is given to narrative methods, representative themes, and global perspectives. **Effective From: Spring 2009**

LIT 352 - 20th Century European Fiction (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Examines themes ranging from war and occupation, revolution, Fascism, and Communism to individual liberation and self-discovery, existen-tialism, absurdism, and feminism. **Effective From: Spring 2009**

LIT 355 - Poetry (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Explores the problems, devices, and techniques of poetry'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. **Effective From: Spring 2009**

LIT 360 - Drama (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

LIT 361 - 20th Century American Drama (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

LIT 362 - Non-Western Drama (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Explores clas-sical and contemporary theater and drama in China, Japan, India, Africa, and the Middle East. **Effective From: Spring 2009**

LIT 363 - Ethnic and Minority Drama (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Using con-tem-porary dramas as social, historical, and cultural artifacts, examines the experience of Latinos, Asian Americans, Native Americans, and African Americans. **Effective From: Spring 2009**

LIT 364 - Modern Continental and British Drama (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

LIT 365 - Non-Fiction (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Examines the ways that writers examine cultural issues through the use of literary non-fiction. Emphasis is placed on autobiographical, persuasive, and narrative techniques. **Effective From: Spring 2009**

LIT 370 - Literature and Diversity (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Allows students to explore the literature of human difference, including the literature of cross-cultural experience and sexual difference. **Effective From: Spring 2009**

LIT 372 - African-American Literature (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Allows students to explore themes and styles particular to literary works by and about African-Americans. **Effective From: Spring 2009**

LIT 374 - Women and Literature (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Allows students to explore literature by and about women from around the world. Special attention is paid to autobiographical narratives **Effective From: Spring 2009**

LIT 376 - Latin American Literature (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Examines the ways that writers of Latin America and the Caribbean explore their respective culture through techniques such as dream, myth, and legend to achieve an authentic and unique -vision. Special emphasis is given to 20th-century authors. **Effective From: Spring 2009**

LIT 378 - Literature and Nature (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

LIT 380 - Historical Literature (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

LIT 382 - The Comic Tradition in English and American Literature (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

LIT 384 - Musical Theater Adaptations (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or betterThe 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. **Effective From: Fall 2011**

LIT 386 - Science Fiction (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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 video are used. **Effective From: Spring 2009**

LIT 388 - The Russian Novel and Short Story (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Management: Offered by the School of Management.

UNDERGRADUATE COURSES:

Mgmt 190 - Introduction to Business (3-0-3)
Introduction to business enterprise, including organization structure, basis of authority and responsibility, financial systems, marketing, and the interaction of government and business. The interrelationships of the broad economic, political, psychological, and social influences upon business. **Effective From: Spring 2008**

Mgmt 216 - Business Statistics (3-0-3)
Prerequisite: Math 105 or Math 333. Introduction to business data analysis for application in management decision-making processes. Productivity measures, employment trends, national income data, and consumer price changes. Methods for collection of business and economic data, presentation of data and computer applications, index numbers, historical analysis trend projections, survey sampling, and planning for business research.

Mgmt 290 - Business Law I (3-0-3)
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. **Effective From: Spring 2013**

Mgmt 310 - Co-op Work Experience I (3 credits)
Prerequisites: junior standing, 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. **Effective From: Spring 2013**

Mgmt 316 - Business Research Methods (2-1-3)
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. **Effective From: Fall 2009**

Mgmt 350 - Knowledge Management (3-0-3)
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 (3-0-3)
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. **Effective From: Spring 2013**

Mgmt 380 - Principles of E-Commerce (3-0-3)
This course is designed to provide an overview of electronic commerce technologies, e-commerce strategies and their implications for work organizations. The course focuses on how the Internet has transformed business and the emergence of the digital firm. **Effective Until: Spring 2009**

Mgmt 390 - Principles of Management (3-0-3)
Prerequisite: junior or senior standing. The broad basic principles of the managerial process that are fundamental to the successful operation of various types of enterprises. Emphasizes the role of management at all levels of responsibility. Organization,

motivation and morale; scientific management and human relations; the functions of planning, directing, and controlling. A rational synthesis of research and concepts, which together constitute the subject matter of management.

Mgmt 390H - Honors Principles of Management (3-0-3)
Prerequisites: member of the Honors College or permission of the instructor

Mgmt 410 - Co-op Work Experience II (zero credits)
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. **Effective From: Spring 2013**

Mgmt 460 - Management Strategies for E-Commerce (3-0-3)
Prerequisite: MIS 360. Learn about the Internet, intranets and extranets and incorporating them into business planning and operations

Mgmt 480 - Managing Technology and Innovation (3-0-3)
Prerequisite: Junior standing. 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. **Effective From: Fall 2010**

Mgmt 485 - Special Topics in Management (3-0-3)
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. **Effective From: Fall 2009**

Mgmt 491 - International Business (3-0-3)
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 492 - Business Policy (3-0-3)
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.

Mgmt 492H - Honors Business Policy (3-0-3)
Prerequisites: member of the Honors College, senior standing.

Mgmt 496* - Introduction to Transportation (3-0-3)
Prerequisite: upper division standing. Introduction to transportation systems and the transportation industry. Survey of the various modes of transportation, organizational structure and operation of private and public carriers. The role of government in the regulation of the U.S. transportation industry. Management of traffic and physical distribution operations. Cost and service comparisons of competing modes of transportation. Organized labor and associated costs.

Mgmt 499 - Senior Seminar: Career Planning and MFT (1-0-1)
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. Corequisite: MGMT 492. This course runs for the first 10 weeks of the semester. **Effective From: Fall 2012**

GRADUATE COURSES:

IM 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

Mgmt 501 - Management Foundations (3-0-3)
This course provides foundation knowledge for MSM and MBA students whose undergraduate coursework does not include coursework in accounting and finance. It therefore, serves as a pre-qualifier for the MSM and MBA programs. **Effective From:**

Fall 2004

Mgmt 580 - Managerial Science (3 credits)
Introduction to methods of operations research and systems analysis of managerial problems: objective functions and constraints, theories of values, optimization and simulation modeling with emphasis on models of production systems, decision analysis, inventory systems, project planning, and transportation systems. Deterministic and stochastic approaches to these topics are covered.

Mgmt 610 - Foundations of Management in Organizations (3 credits)
Presented during the residence week for the Executive Program. Includes management accounting, managerial economics, statistics, operations research, marketing, MIS, and finance.

Mgmt 612 - Principles of Emergency Management (3 credits)
This course covers core aspects of Emergency Management (EM). EM theory identifies four critical areas: 1) understanding & mitigating risk, 2) planning & preparedness, 3) reaction & response, 4)recovery/normalization. This course focuses on innovative approaches to EM in each area. Also: risk & cost assessment, entrepreneurial approaches to disaster prevention & response, self-organized response, new technologies for emergency management, terrorism & global issues, and after-action evaluations. **Effective From: Fall 2007**

Mgmt 616 - Learning Methodologies and Training Technologies (3 credits)
This course provides an overview of learning methodologies and training technologies, with an emphasis on emergency management. It reviews theories and develops skills for the planning, evaluation and selection of traditional and new technology-driven learning and training methods. Course participants will review relevant research and learn how to choose the most effective training methodologies, technologies and content resources appropriate to the needs of different audiences. **Effective From: Fall 2007**

Mgmt 620 - Management of Technology (3 credits)
Technology as a main component of an organizational entity. Generation, development, and implementation of technology are outlined. Influence of technology on global competitiveness is also discussed.

Mgmt 625 - Distribution Logistics (3 credits)
Distribution logistics emphasizing techniques used to optimize corporate profit and customer service; transportation modes; inventory policies; warehousing and order processing; and the best logistics gross margin. Same as EM 640 and Tran 640.

Mgmt 630 - Decision Analysis (3 credits)
Introduction to the methodology of decision analysis using computer based techniques and systems analysis. Introduces concepts of modeling, probability, and choice. Addresses the philosophy and detailed methods involved in decision analysis. Methods are applied to address routine and special business decisions.

Mgmt 635 - Data Mining and Analysis (3 credits)
This course provides an introduction to data mining with an emphasis on large scale databases as a source of knowledge generation and competitive advantage. Specific topics include: framing research questions; data modeling; inferential data mining techniques; and evaluation and deployment of data mining systems.

Mgmt 640 - New Venture Management (3 credits)
Prerequisite: Fin 516. For the student who is considering starting or managing a new business. The course combines classroom instruction in business management and a term project involving the analysis of a business case. The course is designed to build upon and integrate the student's previously acquired business knowledge and skills into an understanding of how to start and run a new business.

Mgmt 641 - Global Project Management (3-0-3)
The course reviews key elements of project management frameworks with a particular focus on global projects, which include people from various organizations working in different countries across the world, both face-to-face and virtually. Such projects vary in complexity based on the number of organizations, locations, cultures, languages and time-zones involved. It discusses people, technology and processes relevant to managing global projects and virtual teamwork. **Effective From: Spring 2013**

Mgmt 642 - Corporate Communication (3 credits)
Develops communication skills for modern global corporate and business markets. Business documents may include mission/vision statements, business plans, financial statements/plans, marketing plans, and corporate policies and procedures. **Effective From: Fall 2007**

Mgmt 644 - Communication in Technology Transfer and Innovation (3 credits)
In order to help prepare students for careers in a market-oriented productive economy, this course builds on the understanding

that communication is essential to innovation development and technology transfer. Students first review the principles of successful technical communication and the models and literature of communication in technology transfer. Then, students apply this knowledge in team-based projects to develop Technology Transfer Communication Strategy (TTCS) for technology start-up companies as needed (business plans, documentation, technical reports, etc.) **Effective From: Fall 2007**

Mgmt 645 - New Venture Finance (3 credits)
Prerequisite: Fin 516. This course is designed to provide students with understanding of the problems and opportunities posed by the financing of a new and growing technology-based business. Students will study the financial conditions of new businesses and examine the effect of growth upon cash flow while exploring optimal sources of capital.

Mgmt 649 - Convention, Creativity and Innovation (3-0-3)
This course explores the role of creativity and disruptive thinking in relation to the development of new products, processes, technologies and industries. It begins with a focus on the behavioral aspects of creativity and disruptive thinking and includes exercises and tools to challenge conventional thinking. Disruption is them studies through a strategic lens with emphasis on understanding the conditions under which radical change is appropriate and when it is not. **Effective From: Spring 2013**

Mgmt 650 - Knowledge Management (3 credits)
Students will learn the principles of the knowledge management process. At the end of the course, students will have a comprehensive framework for designing and implementing a successful knowledge management effort and be able to assist in the development of knowledge. **Effective From: Spring 2011**

Mgmt 655 - Global Competitiveness (3 credits)
Improves knowledge of the issues involved in international business operations and their management. Develops skills in selecting key issues and familiarization with emerging methods for organizing and managing international operations. Emphasis will be on companies with technological, product, production, or design focus.

Mgmt 656 - Public Policy and Business (3-0-3)
This course explores the relationship between business and government with a focus on regulatory policies and public?private partnerships. Areas of focus include sustainability and environmental regulations, trade policies and their influence on international commerce, public policy concerning the Internet and emerging digital technologies, patent rights, and opportunities for public?private partnerships with regard to fostering economic development **Effective From: Spring 2013**

Mgmt 657 - Import/Export Processes (3 credits)
Prerequisite: Mgmt 670 or Mgmt 655. Discusses key elements of import/export planning processes with an emphasis on the technology-based firm. International environment, market analysis, export strategy, and transactions are studied. Covers trade regulations and policies, financial advantage of foreign trade zones, and international standards for technology-based products. Factors underlying trade encouragement and restrictions between nations are also considered.

Mgmt 660 - Managing Supply and Value Chains (3 credits)
This course is focused on the flow of products, information and revenue across supply and value chains in organizations. Special emphasis is placed on emerging e-business models and their effects on supply and value chains, and customer relationship management. The course also includes a survey of relevant information technologies.

Mgmt 665 - International Product Development (3 credits)
Prerequisite: Mgmt 670 or Mgmt 655. Students will learn about product development processes as part of international business development operations. Examines differences in developing products for: national and international customers, production and service industries, and static and dynamic client needs. Examines methods of design management, means to integrate product design, production, and marketing functions, and measures for product life-cycle accounting. Term projects examine national differences in product development.

Mgmt 670 - International Business (3 credits)
Covers the scope and the essential characteristics of international business in the world economy; MNEs as economic, political, and social institutions; national and international control; functional management and operations; country evaluation; and regional market analysis.

Mgmt 675 - Legal Environment of International Business (3 credits)
Focuses on the legal aspects of international business activities. Topics include: international trade practices and government regulations; legal aspects of international joint ventures, mergers, and acquisitions; and the legal component of intellectual property rights and its relation to trade disputes.

Mgmt 676 - Managing the Digital Firm (3 credits)
Sweeping technological change coupled with globalization has led to the development of new organizational forms which fall into

the general category of digital firms. This course is focused on the digital processes that are transforming organizations and on managing all aspects of the digital firm. Topics include managing a virtual workforce, managing digital technologies, and protecting and leveraging digital assets.

Mgmt 678 - Management Strategies for Electronic Commerce (3 credits)
Examines recent developments in information technology that have had a significant impact on the economy and various industries with a focus on management strategies. Topics include intellectual property rights, privacy, ownership of information, and security.

Mgmt 680 - Entrepreneurial Strategy (3 credits)
For the student who is considering starting and/or managing a new business. Integrates knowledge of the different aspects of business that have been learned as separate subjects. Provides an understanding of the decisions that guide the overall operations of an entrepreneurial business organization and how it interacts with its markets, competitors, and suppliers. Combines classroom instruction in business strategy along with case analysis of small firms. Should be taken in the last semester of the program, unless prior arrangement has been made with the instructor or the graduate advisor. Taken in the final semester only.

Mgmt 681 - Project-Based Enterprise Development (3 credits)
Enterprise development involves activities geared toward substantive renewal of established enterprises or industries. In this Course, students will work with enterprise development projects including corporate venturing, international expansion, or business development initiatives, as well as, identification and implementation of new, more ethical business models, or restructuring of established businesses, just to mention a few examples. **Effective From: Fall 2008**

Mgmt 685 - Operations Research and Decision Making (3 credits)
Introduces the concepts of objective functions and constraints, concepts of value and utilities, optimization algorithms, networks, and game theory. Covers models of linear programming, inventory systems, multi-criteria decision-making, project management, and transportation planning. Topics discussed from probabilistic and deterministic approaches.

Mgmt 686 - Corporate Governance (3 credits)
Presents inter-disciplinary perspectives on the rights, responsibilities and roles of the corporation in society. Focuses on the relationships among owners, managers, and other stakeholders. Analyzes corporate control mechanisms including ownership concentration, executive compensation, boards of directors, and the market for corporate control. Includes changes in political/legal/regulatory institutional environments over time, and develops a comparative international framework. **Effective From: Fall 2009**

Mgmt 688 - Information Technology, Business and the Law (3 credits)
Includes historical and constitutional foundations, crimes, and torts in cyberspace, virtual property (patents online, copyrights in digital information, trade secrets in cyberspace, and cybermarks), electronic commerce contracting, electronic commerce, electronic money and the law, and information technology and online infringement of rights of intellectual property.

Mgmt 690 - Electronic Communities in Organizations (3 credits)
The rapid acceptance of the Internet and the growth of corporate intranets have spawned the development of electronic communities within and outside of organizations that share ideas, information and knowledge. This course explores the development, use and dynamics of electronic communities with an emphasis on their role in work organizations. Students will learn how to analyze and evaluate learning communities and to examine their relationship to important processes in organizations such as change, knowledge management, and customer relationship management.

Mgmt 691 - Legal and Ethical Issues (3 credits)
Explores the legal and ethical responsibilities of managers. Analyzes extent to which shareholders should be allowed to exercise their legitimate economic, legal, and ethical claims on corporate managers; extent of regulation of a particular industry, individual rights of the employee and various corporate interests, and corporate responsibility to consumers, society, and conservation of natural resources and the environment.

Mgmt 692 - Strategic Management (3 credits)
This course focuses on the Strategic Integration of the different functional areas in management providing a top management perspective to the role of chief executive in an organization. An integral part of this course is to understand the roles of both competitive environment and the organization's experience in developing corporate strategy to gain competitive advantage. We also emphasize ethical issues related to corporate strategies.

Mgmt 695 - Business Strategy for Environmental Management (3 credits)
This is a capstone course integrating the functional areas in management to provide a top management perspective to potential managers. The course deals with the role of the chief executive in environmental management and how strategies are formulated and implemented.

Mgmt 701 - Master's Thesis (6 credits)
Prerequisite: approval of the assistant dean for graduate programs. For students who desire to complete a thesis in management. Students must register every semester until the thesis is completed. Only 6 credits indicated for the thesis is applied to degree credit.

Mgmt 710 - Forecasting Methods for Business Decisions (3 credits)
Covers the application of forecasting techniques to various phases of business and management decision making. Topics include forecasting with cyclical and seasonal series; Box-Jenkins modeling; regression modeling; use of stochastic models; and the linkage of management forecasts to macro forecasts. Actual models in use will be reviewed and evaluated.

Mgmt 791 - Graduate Seminar (Non-credit)
Faculty, students and invited speakers present and discuss current topics of research in management.

R620:555 - Seminar in Organizational Behavior (3 Credits)
For more details go to Rutgers Catalog.

R620:556 - Seminar in Organizational Theory (3 credits)
For more details go to Rutgers Catalog.

R620:671 - Management of Innovation and Technology (3 credits by arrangement)
For more details go to Rutgers Catalog.

R620:677 - Culture and Organizations (3 credits by arrangement)
For more details go to Rutgers Catalog.

Marketing Management: Offered by the School of Management

UNDERGRADUATE COURSES:

Mrkt 330 - Principles of Marketing (3-0-3)
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. **Effective From: Spring 2008**

Mrkt 331 - Consumer and Buyer Behavior ((3-0-3))
Prerequisites: Math 105 and Mrkt 330. Psychological, social, and economic influences on consumer behavior. The application of consumer behavioral innovation to marketing decisions: research and measurement techniques, individual influences, environmental influences, and consumer information processing and decision making. A field research project will be undertaken. **Effective From: Fall 2005**

Mrkt 338 - Product Development and Management (3-0-3)
Prerequisite: Mrkt 330. The process of product development is studied in detail with specific emphasis on technology-driven innovation. Techniques for getting closer to customers including TQM principles are also covered.

Mrkt 339 - Professional Selling (3-0-3)
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. Concepts are discussed and integrated using role-playing, experiential exercies, videos, cases and class projects. **Effective From: Spring 2008**

Mrkt 360 - Internet Marketing (3-0-3)
Prerequisite: Mrkt 330. Provides an overview of fundamental principles of Internet marketing for the contemporary business environment. Topics include Internet marketing strategies, Internet marketing plan, and development of Internet-based marketing programs. **Effective From: Spring 2008**

Mrkt 430 - Marketing Research (3-0-3)
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 secondary research and multivariate statistical methods. Data analysis is conducted using SAS and/or SPSS.

Mrkt 432 - Sales Management (3-0-3)
Prerequisite: Mrkt 330. 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. **Effective From: Fall 2008**

Mrkt 434 - Business to Business Marketing (3-0-3)
Prerequisite: Mrkt 330. Techniques for marketing industrial products to organizations in the manufacturing, service, government, and non-profit sectors are covered within the context of a global marketplace. Emphasis is on the marketing of high technology products using a customer-driven approach. **Effective From: Spring 2008**

Mrkt 435 - International Marketing (3-0-3)

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. **Effective From: Summer 2008**

Mrkt 485 - Special Topics in Marketing (3-0-3)
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. **Effective From: Fall 2009**

GRADUATE COURSES:

Mrkt 530 - Principles of Marketing 3 credits (3 credits)
Examination of the factors relating to marketing process. The nature and significance of consumer and organization buying behaviors, competition, government regulations, consumerism, and social responsibility are analyzed. Covers decision making in market research, product development, pricing, distribution, advertising, promotion, selling, and marketing strategy.

Mrkt 620 - Competing in Global Markets (3 credits)
Designed to help prepare students to become effective managers overseeing global market activities in an increasingly competitive environment. It will examine the impact of global economic, financial, cultural, political, and legal factors on the development of marketing programs and on the marketing/R&D and marketing/manufacturing interfaces.

Mrkt 630 - Models of Consumer Behavior (3 credits)
Provides students a framework, the buyer decision process model, to analyze how and why products and services are selected and purchased. Impact of consumer decisions on the marketing strategies of organizations is emphasized. Focus on quality management of the marketing function to determine customer needs; provide the appropriate products, prices, distribution systems, and promotion messages; and measure customer satisfaction after purchase and use.

Mrkt 631 - Market Planning and Analysis (3 credits)
Provides a research and managerial perspective on advanced marketing research methods and analytical techniques. Topics include problem formulation, research design, data collection and analysis, managerial report writing. Students will acquire experience by developing and executing their own marketing research project using sophisticated computerized analytical techniques.

Mrkt 632 - Marketing Strategy for Technology-Based Organizations (3 credits)
Students combine the knowledge and skills learned in other marketing courses and develop strategic marketing plans that focus on quality management, productivity improvement, and international competitiveness. Buyer decision making, market segmentation and targeting, product positioning, market response, and competitive actions are analyzed. Case studies and student projects add realism and practical experience to the course.

Mrkt 636 - Design and Development of High Technology Products (3 credits)
Focus on analysis of needs of buyers and consumers for specific product characteristics and the development of appropriate products to satisfy such needs. The process of identifying new product opportunities, screening new product concepts, product testing and test marketing, product positioning, and development of the marketing strategy and implementation plans.

Mrkt 637 - Marketing Communications and Promotions (3 credits)
Communications, sales promotion, and public relations are examined from the perspective of the manager. Topics include advertising and promotion research, media selection, creative production of electronic and print materials, and the budgeting and control of their use. Field research will be stressed as part of the course project requirement.

Mrkt 638 - Sales Management for Technical Professionals (3 credits)
Focuses on the promotion and sales of products in the business-to-organization market. All elements of the marketing communications mix are covered according to their importance in that market: selling, sales promotion, trade advertising, and publicity. The latest techniques are reviewed and discussed using case histories and student projects. Issues of global competitiveness, high technology products, and the role of total quality management in marketing communications are emphasized.

Mrkt 640 - Industrial Marketing Management (3 credits)
Stresses the role of the manager in all aspects of marketing. Managerial decision-making techniques and strategies for product development, product pricing, distribution channels, personal selling, advertising and promotion. Strategic and operational

marketing plans are developed based on student field research.

Mrkt 642 - International Marketing Management (3 credits)
Focus on multinational enterprise in the global market, emphasizing special managerial skills required to adapt sound marketing practices to foreign cultural, political, economic and financial environments. Foreign opportunities and marketing strategies are examined. Students prepare a marketing plan for entry into an international market after conducting appropriate research.

Mrkt 645 - Internet Marketing Strategy (3 credits)
Introduction to the use of the Internet and electronic commerce in the development of marketing strategy. Examines the characteristics of electronic markets, the use of Internet for data collection and market research, the Internet as a communication and distribution medium, and the development of Internet-based marketing strategies.

Mrkt 701 - Thesis in Marketing Management (3 credits)
Prerequisites: Mrkt 630, Mrkt 631, Mrkt 632 or waived with approval of the Dean. For students who do a thesis in marketing. State-of-the-art marketing research methods: importance in marketing decision making, research objectives, research design, measurement concepts, reliability and validity, primary and secondary data collection, sampling design, qualitative and quantitative research and analytical methods, field studies and survey research, multivariate analytical models. Also covers planning, preparation and submission of the thesis.

Mrkt 731 - Advanced Market Planning and Analysis (3 credits)
Prerequisite: Mrkt 631. Covers advanced topics in the design and analysis of market research studies. Focus on the development of statistical sampling methods and techniques to develop estimates for complex marketing problems. Also focuses on advanced multivariate analysis and estimation techniques needed in the interpretation of complex marketing problems.

Mrkt 753 - Marketing Science (3 credits)
Prerequisite: Mrkt 631. Emphasizes quantitative model building approach to the complex problems of marketing decision making using the principles of quantitative decisions to management problems and econometrics to the understanding of large amounts of data, which lead to improvements in marketing decision effectiveness. Such areas of marketing as buyer behavior, pricing, promotion, advertising, sales force management, and new product planning will be analyzed.

R630:576 - Quantitative Methods in Marketing Credits by arrangement (3 credits)
For more details go to Rutgers Catalog.

R630:625 - Clustering Analysis (3 Credits by arrangement)
For more details go to Rutgers Catalog.

R630:660 - Qualitative Research Methods (3 credits)
For more details go to Rutgers Catalog.

R630:668 - Causal Modeling (3 credits)
For more details go to Rutgers Catalog.

Material, Science and Engineering : Offered by the Materials Science and Engineering Committee

UNDERGRADUATE COURSES:

MtSE 301 - Principles of Material Science and Engineering (3-0-3)
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 (3-0-3)
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 (3-2-4)
Prerequisites: Physics III; 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 (3-0-3)
Prerequisites: Physics III; Chem 126. This course is identical to MtSE 318, with the laboratory omitted.

MtSE 450 - Electron Microscopy (2-2-3)
Prerequisites: Physics III; Chem 126. Combines the lecture and laboratory in introducing the field of electron microscopy. Topics include magnetic electron lenses, electron optical systems, selected area diffraction, sample preparation, thin foil techniques, and photography.

MtSE 451 - X-Ray Diffraction (2-2-3)
Prerequisites: Physics III; Chem 126. Combines the lecture and laboratory in introducing the methods of X-ray diffraction. Topics include directions and intensities of diffracted beams, diffractometer methods, Laue methods, power photographs, reciprocal lattice constructions, and the rotating crystal method.

MtSE 452 - Materials Science I (3-0-3)
Prerequisites: Physics III; 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 (3-4-5)
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.

GRADUATE COURSES:

MtSE 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

MtSE 601 - Fundamentals of Engineering Materials (3 credits)
Prerequisite: graduate standing. Core course for students in Material Science and Engineering. The effect of structure on the properties and behavior of engineering materials. Topics include atomic structure, bonding, crystallography, and defects in solids; properties of metals, semiconductors, ceramics, and polymers and their behavioral response to mechanical, chemical, optical, electrical, and magnetic stimuli. **Effective From: Fall 2005**

MtSE 602 - Thermodynamics of Materials (3 credits)
Prerequisite: undergraduate thermodyamics. Core course for students in Material Science and Engineering. Review of first, second, and third laws of thermodynamics and their applications to materials. Stability criteria, simultaneous chemical reactions, binary and multicomponent solutions, phase diagrams, surfaces, adsorption phenomena, thermochemistry of homogeneous and heterogeneous reactions are covered. **Effective From: Fall 2005**

MtSE 605 - Fundamentals of Engineering Materials (3 credits)
Prerequisite: graduate standing. The effect of structure on the properties and behavior of engineering materials. Topics include atomic structure, bonding, crystallography, and defects in solids; properties of metals, semiconductors, ceramics, and polymers and their behavioral response to mechanical, chemical, optical, electrical, and magnetic stimuli.

MtSE 610 - Mechanical Properties of Materials (3 credits)
Prerequisite: graduate standing. Elements of elasticity and plasticity theory, deformation and fracture behavior of materials, the concept of dislocations and their interaction with other lattice defects, strengthening mechanisms in solids, and principles of failure analysis. Materials to be studied include metals, polymers, ceramics, glasses, and composites.

MtSE 615 - Composite Materials (3 credits)
Prerequisites: MtSE 605 and MtSE 610. Introduction to fundamental principles of design and technology of composite materials. Materials based on polymer, ceramic, and metal matrices are discussed. Properties of the constitutive materials, their structure, methods of structural arrangements, as well as properties and characterization of the final products are described. The different perspectives, examples, and problems in composite applications are outlined.

MtSE 619 - Nano-scale Characterization of Materials (3 credits)
The course presents the basics of nanotechnology and the principles and application of advanced instrumentation for the characterization of nanostructures. Topics include atomic force microscopy, near-field optics, dielectric spectroscopy, and light scattering. The significant component of the course is laboratory work at the W. M. Keck Foundation Laboratory and research project. **Effective From: Fall 2007**

MtSE 625 - Introduction to Ceramics (3 credits)
Prerequisite: MtSE 605. Mechanical, thermal, electrical, magnetic, and optical properties of crystalline and glassy ceramics are discussed from a structural viewpoint. Important processing methods, design and evaluation of properties, and modern applications of ceramic materials are emphasized.

MtSE 627 - Glass Science and Engineering (3 credits)
Prerequisites: MtSE 605 and MtSE 630. Formation and structure of inorganic, polymeric, and metallic glasses. Transport phenomena, kinetics of crystallization, glass transition, and phase separation; chemical, mechanical and optical properties of glasses.

MtSE 630 - Thermodynamics of Materials (3 credits)
Prerequisite: undergraduate thermodyamics. Review of first, second, and third laws of thermodynamics and their applications to materials. Stability criteria, simultaneous chemical reactions, binary and multicomponent solutions, phase diagrams, surfaces, adsorption phenomena, thermochemistry of homogeneous and heterogeneous reactions are covered.

MtSE 648 - NanoMaterials (3 credits)
Prerequisite: Junior or Senior courses of modern materials science, chemistry and physics. Introduction to functional nanomaterials and nanotechnology. Types of nanomaterials-fullerenes, nanotubes, quantum dots, supramolecules, dendrimers. Fundamental, materials science, chemistry and physics of nanomaterials. Nanoscale properties and computational modeling. Synthesis, assembly and fabrication techniques. Characterization of nanomaterials. Emerging applications in nanoelectronics, nano-sensors, biology and fuel cells. **Effective Until: Fall 2008**

MtSE 650 - Physical Metallurgy (3 credits)
Prerequisite: MtSE 605. Processing-structure-property relationships in metallic alloys. Alloy systems covered include carbon steels, stainless steels, aluminum and titanium alloys, and super alloys. Topics to be presented include elementary theory of metals, defects and related phenomena, solidification, phase phenomena, solid state diffusion, nucleation and growth kinetics, as well as transformation and deformation processes.

MtSE 655 - Diffusion and Solid State Kinetics (3 credits)
Prerequisite: MtSE 630. The atomic theory of diffusion and mathematical derivation of the diffusion equations. Diffusion phenomena in dilute alloys as well as in ionic and covalent solids are considered. High atom mobility effects at defect sites and surfaces are examined. Chemical kinetics and kinetics of phase transformations including nucleation, growth, and spinodal decomposition are discussed.

MtSE 681 - Composite Materials (3 credits)
Prerequisites: MtSE 601 and MtSE 610. Introduction to fundamental principles of design and technology of composite materials. Materials based on polymer, ceramic, and metal matrices are discussed. Properties of the constitutive materials, their structure, methods of structural arrangements, as well as properties and characterization of the final products are described. The different perspectives, examples, and problems in composite applications are outlined. **Effective From: Fall 2005**

MtSE 682 - Introduction to Ceramics (3 credits)
Prerequisite: MtSE 601. Mechanical, thermal, electrical, magnetic, and optical properties of crystalline and glassy ceramics are discussed from a structural viewpoint. Important processing methods, design and evaluation of properties, and modern applications of ceramic materials are emphasized. **Effective From: Fall 2005**

MtSE 685 - Physical Metallurgy (3 credits)
Prerequisite: MtSE 601. Processing-structure-property relationships in metallic alloys. Alloy systems covered include carbon steels, stainless steels, aluminum and titanium alloys, and super alloys. Topics to be presented include elementary theory of metals, defects and related phenomena, solidification, phase phenomena, solid state diffusion, nucleation and growth kinetics, as well as transformation and deformation processes. **Effective From: Fall 2005**

MtSE 687 - Glass Science and Engineering (3 credits)
Prerequisites: MtSE 601 and MtSE 602. Formation and structure of inorganic, polymeric, and metallic glasses. Transport phenomena, kinetics of crystallization, glass transition, and phase separation; chemical, mechanical and optical properties of glasses. **Effective From: Fall 2005**

MtSE 688 - Mathematical and Statistical Methods in Materials Science (3 credits)
More emphasis on analytical methods and statistics. Course is required for Ph.D. students in Materials Science. **Effective From: Fall 2006**

MtSE 690 - Directed Study in Materials Science and Engineering (3 credits)
Prerequisites: As specified by the instructor. Directed study at the Master's level under the guidance of a faculty member on a topic in materials science and engineering.

MtSE 700 - Master's Project (3 credits)
Prerequisites: sufficient experience and/or graduate courses to work on the project and approval of project advisor. An extensive report involving an experimental, theoretical, or literature investigation is required. The literature investigation should result in a critical review of a specific area. Students may extend the master's project into a master's thesis.

MtSE 701 - Master's Thesis (6 credits)
Prerequisites: sufficient experience and/or graduate courses to work on the thesis and approval of thesis advisor. Research involving experimental or theoretical investigations or collaborative projects with industry or governmental agencies may be accepted. Completed work in the form of a written thesis should merit publication in a technical journal and must be approved by a committee consisting of three faculty members. A student must register for 3 credits per semester. Only the 6 credits indicated for the thesis will be applied to the degree.

MtSE 702 - Characterization of Solids (3 credits)
Current methods for characterizing the chemical composition, crystallographic structure, electrical mapping, and morphology of solid materials. Principles and application of Auger Electron Spectroscopy (AES), Secondary Ion Mass Spectroscopy (SIMS), X-ray Photoelectron Spectroscopy (XPS), X-ray Emission Spectroscopy (XES), and Rutherford Backscattering Spectroscopy (RBS) for chemical analysis, X-ray Diffraction (XRD) and electron diffraction for crystallographic analysis, Electron Beam Induced Current (EBIC) microscopy, voltage contrast microscopy, Cathodoluminescence for electrical mapping, and Atomic Force Microscopy (AFM), Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM) and Nomarski interference contrast microscopy (DIC) for morphology.

MtSE 719 - Physical Principles of Characterization of Solids (3 credits)
Core course for students in Material Science and Engineering, Nano-scale characterization of materials. Basic science behind solid state characterization. Elements of modern physics. Optical microscope. Neutron scattering. Infrared and Raman spectroscopy. Rutherford backscattering spectroscopy. NMR. X-ray diffraction. X-ray photoelectron spectroscopy and Auger Electron Spectroscopy. SEM, TEM, STEM and STM.

MtSE 722 - Science and Technology of Thin Films (3 credits)
Prerequisite: graduate standing. Methods of preparing thin films by physical and chemical means are examined. Topics pertinent to nucleation and growth mechanism of single and polycrystalline films, structure determination, film thickness and compositional evaluation properties are discussed. The electrical, magnetic, optical, and mechanical properties of metallic, semiconductor, and insulating thin films are studied with particular relevance to integrated circuit applications. **Effective From: Fall 2005**

MtSE 723 - Defects in Solids (3 credits)
Prerequisites: MtSE 601 and MtSE 725. Crystallographic defects in solids, namely point defects such as vacancies and interstitial, line defects such as dislocations, and planar defects such as grain boundaries. Correlation of these defects to the mechanical, electrical and optical behavior of materials is examined in particular. Experimental methods for observation and characterization of defects including TEM, EBIC, DLTS are described. **Effective From: Fall 2005**

MtSE 724 - Transport of Electrons and Phonons in Solids (3 credits)
Prerequisite: Phys 687/26:755:687. Basic transport processes involving electrons and phonons in solids. Topics inlcude transport-related phenomena such as Hall effect, quantum Hall effect, magneto-resistance, size effects, thermal conductivity, thermoelectric effects, phonon drag, ballistic phonons, and ballistic electrons. Applications of transport to the characterization of new electronic materials including thin films are stressed. **Effective From: Fall 2005**

MtSE 725 - Crystallography and Diffraction (3 credits)
Prerequisite: graduate standing. The atomic arrangement of crystalline materials including treatment of crystalline defects and diffraction phenomena. Lattices, crystal systems, symmetry operations are covered as well as the fundamentals of electron and X-ray diffraction.

MtSE 737 - Transport of Electrons and Phonons in Solids (3 credits)
Prerequisite: Phys 687/26:755:687. Basic transport processes involving electrons and phonons in solids. Topics inlcude transport-related phenomena such as Hall effect, quantum Hall effect, magneto-resistance, size effects, thermal conductivity, thermoelectric effects, phonon drag, ballistic phonons, and ballistic electrons. Applications of transport to the characterization of new electronic materials including thin films are stressed.

MtSE 757 - Defects in Solids (3 credits)
Prerequisites: MtSE 605 and MtSE 725. Crystallographic defects in solids, namely point defects such as vacancies and interstitial, line defects such as dislocations, and planar defects such as grain boundaries. Correlation of these defects to the mechanical, electrical and optical behavior of materials is examined in particular. Experimental methods for observation and characterization of defects including TEM, EBIC, DLTS are described.

MtSE 765 - Science and Technology of Thin Films (3 credits)
Prerequisite: graduate standing. Methods of preparing thin films by physical and chemical means are examined. Topics pertinent to nucleation and growth mechanism of single and polycrystalline films, structure determination, film thickness and compositional evaluation properties are discussed. The electrical, magnetic, optical, and mechanical properties of metallic, semiconductor, and insulating thin films are studied with particular relevance to integrated circuit applications.

MtSE 780 - Current Topics in Materials Science and Engineering (3 credits)
Prerequisites: As specified by the program for the semester's offering. Topics of current interest in materials science and engineering.

MtSE 790 - Doctoral Dissertation (Credits as designated)
Required of all candidates for the degree of Doctor of Philosophy. A minimum of 36 credits is required. Students must register for 6 credits each semester until 36 credits are reached. If the dissertation is not yet complete, registration for an additional 3 credits is required each semester thereafter.

MtSE 791 - Graduate Seminar (Non-credit)
Required of all students enrolled in the M.S. or Ph.D. Program in Materials Science and Engineering. Faculty, students, and invited speakers will present and discuss current topics of research in materials science and engineering.

MtSE 792 - Pre-Doctoral Research (3 credits)
Prerequisite: permission of the program director. For students enrolled in the Ph.D. program before passing the Ph.D. qualifying examinations. Research is carried out under the supervision of a faculty member of the student's choice. A maximum of 6 credits may be applied to MtSE 790

Mathematics: Mathematics

UNDERGRADUATE COURSES:

Math 098 - Introduction to College Math A (4-1-4 additive credits)
Intended for students whose major requires Math 113, Math 138, Math 135, or Math 116. Topics include: Elementary Algebra, Introduction to Graphs and Functions, Linear Functions, Equations, Inequalities, Systems of Linear Equations, Radicals and Complex Numbers, Quadratic Equations, Rational Expressions and Rational Functions, Functions and Relations, Exponential and Logarithmic Functions and Equations. Introduction to the logistics of applied calculus. Diverse applications will be emphasized throughout the course. This course may not be used to satisfy degree requirements in any program. **Effective From: Spring 2009 Until: Spring 2011**

Math 099 - Introduction to College Math B (4-1-4 additive credits)
Intended for students whose major requires Math 111. Topics include: Elementary Algebra, Introduction to Graphs and Functions, Linear Functions, Equations, Inequalities, Systems of Linear Equations, Radicals and Complex Numbers, Quadratic Equations, Rational Expressions and Rational Functions, Functions and Relations, Exponential and Logarithmic Functions and Equations. Introduction to the logistics of applied calculus. Diverse applications will be emphasized throughout the course. This course may not be used to satisfy degree requirements in any program. **Effective From: Spring 2009 Until: Spring 2011**

Math 101 - University Mathematics II-Trigonometry (4-1-4)
Intended for students whose major requires Math 113, Math 135, or Math 138. Prerequisite: Placement by performance on standardized entrance examinations. This course reviews the trigonometry needed for higher level mathematics courses. The following topics are covered: radian measure, conic sections, trigonmetric functions and identities, laws of sines and cosines, logarithmic equations, partial fraction decomposition, systems of linear and nonlinear equations, functions in polar coordinates, and hyperbolic functions. Degree credit awarded for the following majors only: Hist, PTC, MGMT, and STS. **Effective From: Spring 2009 Until: Summer 2011**

Math 101 - Foundations of Mathematics for the Liberal Arts (3-0-3)
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 History. **Effective From: Fall 2011**

Math 102 - Modern Pre-calculus (6 credits)
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. **Effective From: Spring 2009**

Math 103 - University Mathematics I (4-1- 4 additive credits)
Prerequisite: Math 098 with a grade of C or better or placement by performance on standardized entrance examinations. Consists of a series of projects, many of which introduce and use elementary differentiation and/or integration in which the students perform sustained algebraic and trigonometric computations. The projects involve the following topics: polynomials, rational expressions, expressions involving radicals, exponential and logarithmic functions, right triangle trigonometry, and the solution of linear and quadratic equations. This course may not be used to satisfy degree requirements in any program. **Effective From: Spring 2009**

Math 104 - University Mathematics II (4-1- 4 additive credits)
Prerequisite: Math 103 with a grade of C or better or placement by performance on standardized entrance examinations. Consists of a series of projects, many of which introduce and use elementary differentiation and/or integration in which the students perform sustained algebraic and trigonometric computations. The projects involve the following topics: radian measure, conic sections, trigonometric functions and identities, law of sines and cosines, logarithmic equations, partial fraction decomposition, systems of linear and nonlinear equations, functions in polar coordinates, and hyperbolic functions. This course may not be used to satisfy degree requirements in any program. **Effective From: Spring 2009**

Math 105 - Elementary Probability and Statistics (3-0-3)
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. **Effective From: Fall 2011**

Math 106 - University Mathematics I A (4-1-4)
Prerequisite: Math 098 with a grade of C or better or Math 099 with a grade of C or better or placement by performance on standardized entrance examinations. Intended for students whose major requires Math 113 or Math 138. Intended for students whose major requires Math 113, Math 135 or Math 138. Consists of a series of projects, many of which introduce and use elementary differentiation and/or integration in which the students perform sustained algebraic and trigonometric computations. The projects involve the following topics: polynomials, rational expressions, expressions involving radicals, exponential and logarithmic functions, right triangle trigonometry, and the solution of linear and quadratic equations. Degree credit awarded for the following majors only: Hist, PTC and STS. **Effective From: Spring 2009 Until: Spring 2011**

Math 107 - University Mathematics BI (3-0-3)
Linear functions, equations, inequalities, systems of linear equations, quadratic equations, elementary functions, graphing functions. **Effective From: Fall 2012**

Math 107(archived) - University Mathematics II A (4-1-4)
Intended for students whose major requires Math 113 or Math 138. Prerequisite: Math 106 with a grade of C or better. Consists of a series of projects, many of which introduce and use elementary differentiation and/or integration in which the students perform sustained algebraic and trigonometric computations. The projects involve the following topics: radian measure, conic sections, trigonometric functions and identities, laws of sines and cosines, logarithmic equations, partial fraction decomposition, systems of linear and nonlinear equations, functions in polar coordinates, and hyperbolic functions. Degree credit awarded for the following majors only: Hist, PTC and STS. **Effective From: Spring 2009 Until: Spring 2011**

Math 108 - University Mathematics I B (4-1-4)
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. **Effective From: Spring 2009**

Math 109 - University Mathematics II B (4-1-4)
Intended for students whose major requires Math 111. Prerequisite: Math 108 with a grade of C or better. Consists of a series of projects, many of which introduce and use elementary differentiation and/or integration in which the students perform sustained algebraic and trigonometric computations. The projects involve the following topics: radian measure, conic sections, trigonometric functions and identities, laws of sines and cosines, logarithmic equations, partial fraction decomposition, systems of linear and nonlinear equations, functions in polar coordinates, and hyperbolic functions. Degree credit awarded for the following majors only: Hist, PTC and STS. **Effective From: Spring 2009 Until: Spring 2011**

Math 110 - University Mathematics B II - Trigonometry (4-1-4)
Intended for students whose major requires Math 111. Perequisite: 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 coodinates. **Effective From: Fall 2011**

Math 111 - Calculus I (4-1-4)
Prerequisite: Math 139 with a grade of B or better, or placement by performance on standardized entrance examinations. Topics include limits, differentiation, applications of differentiation, and integration. **Effective From: Spring 2013**

Math 111H - Honors Calculus I (4-1-4)
Admission to this course is by invitation, based on standardized entrance exams. Topics enhance those of Math 111 and concepts are studied in detail. Emphasizes science and engineering applications. **Effective From: Spring 2009**

Math 112 - Calculus II (4-1-4)
Prerequisite: Math 111 with a grade of C or better or Math 132 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. **Effective From: Spring 2012**

Math 112H - Honors Calculus II (4-1-4)
Prerequisite: Math 111H with a grade of B or better or Math 111 with a grade of A or Math 132 with a grade of A. Topics enhance those of Math 112 and concepts are studied in detail. Emphasizes science and engineering applications. **Effective From: Fall 2012**

Math 113 - Finite Mathematics and Calculus I (3-0-3)

Prerequisite: (Intended for Architecture students.) Math 107 with a grade of C or better, or Math 108 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. **Effective From: Fall 2013**

Math 114 - Finite Mathematics and Calculus II (4-0-4)
Prerequisite: (Intended for Architecture students.) Math 113 with a grade of C or better. Topics include numerical methods, set theory and counting, series, descriptive statistics and basic probability, matrices, and optimization. **Effective From: Spring 2009**

Math 115 - Elements of Geometry (3-0-3)
A modern approach to the elements of geometry grounded in real-world applications. Topics included basic axiomatic, Euclidean geometry, non-Euclidean geometry, and transformational geometry. Applications and examples in architecture, engineering and science are integrated throughout the course. **Effective From: Fall 2011**

Math 116 - Mathematics of Design (3-0-3)
The course is project oriented, covering theories of proportion; tiling, symmetry, symmetry groups, and informal geometry; fractals; theory of graphs and knots; three-dimensional design and polyhedra. The mathematics is oriented towards carrying out designs rather than a systematic development of mathematical theory. **Effective From: Fall 2011**

Math 120 - Basic Concepts in Statistics (1-0-1)
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. **Effective From: Spring 2012**

Math 131 - Calculus A (4-1-4)
Prerequisites: Math 139 with a grade of B or higher and permission of the major advisor or placement. The course covers limits, continuity, differentiation, and related rates, also reviewing the foundations of algebra, precalculus, and trigonometry. (4-1-4) Math 131, 132, and 133 are equivalent to math 111 and math 112. **Effective From: Spring 2013**

Math 132 - Calculus B (4-1-4)
Prerequisites: Math 131 with a grade of C or higher or Math 111 with a grade of C or higher. The course covers optimization, integration, calculation of arc length, area, volume, and hyperbolic functions (4-1-4) Math 131, 132, and 133 are equivalent to Math 111 and Math 112 **Effective From: Fall 2011**

Math 133 - Calculus C (4-1-4)
Prerequisites: Math 132 with a grade of C or higher. The course covers integration, applications of integration, numerical integration, series, and polar coordinates. (4-1-4)Math 131, 132 and 133 are equivalent to Math 111 and Math 112. **Effective From: Fall 2011**

Math 135 - Calculus for Business (3-0-3)
Intended for students with major offered by SOM. Prerequisite: Math 107 with a grade of C or better or Math 108 with a grade of C or better or NJIT placement. An introduction to mathematics of business, principles of differential and integral calculus, and optimization. **Effective From: Fall 2013**

Math 138 - General Calculus I (3-0-3)
Intended for students who are not in Science or in Engineering. Prerequisite: Math 107 with a grade of C or better, or Math 108 with a grade of C or better or NJIT placement. An introduction to differential and integral calculus of a single variable. **Effective From: Fall 2013**

Math 139 - Trigonometry and Principles of Differential Calculus (4-1-4)
Prerequisites: Grade A in Math 108 or NJIT placement. Comprehensive review of trigonometry and pre-calculus topics integrated into an introduction to differential calculus. Topics covered include: Exponential, logarithmic and trigonometric functions, analytics trigonometry, conic sections, limits, derivatives, applications of differentiation. **Effective From: Fall 2013**

Math 211 - Calculus III A (3-0-3)
Prerequisite: Math 112 with a grade of C or better or Math 133 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. **Effective From: Fall 2012**

Math 211H - Honors Calculus IIIA (3-0-3)
Prerequisite: Math 112H with a grade of B or better or Math 112 with a grade of A or Math 133 with a grade of A. Topics enhance those of Math 211 and concepts are studied in detail. **Effective From: Fall 2012**

Math 213 - Calculus III B (4-0-4)

Prerequisite: Math 112 with a grade of C or better or Math 133 with a grade of C or better. Topics include vectors, curvature, partial derivatives, multiple integrals, line integrals, and Green's, divergence, and Stokes' theorems. **Effective From: Fall 2012**

Math 213H - Honors Calculus III (4-0-4)
Prerequisite: Math 112H with a grade of B or better or Math 112 with a grade of A or Math 133 with a grade of A. Topics enhance those of Math 213 and concepts are studied in detail. Emphasizes science and engineering applications. **Effective From: Fall 2012**

Math 222 - Differential Equations (4-0-4)
Prerequisite: Prerequisite: Math 112 with a grade of C or better or Math 133 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. **Effective From: Fall 2012**

Math 222H - Honors Differential Equations (4-0-4)
Prerequisite: Math 112H with a grade of B or better or Math 112 with a grade of A or Math 133 with a grade of A. Topics enhance those of Math 222 and concepts are studied in detail. Emphasizes science and engineering applications. Effective From: Spring 2009 **Effective From: Fall 2012**

Math 225 - Survey of Probability and Statistics (1-0-1)
Prerequisite: Math 112 with a grade of C or better or Math 133 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. **Effective From: Fall 2012**

Math 226 - Discrete Analysis (3-0-3)
Prerequisite: Math 112 with a grade of C or better or Math 133 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. **Effective From: Fall 2012**

Math 226H - Honors Discrete Analysis (4-0-4)
Prerequisite: grade of B or better in Math 112H or grade of A in Math 112 or a grade of A in Math 133. An introduction to discrete mathematics. Topics enhance those of Math 226 and concepts are studied in detail. Emphasizes science and engineering applications. **Effective From: Spring 2009**

Math 227 - Mathematical Modeling (4-0-4)
Prerequisite: Math 112 with a grade of C or better or Math 133 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. **Effective From: Spring 2013**

Math 238 - General Calculus II (3-0-3)
Prerequisite: Math 138 with a grade of C or better or math 139 with a grade of C or better or Math 111 with a grade of C or better or placement. A continuation of Math 138. Topics include applications of integral calculus and an introduction to ordinary differential equations. **Effective From: Spring 2013**

Math 240 - Numerical Mathematics Laboratory (3-0-3)
Prerequisite: Math 112 with a grade of C or better, and CS 113 or knowledge of FORTRAN, C, or C++. Introduction to basic concepts and processes of numerical mathematics with emphasis on practical issues of implementation, use of numerical algorithms and software, and interpretation of numerical data. Weekly projects involving writing computer programs, presenting numerical results in tables and graphs, evaluation and approximation of standard numerical functions, round-off errors and loss of significance, basic iterative processes, matrix arithmetic, random number generation, and Monte Carlo methods. Students gain experience using a programming language, such as C, and mathematical software, such as MATLAB. **Effective From: Spring 2009**

Math 244 - Introduction to Probability Theory (3-0-3)
Prerequisite: Math 112 with a grade of C or better or Math 133 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. **Effective From: Fall 2012**

Math 245 - Multivariate Probability and Stochastic Processes (3-0-3)
Prerequisite: 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 normal distributions, order statistics, discrete and continuous Markov chains, Poisson processes, and Brownian motion processes. **Effective From: Spring 2009**

Math 246 - Introduction to Financial Mathematics ((3-0-3))
Prerequisite: Math 135 with a grade of C or better or Math 138 with a grade of C or better or Math 111 with a grade of C or better. An introduction to the basics of simple interest and discount, compound interest and discount, and simple annuities. This course is primarily intended for students whose major only requires Calculus I. It cannot be used for credit towards major or minor degrees offered by the Department of Mathematical Sciences. **Effective From: Spring 2009**

Math 279 - Statistics and Probability for Engineers (2-0-2)
Prerequisite: Math 112 with a grade of C or better or Math 133 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, 244, or 333. **Effective From: Fall 2012**

Math 305 - Statistics for Technology (3-0-3)
Prerequisite: (Intended for students in Engineering Technology.) Math 111 with a grade of C or better, or Math 132 with a grade of C or better, or Math 138 with a grade of C or better. 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. **Effective From: Fall 2012**

Math 309 - Mathematical Analysis for Technology (3-0-3)
Prerequisite: Math 112 with a grade of C or better, or Math 133 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. **Effective From: Fall 2012**

Math 310 - Co-op Work Experience I (3 Credits)
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 **Effective From: Spring 2013**

Math 321 - Introduction to the Finite Element Method (3-0-3)
Prerequisite: Math 222 with a grade of C or better. An elementary introduction to the theory and practice of the finite element method (FEM) is given. The mathematical underpinnings covered in this course include the basics of Sobolev spaces, Galerkin's method and various other weak formulations. Mathematical modeling of different physical problems and their solution techniques are also discussed. Existing finite element programs will be introduced through a course project. **Effective From: Spring 2009**

Math 322 - Differential Equations for Applications (3-0-3)
Prerequisite: Math 112 with a grade of C or better or Math 133 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. **Effective From: Fall 2012**

Math 326 - Discrete Analysis for Computer Engineers (3-0-3)
Prerequisite: Math 112 with a grade of C or better or Math 133 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. **Effective From: Fall 2012**

Math 328 - Mathematical Methods for Scientists and Engineers (3-0-3)
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. **Effective From: Spring 2009**

Math 331 - Introduction to Partial Differential Equations (3-0-3)
Prerequisite: 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. **Effective From: Fall 2010**

Math 331H - Honors Introduction to Partial Differential Equations (3-0-3)
Prerequisite: Grade of B or better in Math 222H and either grade of B or better in Math 221H or Math 213H. Or grade of A in Math 222 and either grade of A or grade of A in Math 213. Topics enhance those of Math 331 and concepts are studied in detail. Emphasizes science and engineering applications. **Effective From: Spring 2009**

Math 332 - Introduction to Functions of a Complex Variable (3-0-3)
Prerequisite: 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. **Effective From: Fall 2010**

Math 332H - Honors Introduction to Functions of a Complex Variable (3-0-3)
Prerequisite: Grade of B or better in Math 222H and either grade of B or better in Math 211H or Math 213H. Or grade of A in Math 222 and either grade of A in Math 211 or grade of A in Math 213. Topics enhance those of Math 332 and concepts are studied in detail. Emphasizes science and engineering applications. **Effective From: Spring 2009**

Math 333 - Probability and Statistics (3-0-3)
Prerequisite: Math 112 with a grade of C or better or Math 133 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. **Effective From: Fall 2012**

Math 333H - Honors Probability and Statistics (3-0-3)
Prerequisite: Math 112H with a grade of B or better or Math 112 with a grade of A or Math 133 with a grade of A. Topics enhance those of Math 333 and concepts are studied in detail. Emphasizes science and engineering applications. **Effective From: Fall 2012**

Math 334 - Operations Research (3-0-3)
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. **Effective From: Spring 2009**

Math 335 - Vector Analysis (3-0-3)
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. **Effective From: Spring 2009**

Math 336 - Applied Abstract Algebra (3-0-3)
Prerequisite: Math 112 with a grade of C or better or Math 133 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. **Effective From: Fall 2012**

Math 337 - Linear Algebra (3-0-3)
Prerequisite: Math 112 with a grade of C or better or Math 133 with a grade of C or better. Matrices, determinants, systems of linear equations, vector spaces, linear transformations, eigenvalues, eigenvectors, and related topics. **Effective From: Fall 2012**

Math 337H - Honors Linear Algebra (3-0-3)
Prerequisite: Math 112H with a grade of B or better or Math 112 with a grade of A or Math 133 with a grade of A. Topics enhance those of Math 337 and concepts are studied in detail. Emphasizes science and engineering applications. **Effective From: Fall 2012**

Math 340 - Applied Numerical Methods (3-1-3)
Prerequisites: Math 211 with a grade of C or better or Math 213 with a grade of C or better, and 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 or Math 240 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. **Effective From: Spring 2009**

Math 340H - Honors Applied Numerical Methods (3-0-3)
Prerequisites: 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. Grade of B or better in Math 213H or grade of A in Math 211 or Math 213. Topics enhance those of Math 240 and concepts are

studied in detail. Emphasizes science and engineering applications. **Effective From: Spring 2009**

Math 341 - Statistical Methods II (3-0-3)
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. **Effective From: Spring 2009**

Math 344 - Regression Analysis (3-0-3)
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. **Effective From: Spring 2009**

Math 345 - Multivariate Distributions (3-0-3)
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. **Effective From: Spring 2009**

Math 346 - Mathematics of Finance I (3-0-3)
Prerequisite: Math 112 with a grade of C or better or Math 133 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. **Effective From: Fall 2012**

Math 347 - Mathematics of Finance II (3-0-3)
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. **Effective From: Fall 2010**

Math 371 - Physiology and Medicine (3-0-3)
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. **Effective From: Spring 2009**

Math 372 - Population Biology (3-0-3)
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. **Effective From: Spring 2009**

Math 373 - Introduction to Mathematical Biology (3-0-3)
Prerequisites: Math 211 with a grade of C or better or 213 with a grade of C or better or 213H with a grade of C or better and Math 337 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. **Effective From: Spring 2009**

Math 388 - Introduction to Chaos Theory (3-0-3)
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. **Effective From: Spring 2009**

Math 391 - Numerical Linear Algebra (3-0-3)
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. 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. **Effective From: Spring 2009**

Math 401 - Undergraduate Research Seminar (1-1-1)
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. **Effective From: Spring 2008**

Math 410 - Co-op Work Experience II (3 credits)
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 **Effective From: Spring 2013**

Math 426 - Advanced Discrete Analysis (3-0-3)
Prerequisite: Math 226 with a grade of C or better or Math 326 with a grade of C or better. Topics include graphs, trees and their applications, grammars, finite state machines, Turing machines and Petri nets, applied combinatorics -- Stirling, Catalan, and Ramsey numbers, Polya-Burnside counting methods, finite Markov chains and coding theory. **Effective From: Spring 2009**

Math 430 - Analytical and Computational Neuroscience (3-1-3)
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 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. **Effective From: Fall 2013**

Math 431 - Systems Computational Neuroscience (3-1-3)
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. **Effective From: Fall 2013**

Math 432 - Mathematics of Financial Derivatives I (Capstone I) (3-0-3)
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. **Effective From: Spring 2009**

Math 433 - Mathematics of Financial Derivatives II (Capstone II) (3-0-3)
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. **Effective From: Fall 2011**

Math 440 - Advanced Applied Numerical Methods (3-0-3)
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. **Effective From: Spring 2009**

Math 440H - Honors Advanced Applied Numerical Methods (3-0-3)
Prerequisites: grade of B or better in Math 331 and grade of B or better in Math 340. Topics enhance those of Math 440 and concepts are studied in detail. Emphasizes science and engineering applications. **Effective From: Spring 2009**

Math 441 - Actuarial Mathematics I (3-0-3)
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. **Effective From: Spring 2009**

Math 442 - Actuarial Mathematics II (3-0-3)
Prerequisite: Math 441 with a grade of C or better. Topics include net premium reserves, insurance models including expenses, nonforfeiture benefits, and dividends. **Effective From: Spring 2009**

Math 443 - Statistical Methods (3-0-3)
Prerequisite: Math 341 with a grade of C or better. Topics include complete sufficient statistics and uniformly minimum variance estimators, general linear hypotheses and related topics, nonparametric inference including rank and order statistics, permutation

methods, U-statistics, and Pitman efficiency. **Effective Until: Spring 1996**

Math 444 - Applied Sampling Methods and Quality Control (3-0-3)
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. **Effective From: Spring 2009**

Math 445 - Introduction to Experimental Design (3-0-3)
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. **Effective From: Spring 2009**

Math 446 - Topics in Applied Statistics (3-0-3)
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. **Effective From: Spring 2009**

Math 447 - Applied Time Series Analysis (3-0-3)
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. **Effective From: Fall 2010**

Math 448 - Stochastic Simulation (3-0-3)
Prerequisite: Math 333 with a grade of C or better and Math 340 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. **Effective From: Spring 2009**

Math 450H - Methods of Applied Mathematics I (Capstone I) (3-0-3)
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. **Effective From: Spring 2009**

Math 451H - Methods of Applied Mathematics II (Capstone II) (3-0-3)
Prerequisite: Math 450H with a grade of C or better. Small teams of students conduct research projects under the guidance of faculty members who perform applied research. **Effective From: Spring 2009**

Math 453 - High-Performance Numerical Computing (3-0-3)
Prerequisites: Math 391 with a grade of C or better and Math 440 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. **Effective From: Spring 2009**

Math 460 - Differential Geometry of Curves and Surfaces (3 credits)
Prerequisites: Math 222 with a grade of C or better. Curves in the plane and Euclidean space, moving frames, surfaces in Euclidean space, orientability of surfaces, Gaussian and mean curvatures, surfaces of revolution, ruled surfaces, minimal surfaces, special curves on surfaces, Theorema Egregium, the intrinsic geometry of surfaces. **Effective From: Spring 2009**

Math 473 - Intermediate Differential Equations (3-0-3)
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. **Effective From: Spring 2009**

Math 475 - Intermediate Partial Differential Equations (3-0-3)
Prerequisites: Math 331 with a grade of C or better and Math 337 with a grade of C or better. A survey of methods, beyond separation of variables, for analyzing and solving the fundamental partial differential equations of mathematical physics. Considers first-order equations, Laplace's equation, the wave equation, the heat equation, and linear hyperbolic systems. Emphasizes using methods of calculus to solve canonical initial- and boundary-value problems. **Effective From: Spring 2009**

Math 475H - Honors Intermediate Partial Differential Equations (3-0-3)
Prerequisites: Grade of B or better in Math 331H and Math 337H or Grade of A in Math 331 and Math 337. Topics enhance those

of Math 475 and concepts are studied in detail. Emphasizes science and engineering applications. **Effective From: Spring 2009**

Math 477 - Stochastic Processes (3-0-3)
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. **Effective From: Spring 2009**

Math 480 - Introductory Mathematical Analysis (3-0-3)
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. **Effective From: Spring 2009**

Math 481 - Advanced Calculus (3-0-3)
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. **Effective From: Spring 2009**

Math 491 - Independent Study in Mathematics (3-0-3)
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. **Effective From: Spring 2009**

Math 493 - Seminar in Actuarial Science (1-0-1)
Prerequisite: Departmental approval. A series of lectures by practicing actuaries on topics of technical and/or current practices. Subjects announced at the time of registration. Progress is evaluated through projects and term papers. A comprehensive report summarizing some aspect of special interest to the student is required. **Effective From: Spring 2009**

Math 495 - Topics in Applied Mathematics (3-0-3)
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. **Effective From: Spring 2009**

GRADUATE COURSES:

Math 545 - Introductory Mathematical Analysis (3 credits)
Prerequisite: Math 211 or Math 213, and departmental approval. Rigorous treatment of the calculus of real-valued functions of one real variable: the real number system, epsilon-delta theory of limit, continuity, derivative, and the Riemann integral. The fundamental theory of calculus. Series and sequences including Taylor series and uniform convergence. The inverse and implicit function theorems.

Math 546 - Advanced Calculus (3 credits)
Prerequisite: Math 545 or Math 480. Rigorous treatment of the calculus of real-valued functions of several real variables: the geometry and algebra of n-dimensional Euclidean space, limit, continuity, derivative, and the Riemann integral of functions of several variables, the inverse and implicit function theorems, series, including Taylor series, optimization problems, integration on curves and surfaces, the divergence and related theorems.

Math 573 - Intermediate Differential Equations (3 credits)
Prerequisites: Math 222, Math 337, or departmental approval. Methods and applications for systems of ordinary differential equations: existence and uniqueness for solutions of ODEs, linear systems, stability analysis, phase plane and geometrical methods, Sturm-Liouville eigenvalue problems.

Math 590 - Graduate Co-op Work Experience I (3 additive credits)
Prerequisites: Graduate status, departmental approval, and permission of the Division of Career Development Services. Cooperative education/internship providing on-the-job complement to academic programs in mathematics. Work assignments and projects are developed by the Co-op Office in consultation with the Department of Mathematical Sciences.

Math 591 - Graduate Co-op Work Experience II (3 additive credits)
Prerequisites: Graduate status, departmental approval, and permission of the Division of Career Development Services.

Math 592 - Graduate Co-op Work Experience III (3 additive credits)
Prerequisites: Graduate status, departmental approval, and permission of the Division of Career Development Services.

Math 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

Math 599 - Teaching in Mathematics (3 credits)
Required of all master's and doctoral students in Mathematical Sciences who are receiving departmental or research-based awards. Provides students with the skills needed to communicate effectively and to perform their teaching and related duties. Students are exposed to strategies and methods for communicating and for teaching undergraduate mathematics, and they are required to practice and demonstrate these techniques. Not counted for degree credit.

Math 604 - Mathematical Finance (3-0-3)
Prerequisites: Fin 641 Derivatives, Math 605 Stochastic Calculus, or permission of the instructor. This course will explore the structure, analysis, and use of financial derivative instruments deployed in investment strategies and portfolio risk management. Topics include continuous time dynamics, arbitrage pricing, martingale methods, and valuation of European, American, and path dependent derivatives. **Effective From: Fall 2011**

Math 605 - Stochastic Calculus (3 credits)
This course provides an introduction to stochastic calculus. Topics include conditioning, Poisson processes, martingales, Brownian motion, Ito integrals, Ito's formula, stochastic differential equations, Feynman-Kac formula, Girsanov's theorem, and the martingale representation theorem. Financial applications include pricing, hedging, and interest rate models. **Effective From: Fall 2009**

Math 606 - Term Structure Models (3-0-3)
Prerequisites: Math 605, or permission of the instructor. Corequisite: Math 608. This course will develop the mathematical structure of interest rate models and explore the considerable hurdles involved in practical implementation. Short rate models, single and multifactor; the Heath-Jarrow-Morton framework; and modern Libor market models will be examined. **Effective From: Fall 2011**

Math 607 - Credit Risk Models (3-0-3)
Prerequisites: Math 604, 605, 606 or permission of the instructor. This course explores mathematical models and methods for credit risk measurement and rating. The nature of credit risk is reviewed through examination of credit instruments, including credit default swaps, collateralized debt obligations, and basket credit derivatives. These instruments, through which risk exposure opportunities and hedging possibilities are created and managed, are explored with respect to dynamics and valuation techniques, applying PDE methods and stochastic processes. **Effective From: Fall 2011**

Math 608 - Partial Differential Equations for Finance (3 credits)
This course presents the subject of partial differential equations (PDE's) with a strong emphasis on the PDE's arising in the study of stochastic processes and finance. The focus is on analytical and numerical methods for obtaining solutions in a form useful for solving problems in financial engineering. Topics include modeling with PDE's, classification of PDE's, analytical and numerical methods for PDE's and application to finance. **Effective From: Fall 2009**

Math 609 - Projects in Mathematical and Computational Finance (3-0-3)
Prerequisites: Math 604 Mathematical Finance, Math 605 Stochastic Calculus, Math 606 Term Structure Models, or permission of the instructor. This project course requires students to demonstrate attained mastery of the material studies in the prerequisite courses. Projects also extend students? knowledge of specific areas beyond that covered in earlier courses into areas such as particle filtering or optimization techniques for term structure model calibration. The aim is to broaden the students? classroom focus to the more unconstrained, open ended and less well defined contexts that are frequently encountered in practice. **Effective From: Fall 2011**

Math 610 - Graduate Research Methods (3 Credits)
Prerequisite: Math 614, Math 671, and Math 690. Acquaints second-year graduate students with the techniques and vocabulary of a field in applied mathematics. Each student contacts a designated faculty member and is given several basic papers or books on a research topic of current interest. The student prepares two lectures on his/her topic to be given at the end of the semester. A sample list of active fields of research includes acoustics, electromagnetic theory, elasticity, fluid dynamics, combustion, and mathematical biology. **Effective From: Fall 2010**

Math 611 - Numerical Methods for Computation (3 credits)
This course provides a practical introduction to numerical methods. Numerical solution of linear systems. Interpolation and quadrature. Interative solution of nonlinear systems. Computation of eigenvalues and eigenvectors. Numerical solution of initial and boundary value problems for ODE's. Introduction to numerical solution of PDE's. Applicatons drawn from science, engineering, and finance. **Effective From: Spring 2009**

Math 613 - Advanced Applied Mathematics I: Modeling (3 credits)
Prerequisites: Math 331 and Math 337, or departmental approval. Concepts and strategies of mathematical modeling are developed by investigation of case studies in a selection of areas. Consistency of a model, nondimensionalization and scaling, regular and singular effects are discussed. Possible topics include continuum mechanics (heat and mass transfer, fluid dynamics, elasticity), vibrating strings, population dynamics, traffic flow, and the Sommerfeld problem.

Math 614 - Numerical Methods I (3 credits)
Prerequisites: Math 222, Math 337, Math 340, and proficiency in a computer language (FORTRAN, C, or C++), or departmental approval. Theory and techniques of scientific computation, with more emphasis on accuracy and rigor than Math 611. Machine arithmetic. Numerical solution of a linear system and pivoting. Interpolation and quadrature. Iterative solution of nonlinear systems. Computation of eigenvalues and eigenvectors. Numerical solution of initial- and boundary-value problems for systems of ODEs. Applications. The class includes examples requiring student use of a computer.

Math 615 - Approaches to Quantitative Analysis in the Life Sciences (3 credits)
A graduate seminar-style course based around case studies of common data analytic methods used in the life sciences. The case studies are designed to help students who are interested in applications of statistical thinking to biological sciences appreciate the scope of quantitative methods, their underlying concepts, assumptions and limitations. While the mathematics of specific methods are not covered, students of the course will get an understanding of the diverse approaches to statistical inference in the life sciences. **Effective From: Fall 2009**

Math 630 - Linear Algebra and Applications (3 credits)
Prerequisites: (This course is not intended for students in the Master's in Applied Mathematics program or in the doctoral program in Mathematical Sciences.) Math 211 or Math 213, and Math 222. Development of the concepts needed to study applications of linear algebra and matrix theory to science and engineering. Topics include linear systems of equations, matrix algebra, orthogonality, eigenvalues and eigenvectors, diagonalization, and matrix decomposition.

Math 631 - Linear Algebra (3 credits)
Prerequisites: Math 222 and Math 337, or departmental approval. Similar in aim and content to Math 630 but with more emphasis on mathematical rigor. Linear systems of equations, matrix algebra, linear spaces, orthogonality, eigenvalues and eigenvectors, diagonalization, and matrix decomposition. Applications.

Math 635 - Analytical Computational Neuroscience (3 credits)
Prerequisites: Math 211 or 213, Math 337, and CIS 113 or Math 240, or departmental approval. This course will provide an intermediate-level mathematical and computational modeling background for small neuronal systems. Models of biophysical mechanisms of single and small networks of neurons are discussed. Topics include voltage-dependent channel gating mechanisms, the Hodgkin-Huxley model for membrane excitability, repetitive and burst firing, single- and multi-compartmental modeling, synaptic transmission, mathematical treatment of 2-cell inhibitory or excitatory networks. In this course, the students will be required to build computer models of neurons and networks and analyze these models using geometric singular-perturbation analysis and dynamical systems techniques.

Math 636 - Systems Computational Neuroscience (3 credits)
Prerequisites: Math 635. This course covers mathematical and computational modeling of neuronal networks. Topics covered include central pattern generators, models of visual processes, models of learning and memory, neural coding and mathematics of neural networks, models of oscillations in sensory, thalamic and thalamo-cortical networks, neuronal wave propagation.

Math 637 - Foundations of Mathematical Biology (3 credits)
Prerequisites: Math 222 and Math 337, or departmental approval. This course provides an introduction to the use of mathematical techniques applied to solve problems in biology. Models discussed fall into 3 categories: discrete, continuous, and spatially distributed. Biological topics discussed range from the subcellular molecular systems and cellular behavior to physiological problems, population biology and developmental biology.

Math 639 - Mathematical Modeling II (3-0-3)
Continuation of Math 613 (Advanced Applied Mathematics I, Modeling). Concepts and strategies of Mathematical modeling are developed by case studies in a selection of areas. Topics will be complementary to those presented in Math 613, and include for example, the mathematical theory of elasticity and electromagnetism. **Effective From: Fall 2006**

Math 644 - Regression Analysis Methods (3 credits)
Prerequisite: Math 661. Regression models and the least squares criterion. Simple and multiple linear regression. Regression diagnostics. Confidence intervals and tests of parameters, regression and analysis of variance. Variable selection and model building. Dummy variables and transformations, growth models. Other regression models such as logistic regression. Using statistical software for regression analysis.

Math 645 - Analysis I (3 credits)
Prerequisite: Math 546 or departmental approval. Review and extension of the fundamental concepts of advanced calculus: the real number system, limit, continuity, differentiation, the Riemann integral, sequences and series. Point set topology in metric spaces. Uniform convergence and its applications.

Math 646 - Time Series Analysis (3 credits)
Prerequisite: Math 661 or departmental approval. Time series models, smoothing, trend and removal of seasonality. Naive forecasting models, stationarity and ARMA models. Estimation and forecasting for ARMA models. Estimation, model selection, and forecasting of nonseasonal and seasonal ARIMA models.

Math 647 - Time Series Analysis II (3 credits)
Prerequisite: Math 646. Continuation of Math 646. Covers methods of time series analysis useful in engineering, the sciences, economics, and modern financial analysis. Topics include spectral analysis, transfer functions, multivariate models, state space models and Kalman filtering. Selected applications from topics such as intervention analysis, neural networks, process control, financial volatility analysis.

Math 651 - Methods of Applied Mathematics I (3 credits)
Prerequisite: Math 222 or departmental approval. A survey of mathematical methods for the solution of problems in the applied sciences and engineering. Topics include: ordinary differential equations and elementary partial differential equations. Fourier series, Fourier and Laplace transforms, and eigenfunction expansions.

Math 652 - Methods of Applied Mathematics II (3 credits)
Prerequisite: (This course is not intended for students in a graduate program in Mathematical Sciences.) Math 651. Continuation of Math 651. Topics include: partial differential equations, functions of a complex variable, and the calculus of variations.

Math 654 - Clinical Trials Design and Analysis (3 credits)
Prerequisites: Math 665 or equivalent with Departmental approval. Statistical methods and issues in the design of clinical trials and analysis of their data. Topic include clinical trial designs for phases 1-4, randomization principle and procedures, analysis of pharmacokinetic data for bioequivalence, multi-center trials, categorical data analysis, survival analysis, longitudinal data analysis, interim analysis, estimation of sample size and power, adjustment for multiplicity, evaluation of adverse events, and regulatory overview. **Effective From: Fall 2007**

Math 656 - Complex Variables I (3 credits)
Prerequisite: Math 545 or Math 645 or departmental approval. The theory and applications of analytic functions of one complex variable: elementary properties of complex numbers, analytic functions, elementary complex functions, conformal mapping, Cauchy integral formula, maximum modulus principle, Laurent series, classification of isolated singularities, residue theorem, and applications.

Math 659 - Survival Analysis (3 credits)
Prerequisites: Math 665 or equivalent with Departmental approval. Introduction to statistical methods for modeling time-to-event data in the presence of censoring and truncation, with emphasis on applications to the health sciences. Topics include survival and hazard functions, censoring and truncation, parametric and nonparametric models for survival data, competing-risks, regression models including Cox proportional hazards model and time-dependent covariates, one and two sample tests, and use of appropriate statistical software for computations. **Effective From: Fall 2007**

Math 661 - Applied Statistics (3 credits)
Prerequisite: Math 112. Role and purpose of applied statistics. Data visualization and use of statistical software used in course. Descriptive statistics, summary measures for quantitative and qualitative data, data displays. Modeling random behavior: elementary probability and some simple probability distribution models. Normal distribution. Computational statistical inference: confidence intervals and tests for means, variances, and proportions. Linear regression analysis and inference. Control charts for statistical quality control. Introduction to design of experiments and ANOVA, simple factorial design and their analysis. Math 661 and Math 663 cannot both be used toward degree credits at NJIT. **Effective From: Fall 2010**

Math 662 - Probability Distributions (3 credits)
Prerequisite: Math 341 or Math 333, and departmental approval. Probability, conditional probability, random variables and distributions, independence, expectation, moment generating functions, useful parametric families of distributions, transformation of random variables, order statistics, sampling distributions under normality, the central limit theorem, convergence concepts and illustrative applications.

Math 663 - Introduction to Biostatistics (3-0-3)
Prerequisites: Undergraduate Calculus. Introduction to statistical techniques with emphasis on applications in health related sciences. This course will be accompanied by examples from biological, medical and clinical applications. Summarizing and

displaying data; basic probability and inference; Bayes' theorem and its application in diagonostic testing; estimation, confidence intervals, and hypothesis testing for means and proportions; contingency tables; regression and analysis of variance; logistic regression and survival analysis; basic epidemiologic tools; use of statistical software. Math 661 and Math 663 cannot both be used toward degree credits at NJIT. **Effective From: Fall 2010**

Math 664 - Methods for Statistical Consulting (3 credits)
Prerequisite: Math 661 or departmental approval. Communicating with scientists in other disciplines. Statistical tools for consulting. Using statistical software such as JMP, SAS, and S-plus. Case studies which illustrate using statistical methodology and tools are presented by the instructor and guest speakers from academia and industry. Assignments based on case studies with use of statistical software is required.

Math 665 - Statistical Inference (3 credits)
Prerequisite: Math 662 or departmental approval. Review of sampling distributions. Data reduction principles: sufficiency and likelihood. Theory and methods of point estimation and hypothesis testing, interval estimation, nonparametric tests, introduction to linear models. **Effective From: Fall 2007**

Math 666 - Simulation for Finance (3 credits)
Covers the use of Monte Carlo stochastic simulation for finance applications. Topics include generation of various random variables and stochastic processes (e.g., point processes, Brownian motion, diffusions), simulation methods for estimating quantities of interest (e.g., option prices, probabilities, expected values, quantiles), input modeling, and variance-reduction techniques. Students will write computer programs in C++. Students cannot receive credit for both CS 661 and CS/Math 666. **Effective From: Spring 2010**

Math 668 - Probability Theory (3 credits)
The subject matter of this course deals with the foundations of axiomatic probability - based on abstract measure theory, stochastic convergence, limit theorems, conditional expectations and martingales - is aimed primarily at Ph.D. level students. Modified pre-requisite require appropriate background in real analysis. Course content remains unchaged. **Effective Until: Fall 2008**

Math 671 - Asymptotic Methods I (3 credits)
Prerequisite: Math 645 or Math 545, and Math 656, or departmental approval. Asymptotic sequences and series. Use of asymptotic series. Regular and singular perturbation methods. Asymptotic methods for the solution of ODEs, including: boundary layer methods and asymptotic matching, multiple scales, the method of averaging, and simple WKB theory. Asymptotic expansion of integrals, including: Watson's lemma, stationary phase, Laplace's method, and the method of steepest descent.

Math 672 - Biomathematics I: Biological Waves and Oscillations (3 credits)
Prerequisites: Math 222, Math 331, and Math 337, or departmental approval. Models of wave propagation and oscillatory phenomena in nerve, muscle, and arteries: Hodgkin-Huxley theory of nerve conduction, synchronization of the cardiac pacemaker, conduction and rhythm abnormalities of the heart, excitation-contraction coupling, and calcium induced waves, wave propagation in elastic arteries, models of periodic human locomotion.

Math 673 - Biomathematics II: Pattern Formation in Biological Systems (3 credits)
Prerequisites: Math 222, Math 331, and Math 337, or departmental approval. Emergence of spatial and temporal order in biological and ecological systems: Hopf and Turing bifurcation in reaction-diffusion systems, how do zebras get their stripes, patterns on snake skins and butterfly wings, spatial organization in the visual cortex, symmetry breaking in hormonal interactions, how do the ovaries count. Basic techniques of mathematics are introduced and applied to significant biological phenomena that cannot be fully understood without their use.

Math 675 - Partial Differential Equations (3 credits)
Prerequisite: Math 690 or departmental approval. A survey of the mathematical theory of partial differential equations: first-order equations, classification of second-order equations, the Cauchy-Kovalevsky theorem, properties of harmonic functions, the Dirichlet principle. Initial- and boundary-value problems for hyperbolic, elliptic, and parabolic equations. Systems of equations.

Math 676 - Advanced Ordinary Differential Equations (3 credits)
Prerequisites: Math 222, Math 337, and Math 545 or Math 645. A rigorous treatment of the theory of systems of differential equations: existence and uniqueness of solutions, dependence on initial conditions and parameters. Linear systems, stability, and asymptotic behavior of solutions. Nonlinear systems, perturbation of periodic solutions, and geometric theory of systems of ODEs.

Math 677 - Calculus of Variations (3 credits)
Prerequisite: Math 545 or Math 645 or departmental approval. Necessary conditions for existence of extrema. Variation of a functional, Euler's equation, constrained extrema, first integrals, Hamilton-Jacobi equation, quadratic functionals. Sufficient conditions for the existence of extrema. Applications to mechanics.

Math 685 - Combinatorics (3 credits)
Prerequisite: Math 545 or Math 645. Generating functions, principle of inclusion-exclusion, pigeonhole principle, partitions. Polya's theory of counting, graph theory, and applications.

Math 687 - Quantitative Analysis for Environmental Design Research (3 credits)
Prerequisites: Math 333 and departmental approval. Fundamental concepts in the theory of probability and statistics including descriptive data analysis, inferential statistics, sampling theory, linear regression and correlation, and analysis of variance. Also includes an introduction to linear programming and nonlinear models concluding with some discussion of optimization theory.

Math 688 - Mathematical and Statistical Methods in Materials Science (3 credits)
More emphasis on analytical methods and statistics. Course will be required for Ph.D. students in Materials Science. **Effective From: Fall 2006**

Math 689 - Advanced Applied Mathematics II: Ordinary Differential Equations (3 credits)
Prerequisites: Math 545 or Math 645, Math 613, and Math 631. A practical and theoretical treatment of boundary-value problems for ordinary differential equations: generalized functions, Green's functions, spectral theory, variational principles, and allied numerical procedures. Examples will be drawn from applications in science and engineering.

Math 690 - Advanced Applied Mathematics III: Partial Differential Equations (3 credits)
Prerequisite: Math 689. A practical and theoretical treatment of initial- and boundary-value problems for partial differential equations: Green's functions, spectral theory, variational principles, transform methods, and allied numerical procedures. Examples will be drawn from applications in science and engineering.

Math 691 - Stochastic Processes with Applications (3 credits)
Prerequisite: Math 662. Renewal theory, renewal reward processes and applications. Homogeneous, non-homogeneous, and compound Poisson processes with illustrative applications. Introduction to Markov chains in discrete and continuous time with selected applications.

Math 698 - Sampling Theory (3 credits)
Prerequisite: Math 662. Role of sample surveys. Sampling from finite populations. Sampling designs, the Horowitz-Thompson estimator of the population mean. Different sampling methods, simple random sampling, stratified sampling, ratio and regression estimates, cluster sampling, systematic sampling.

Math 699 - Design and Analysis of Experiments (3 credits)
Prerequisite: Math 662. Statistically designed experiments and their importance in data analysis, industrial experiments. Role of randomization. Fixed and random effect models and ANOVA, block design, latin square design, factorial and fractional factorial designs and their analysis. **Effective From: Spring 2006**

Math 700 - Master's Project (3 credits)
Prerequisites: Matriculation for the Master of Science in Applied Mathematics or in Applied Statistics and departmental approval. Work must be initiated with the approval of a faculty member, who will be the student's project advisor. Work of sufficient quality may qualify for extension into a master's thesis, see Math 701.

Math 701 - Master's Thesis (6 credits)
Prerequisite: Matriculation for the master's degree and departmental approval. Students must register for a minimum of 3 credits per semester until completion. The work is carried out under the supervision of a designated member of the faculty.

Math 707 - Advanced Applied Mathematics IV: Special Topics (3 credits)
Prerequisite: Departmental approval. A current research topic of interest to departmental faculty. Typical topics include: computational fluid dynamics, theoretical fluid dynamics, acoustics, wave propagation, dynamical systems, theoretical and numerical aspects of combustion, mathematical biology, and various topics in statistics.

Math 710 - Graduate Research Methods (3 credits)
Prerequisite: Math 614, Math 671, and Math 690. Acquaints second-year graduate students with the techniques and vocabulary of a field in applied mathematics. Each student contacts a designated faculty member and is given several basic papers or books on a research topic of current interest. The student prepares two lectures on his/her topic to be given at the end of the semester. A sample list of active fields of research includes acoustics, electromagnetic theory, elasticity, fluid dynamics, combustion, and mathematical biology. **Effective Until: Summer 2010**

Math 712 - Numerical Methods II (3 credits)
Prerequisites: Math 614, Math 331 or departmental approval, and proficiency in a computer programming language (FORTRAN, C, or C++). Numerical methods for the solution of initial- and boundary-value problems for partial differential equations, with emphasis on finite difference methods. Consistency, stability, convergence, and implementation are considered.

Math 713 - Advanced Scientific Computing: Multi-Dimensional Finite-Difference Schemes and Spectral Methods (3 credits)
Prerequisite: Math 712 and proficiency in a computer programming language (FORTRAN, C, or C++). Derivation and analysis of finite difference schemes for systems of partial differential equations in two and three spatial dimensions and time. Issues pertaining to efficient implementation of algorithms and to stability of physical and numerical boundary conditions. Pseudo-spectral and spectral methods to solve partial differential equations. Approximation properties of Fourier and Chebyshev series and techniques based on the Fast Fourier Transform (FFT) and on matrix multiplication to numerically compute partial derivatives. Time-discretization techniques suitable for use with pseudo-spectral and spectral methods. Model systems arising in wave propagation, fluid dynamics, and mathematical biology will be considered.

Math 715 - Mathematical Fluid Dynamics I (3-0-3)
Introduction to the basic ideas of fluid dynamics, with an emphasis on rigorous treatment of fundamentals and the mathematical developments and issues. The course focuses on the background and motivation for recent mathematical and numerical work on the Euler and Navier-Stokes equations, and presents a mathematically intensive investigation of various model equations of fluid dynamics (e.g., the Korteweg-de-Vries equations). **Effective From: Fall 2005**

Math 716 - Mathematical Fluid Dynamics II (3-0-3)
Continuation of Math 715. Further development of the ideas of fluid dynamics, with an emphasis on mathematical developments and issues. A selection of topics will be developed in some detail, for example: Stokes flow and low-Reynolds-number hydrodynamics; flow at high Reynolds number and boundary layers; shock waves and hyperbolic systems; dynamics of interfacial flows; hydrodynamic stability; rotating fluids. **Effective From: Fall 2005**

Math 717 - Inverse Problems and Global Optimization (3-0-3)
Introduction to inverse problems and global optimization. Linear, quasi-linear, and nonlinear inverse problems are studied with emphasis on regularization techniques. Bayesian statistical approaches and Monte Carlo methods are introduced and discussed in the context of inverse problems. The mathematical foundations of simulated annealing, genetic algorithms, and TABU are presented. **Effective From: Fall 2006**

Math 720 - Tensor Analysis (3 credits)
Prerequisite: Math 613 and Math 631, or departmental approval. Review of vector analysis in general curvilinear coordinates. Algebra and differential calculus of tensors. Applications to differential geometry, analytical mechanics, and mechanics of continuous media. The choice of applications will be determined by the interests of the class.

Math 722 - Wave Propagation (3-0-3)
Derivation of linear wave equations describing acoustic, electromagnetic, elastodynamic and hydrodynamic phenomena. Fundamental solutions and their application to initial value problems. Applications and solution of boundary value problems using Green's functions, image and spectral methods. Related time harmonic problems, including radiation, scattering, diffraction and transmission phenomena. Dispersive waves and the method of stationary phase. Linear waves in anisotropic media. **Effective From: Fall 2006**

Math 745 - Analysis II (3 credits)
Prerequisite: Math 645. Lebesgue measure and integration, including the Lebesgue dominated convergence theorem and Riesz-Fischer theorem. Elements of Hilbert spaces and Lp-spaces. Fourier series and harmonic analysis. Multivariate calculus.

Math 756 - Complex Variables II (3 credits)
Prerequisite: Math 656. Selected topics from: conformal mapping and applications of the Schwarz-Christoffel transformation, applications of calculus of residues, singularities, principle of the argument, Rouche's theorem, Mittag-Leffler's theorem, Casorati-Weierstrass theorem, analytic continuation, and applications, Schwarz reflection principle, monodromy theorem, Wiener-Hopf technique, asymptotic expansion of integrals; integral transform techniques, special functions.

Math 761 - Statistical Reliability Theory and Applications (3 credits)
Prerequisite: Math 662 or departmental approval. Survival distributions, failure rate and hazard functions, residual life. Common parametric families used in modeling life data. Introduction to nonparametric aging classes. Coherent structures, fault tree analysis, redundancy and standby systems, system availability, repairable systems, selected applications such as software reliability.

Math 762 - Statistical Inference (3 credits)
Prerequisite: Math 662 or departmental approval. Review of sampling distributions. Data reduction principles: sufficiency and likelihood. Theory and methods of point estimation and hypothesis testing, interval estimation, nonparametric tests, introduction to linear models. **Effective Until: Spring 2007**

Math 763 - Generalized Linear Models (3 credits)

Prerequisites: Math 662 and Math 665 or departmental approval. Theoretical and applied aspects of generalized linear models. Classical linear models, nonlinear regression models, and generalized estimating equations. **Effective From: Fall 2011**

Math 767 - Fast Numerical Algorithms (3-0-3)
The course covers state-of-the-art, analysis-based, fast numerical algorithms for computing discrete summations/transforms and for solving differential/integral equations. In particular, this course presents fast multiple methods and their descendants, including fast Fourier transform for nonequispaced data, fast Gauss transform, fast iterative solver and direct solver for elliptic boundary value problems. **Effective From: Fall 2008**

Math 768 - Probability Theory (3 credits)
Prerequisite: Math 645 or departmental approval. Measure theoretic introduction to axiomatic probability. Probability measures on abstract spaces and integration. Random variables and distribution functions, independence, 0-1 laws, basic inequalities, modes of convergence and their interrelationships, Laplace-Stieltjes transforms and characteristic functions, weak and strong laws of large numbers, conditional expectation, discrete time martingales. **Effective From: Spring 2009**

Math 771 - Asymptotic Methods II (3 credits)
Prerequisite: Math 671. Continuation of Math 671. Asymptotic methods for the solution of PDEs, including: matched asymptotic expansions, multiple scales, the WKB method or geometrical optics, and near-field far-field expansions. Applications to elliptic, parabolic, and hyperbolic problems. Further topics in the asymptotic expansion of integrals and the WKB method. Emphasis on examples drawn from applications in science and engineering.

Math 786 - Large Sample Theory and Inference (3 credits)
Prerequisites: Math 762 and Math 668. Limit theorems, central limit theorem, asymptotic expansions and large deviations, limit theorems in martingales and semi-martingales and stochastic differential equations, asymptotic expansions of functions of statistics, linear parametric estimation, asymptotic efficiency, martingale approach to inference: test for homogeneity and goodness of fit, decomposable statistics, inference for counting processes and censored data, inference in nonlinear regression, existence and consistency of least squares estimator (LSE), asymptotic properties of LSE, Von Mises functionals, estimation of parameters of stable laws, empirical characteristics function for inference, generalized least squares for linear models.

Math 787 - Non-Parametric Statistics (3 credits)
Prerequisite: Math 662. Wilcoxon signed-ranks test, Mann-Whitney U test, binomial sign test for single sample and two dependent samples, McNemar's test, Cochran Q test, Wilcoxon matched-pairs signed-ranks test, Kruskal-Wallis one-way analysis of variance, Friedman two-way analysis of variance, Siegel-Tukey test for equal variability, chi-squared goodness-of-fit test, test for homogeneity and independence, single-sample runs test and other tests of randomness, correlation tests: Spearman's rank-order correlation, coefficient and Kendall's tau, Kendall's coefficient of concordance, and Goodman and Kruskal's gamma, comparing power efficiency.

Math 790 - Doctoral Dissertation (Credits as designated)
Prerequisite: Excellent performance on the doctoral qualifying examination. A minimum of 36 credits is required of all candidates for the Ph.D. degree. Candidates must register for 6 to12 credits per semester, to be determined by a designated dissertation advisor. After reaching 36 credits, students must continue to register for 3 credits each semester until degree completion.

Math 791 - Graduate Seminar (0 credit)
All master's and doctoral students receiving departmental or research-based awards must register for this course each semester. **Effective From: Fall 2006**

Math 792 - Pre-Doctoral Research (3 credits)
Prerequisite: Departmental approval. For students admitted to the Ph.D. program in the Mathematical Sciences. Research is performed under the supervision of a designated faculty member. If the work culminates in doctoral research in the same area, up to 6 credits may be counted toward Math 790. See Math 790.

Mechanical Engineering: Mechanical Engineering

UNDERGRADUATE COURSES:

ME 215 - Engineering Materials and Processes (2-2-3)
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. **Effective From: Spring 2013**

ME 231 - Kinematics of Machinery (3-0-3)
Prerequisites: CIS 101, Mech 234. 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 (3-0-3)
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 (3-0-3)
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 (zero credits)
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. **Effective From: Fall 2011**

ME 311 - Thermodynamics I (3-0-3)
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 (3-0-3)
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 (3-0-3)
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 (3-0-3)
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 (3-0-3)
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 (2-2-3)
Prerequisites: EE 405, Math 225, Mech 236. Corequisite: ME 304. Students also must register for the lab component. Laboratory and lecture in instrumentation and measurement for mechanical engineering students. Applications for the sensing of such variables as pressure, tem-perature, mass flow, and displacement. Particular attention to the applicability and sensitivity of instruments.

ME 403 - Mechanical Systems Design I (2-1-3)
Prerequisites: ME 304, ME 305, ME 312, ME 316. Corequisite: ME 407. 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 (1-2-2)
Prerequisite: ME 343, ME 312. Corequisite: ME 407. 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 (1-2-2)
Prerequisite: ME 405, ME 407. Laboratory covering the testing and evaluation of complete mechanical systems.

ME 407 - Heat Transfer (3-0-3)
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 (1-2-2)
Prerequisite: 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, and requiring design decisions of a more sophisticated nature.

ME 410 - Co-op Work Experience II (3 credits)
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 **Effective From: Spring 2013**

ME 415 - Advanced Manufacturing Processes (3-0-3)
Prerequisites: ME 215 and ME 316. A lecture course discussing principles of conversion of liquid and solid materials in products. The notion of the Unit Manufacturing processes is used to analyze advanced technologies of the change of mass, geometry, composition, phases and structure. **Effective From: Spring 2009 Until: Spring 2012**

ME 425 - Finite Element Method in Mechanical Engineering (3-0-3)
Prerequisites: CIS 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 (2-2-3)
Prerequisites: CIS 101, 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 (3-0-3)
Prerequisites: CIS 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 (3-0-3)
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 (3-0-3)
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. **Effective From: Spring 2013**

ME 435 - Thermodynamics (3-0-3)
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 (3-0-3)
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 (3-0-3)
Prerequisites: Chem 126 or Chem 122, and ME 215. 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. **Effective From: Spring 2013**

ME 439 - Principles of Tribology (3-0-3)
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 (2-2-3)
Prerequisites: 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 (3-0-3)
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 (3-0-3)
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 454 - Compressible Flow (3-0-3)
Prerequisites: ME 304, ME 312, Math 222. Equations of one-dimensional compressible flow. Topics are flows with variable areas, friction, mass addition, heat addition, normal shocks, and combination of these effects. Special topics in two-dimensional flows such as oblique shocks. **Effective Until: Spring 2012**

ME 455 - Automatic Controls (3-0-3)
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 (3-0-3)
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 (3-0-3)
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 472 - Introduction to Biomechanical Engineering (3-0-3)
Prerequisites: ME 316 or equivalent; or permission of the instructor. Introduction to biomechanical engineering integrating the principles of mechanics with the notions of physiology into simple mathematical models consisting of sets of governing equations. Topics include anatomy; basic concepts and definitions of biomechanical engineering; basic solid mechanics such as human force and motion; basic fluid mechanics such as the cardiovascular system and blood circulation; engineering design of general assistive devices. **Effective Until: Spring 2012**

ME 490 - Mechanical Engineering Project A (3-0-3)
Prerequisites: 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 490H - Honors Mechanical Engineering Project I (3-0-3)
Prerequisites: member of Honors College and departmental approval required. Similar to ME 490.

ME 491 - Mechanical Engineering Project B (3-0-3)
Prerequisite: 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 491H - Honors Mechanical Engineering Project II (3-0-3)
Prerequisites: member of Honors College, and departmental approval required. Similar to ME 491.

GRADUATE COURSES:

ME 590 - Graduate Co-op Work Experience I (3 additive credits)
Prerequisites: permission from Department of Mechanical Engineering and Division of Career Development Services. Cooperative education internship providing on-the-job reinforcement of academic programs in mechanical engineering. Work assignments and projects are developed by the co-op office in consultation with the mechanical engineering department. Work assignments are related to student's major and are evaluated by faculty coordinators in mechanical engineering. Course cannot be used for mechanical engineering degree credit.

ME 591 - Graduate Co-op Work Experience II (3 additive credits)
Prerequisites: permission from Department of Mechanical Engineering and Division of Career Development Services. Course cannot be used for mechanical engineering degree credit.

ME 592 - Graduate Co-op Work Experience III (3 additive credits)
Prerequisites: permission from Department of Mechanical Engineering and Division of Career Development Services. Course cannot be used for mechanical engineering degree credit.

ME 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

ME 607 - Advanced Thermodynamics (3 credits)
Prerequisite: undergraduate thermodynamics. Basic laws of thermodynamics are applied to various thermodynamic systems. Topics include: availability, stability requirements, equation of state, property relations, properties of homogeneous mixtures, optimization applied to power generation and refrigeration cycles, and thermodynamic design of system components.

ME 608 - Non-Equilibrium Thermodynamics (3 credits)
Prerequisites: undergraduate thermodynamics and heat transfer, and ME 616. (May be taken concurrently.) Principles and mathematical techniques of non-equilibrium thermodynamics applied to mechanical engineering problems. Topics include field theory, energy and entropy balances, variational principles, and applications to fluid flow, heat exchangers and combustion.

ME 609 - Dynamics of Compressible Fluids (3 credits)
Prerequisites: undergraduate differential equations, fluid mechanics, and thermodynamics. One-dimensional reversible and irreversible compressible fluid flow, including effects of variable area, friction, mass addition, heat addition, and normal shock; two-dimensional reversible subsonic and supersonic flows, and an introduction to the method of characteristics and two-dimensional oblique shock.

ME 610 - Applied Heat Transfer (3 credits)
Prerequisites: undegraduate fluid mechanics, thermodynamics, heat transfer and differential equations. Fundamentals of

conduction, convection and radiation heat transfer. Practical engineering applications of heat exchangers including the design approaches by Mean Temperature Difference and Effectiveness-NTU methods, fins, convection fouling factors, and variable property analysis. **Effective From: Fall 2006**

ME 611 - Dynamics of Incompressible Fluids (3 credits)
Prerequisites: undergraduate fluid mechanics and ME 616. (May be taken concurrently.) An introduction to the hydrodynamics of ideal fluids; two-dimensional potential flow and stream functions; conformal mapping; and differential equations of viscous flow. Boundary layer theory and dimensional analysis are introduced.

ME 612 - Gas Dynamics (3 credits)
Prerequisite: ME 616. (May be taken concurrently.) Physical phenomena of gas dynamics and mathematical methods and techniques needed for analysis. Dynamic and thermodynamic relations for common flow situations are described through vector calculus. The nonlinearity of resulting equations and solutions such as numerical analysis, linearization or small perturbation theory, transformation of variables, and successive approximations are discussed. The method of characteristics is reviewed in detail for shock flows.

ME 613 - Radiation Heat Transfer (3 credits)
Prerequisites: undergraduate differential equations, thermodynamics, heat transfer and ME 616. (May be taken concurrently.) Heat radiation of solid bodies, gases and flames; angle factors; radiative properties of electrical conductors and non-conductors; application of radiative networks to multi-body problems; diffuse specular reflectors: artificial satellites and space vehicles; analogy between heat transfer by radiation and electrical networks; and combined conduction and radiation problems.

ME 614 - Continuum Mechanics (3 credits)
Prerequisites: Undergraduate courses in mechanics, fluid mechanics, solid mechanics, and mathematics (linear algebra, differential equations, and vector calculus) or approval of the instructor. Fundamentals of the mechanics of continuous media. Specific topics include vector and tensor analysis; kinematics associated with finite deformation; the stress tensor; and the conservation laws of mass, linear momentum, angular momentum, and energy. Constitutive equations for linear and non-linear elastic solids and for inviscid and Newtonian fluids are discussed. The role of material invariance under superimposed rigid body motion and material symmetry in the formulation of appropriate constitutive equations are emphasized.

ME 615 - Advanced Mechanical Vibrations (3 credits)
Prerequisites: undergraduate differential equations and system dynamics. One-, Two- and Multiple degree of freedom systems, Lagrange's equation of motion, Runge-Kutta computation, Finite Element Method and classical methods for normal mode analysis, matrix notation and iteration procedure, and Fourier series representation for the solution of vibration problems. **Effective From: Fall 2006**

ME 616 - Matrix Methods in Mechanical Engineering (3 credits)
Prerequisite: undergraduate differential equations. Applications of matrix algebra and matrix calculus to engineering analysis; matrix methods in solid and fluid mechanics; vibration, elasticity, viscous fluids, and heat transfer. Matrix theory is used to show the basic unity in engineering analysis.

ME 618 - Selected Topics in Mechanical Engineering (3 credits)
Prerequisite: departmental approval. Given when interest develops. Topics may include analysis and/or design of energy or mechanical systems of current interest to mechanical engineers.

ME 619 - Nano-scale Characterization of Materials (3 credits)
The course presents the basics of nanotechnology and the principles and application of advanced instrumentation for the characterization of nanostructures. Topics include atomic force microscopy, near-field optics, dielectric spectroscopy, and light scattering. The significant component of the course is laboratory work at the W. M. Keck Foundation Laboratory and research project. **Effective From: Fall 2007**

ME 620 - Stress Methods in Mechanical Design (3 credits)
Prerequisites: undergraduate differential equations and strength of materials. Governing equations and solutions for analysis and design of structural and machine elements; appropriate boundary conditions to investigate pipes and rods subjected to shrink and force fits; rotating disks of uniform and variable thickness; beam and plate elements; and thermal stresses and stress concentrations in mechanical design. **Effective From: Fall 2006**

ME 621 - Energy Methods in Mechanical Design (3 credits)
Prerequisites: undergraduate differential equations and strength of materials. Use of energy methods to design structural and machine elements. Includes approximate solutions for problems using conservation of energy and several variational approaches; the role of energy in failure criteria; combined loads; and the relationship of variational methods to the development of finite element solutions. **Effective From: Fall 2006**

ME 622 - Finite Element Methods in Mechanical Engineering (3 credits)
Prerequisites: undergraduate differential equations and strength of materials. Using variational formulation and Ritz approximation, element equations for bar, beam, potential flow, heat transfer, torsion of a solid bar and plane elasticity problems are derived and solved with computer programs. **Effective From: Fall 2006**

ME 624 - Microlevel Modeling in Particle Technology (3 credits)
Presents methodologies for analyzing the macroscopic properties of particulate systems in terms of the underlying microlevel processes. Significant components are the mathematical modeling of particulate systems at the microlevel, analytical and numerical methods for predicting macroscopic properties from microlevel models, and comparison of theoretical predictions with experimental results. Demonstrates the importance of the interaction of these three components in the scientific process. The first part concerns the flow of dry particles where any interstitial fluid can be ignored. The second part considers the flow of particles suspended in an interstitial fluid. Also includes a class project involving development of simulations. Same as ChE 625.

ME 625 - Introduction to Robotics (3 credits)
Prerequisites: undergraduate differential equations, kinematics and demonstrated competence in computer programming and ME 616. (May be taken concurrently.) Introduction to robotics, and computer-controlled programmable robotic manipulators; robot geometries; kinematics of manipulators; differential motion; work space planning and trajectory control; dynamics; robot sensing, and robot programming.

ME 628 - Machine Vision Principles and Applications (3 credits)
Prerequisites: undergraduate differential equations and demonstrated competence in computer programming. Fundamentals of machine vision as applied to inspection, recognition, and guidance in mechanical and manufacturing processes. Emphasis on real-time machine vision algorithms for machine parts inspection and identification. Topics include lighting and optics, camera selection and calibration, image segmentation, edge detection, feature extraction, and pattern classification.

ME 630 - Analytical Methods in Machine Design (3 credits)
Prerequisites: undergraduate differential equations, machine design, and ME 616. (May be taken concurrently.) Theory and analytical methods used in machine design. Comparisons are made between approximate and exact engineering methods for evaluation of the range of applicability of solutions. Topics include advanced analysis of threaded members; keyed, splined, and shrink fits when subjected to torque; preloaded bearings; surging, presetting and buckling of coiled springs; and accurate analysis of impact stresses and stresses beyond the yield point.

ME 631 - Bearings and Bearing Lubrication (3 credits)
Prerequisites: undergraduate differential equations, machine design and ME 616. (May be taken concurrently.) The theoretical and physical aspects of lubrication: hydrostatic and hydrodynamic problems. Reynold's differential equation for pressure distribution applied to slider bearing and journal bearing problems with and without end leakage.

ME 632 - Mechanical Engineering Measurements (3 credits)
This course offers extensive mechanical engineering lab experience, including measurement fundamentals, hands-on experiments, uncertainty analysis, technique comparison, and professional engineering reports. It also focuses on the fundamental principles behind each methodology and relevant applications. The topics cover measurement in major mechanical engineering areas including thermodynamics, thermofluids, and control. Specialized experiments include fluidization, CAD/CAM, and NC machining. Comparisons of experimental results against theoretical or computational results are also required. **Effective From: Fall 2009**

ME 633 - Dynamics of Machinery (3 credits)
Prerequisites: undergraduate differential equations and matrix analysis. Consideration of kinematics, constraints and Jacobians, linear and angular momentum and potential energy and conservative forces of mechanical systems. Application of principle of virtual work, D?Alembert's principle, method of virtual power and Lagrange's equation to systems of particles and systems of rigid bodies.

ME 635 - Computer-Aided Design (3 credits)
Prerequisites: undergraduate linear algebra (matrices operation) and differential equations. Adaptation of computer for solving engineering design problems; design morphology; simulation and modeling; algorithms; problem-oriented languages; use of available software; computer graphics, and automated design. **Effective From: Fall 2006**

ME 636 - Mechanism Design: Analysis and Synthesis (3 credits)
Prerequisites: undergraduate kinematics, dynamics and demonstrated competence in computer programming and ME 616. (May be taken concurrently.) Kinematic principles combined with computer-assisted methods for designing mechanisms; complex polar notation; and dynamic and kinetostatic analysis of mechanisms. Kinematic synthesis of planar mechanisms; graphical Burmester theory for plane linkage synthesis; and planar linkage synthesis for function and path generation.

ME 637 - Kinematics of Spatial Mechanisms (3 credits)

Prerequisites: undergraduate kinematics, dynamics, knowledge of matrices and ME 616. (May be taken concurrently.) Advanced techniques for the dual-number coordinate-transformation matrix modeling to perform the displacement, velocity, static and dynamic force analysis of spatial mechanisms. Applications considered will include shaft couplings, skew four-bars, wobble plates, generalized slider-cranks and robotic manipulators.

ME 638 - Computer-Aided Machining (3 credits)
Prerequisites: demonstrated competence in computer programming, ME 305, ME 616 and ME 635 or equivalent. Introduction of computer applications to understand integrated computer-aided machining process. Included in the course are the fundamentals of motion control and NC/CNC/DNC machining, part programming and post-processors, and advances in CAM. Student projects are carried out using appropriate manufacturing software.

ME 641 - Refrigeration and Air Conditioning (3 credits)
Prerequisites: undergraduate differential equations, fluid mechanics and thermodynamics. Refrigeration and air conditioning cycles; comfort analysis, psychometric chart analysis, heat and mass transfer steady and transient processes, heating and cooling design loads, energy loads and standards requirements.

ME 643 - Combustion (3 credits)
Prerequisites: Undergraduate thermodynamics & fluid mechanics. Chemical & physical process of combustion: ideal combustion, actual combustion, mass balance, energy of reaction, maximum adiabatic combustion temperature, chemical equilibrium, heating values of fuels, combustion in furnaces, internal combustion engines & other heat engines, with emphasis on the analysis & control of the products of combustion in light of environmental considerations.

ME 644 - Building Environmental Control Principles (3 credits)
Prerequisites: undergraduate thermodynamics, fluid mechanics, heat transfer and differential equations. Control systems for buildings including control of temperature, moisture and air quality. Optimization of systems for control of building energy use. Modern microprocessor-based control systems, including direct digital control, proportional and integral controllers, predictive control, adaptive control, optimum start controllers and optimal control.

ME 653 - Control of Electro-Mechanical Networks (3 credits)
Prerequisites: undergraduate electrical circuits and mechanical vibrations or equivalent. Electro-mechanical systems; control loops; use of mechanical networks in dynamic systems; and stability and response to various inputs in electro-mechanical networks.

ME 655 - Introduction to Modern Control Methods (3 credits)
Prerequisites: undergraduate system dynamics and automatic controls. Introduction to modern control methods applied to mechanical and manufacturing systems. Topics include state variable feedback, observer theory, nonlinear control, optimal control, and adaptive control for both continuous and discrete systems.

ME 660 - Noise Control (3 credits)
Prerequisites: undergraduate differential equations and physics. Engineering methods for reducing noise pollution; reduction of intensity at the source; limitation of transmission paths and absorption; application to structures, machinery, ground transportation, aircraft, and noise measurement.

ME 664 - Experiments and Simulations in Particle Technology (3 credits)
Prerequisites: gradute standing and consent of the instructor. Covers a particle size analysis using sieves as well as laser diffraction technique, size reduction with ball mill, measurement of powder flow properties and internal angle of friction, measurement of angle of repose, design of mass flow hoppers using Jenike direct shear tester, measurement of minimum sintering temperature of powders, particle sedimentation, powder mixing, dry particle coating, and fluidized beds. Simulations involve various dry and fluid based particle systems, focusing on particle-particle and fluid-particle interactions. Same as ChE 664.

ME 670 - Introduction to Biomechanical Engineering (3 credits)
Prerequisites: undergraduate thermodynamics, statics, and dynamics. Introduction to biomechanical engineering of physiological systems; fluid flow, structural, motion, transport, and material aspects; energy balance of the body, and the overall interaction of the body with the environment.

ME 671 - Biomechanics of Human Structure and Motion (3 credits)
Prerequisites: undergraduate statics, kinematics, and dynamics. Principles of engineering mechanics and materials science applied to human structural and kinematic systems and to the design of prosthetic devices. Topics include anatomy; human force systems; human motion; bioengineering materials; and design of implants, supports, braces, and replacements limbs.

ME 672 - Biomaterials-Characterization (3 credits)
Prerequisites: mechanics of materials, principles of materials science and engineering. Engineering physiology, stress analysis and mechanical laboratory. Fundamental concepts on the methods and rationales used in characterization of metal, ceramic,

polymeric, and biologic materials used in biomedical implant fabrication including survey of various techniques and engineering design aspects on biomaterials.

ME 675 - Mechanics of Fiber Composites (3 credits)
Prerequisites: ME 315 (see undergraduate catalog for course description) and demonstrated competence in computer programming. Introduces various design problems using fiber composites. Analysis of general fiber composite laminate and short fiber composites, fracture mechanics, fatigue, creep and viscoelasticity, thermal stresses, special layups and associated optimization problems.

ME 676 - Applied Plasticity (3 credits)
Prerequisite: ME 620 or equivalent. Fundamentals of plasticity applied to mechanical and manufacturing engineering problems. Topics include elastic-plastic analysis for beams, rings and plates. Plastic instability and slip-line fields are considered.

ME 678 - Engineering Design of Plastic Products (3 credits)
Prerequisite: Knowledge of Pro/Engineer (or IDEAS). Structure and properties of plastics including stress-strain behavior and the effect of fillers and reinforcements. Designing for impact, flexure, shear, friction, puncture, creep and fatigue. Case studies of structural, electrical, and optical applications. **Effective From: Fall 2006**

ME 679 - Polymer Processing Techniques (3 credits)
Prerequisites: undergraduate courses in fluid dynamics and heat transfer. Techniques for processing of plastics: extrusion, injection molding, compression molding, thermoforming, casting.

ME 680 - Polymer Processing Equipment (3 credits)
Prerequisites: ChE 645 or equivalent and undergraduate heat transfer. Application of heat transfer, fluid mechanics, and thermodynamics to the design and control of polymer processing equipment. Detailed consideration of extrusion, collandering, rotational molding, stamping, and injection molding.

ME 700 - Master's Project (3 credits)
Prerequisite: department approval. An extensive paper involving design, construction, and analysis, or theoretical investigation. Further information may be obtained from the graduate advisor.

ME 701 - Master's Thesis (6 credits)
Prerequisite: department approval. Projects involving design, construction, experimental, or theoretical investigation carried out under the supervision of a designated member of the mechanical engineering faculty. The completed written thesis must be defended in a publicly announced oral defense. A student must register for a minimum of 3 credits per semester until completion, although degree credit will be limited to the 6 credits indicated for the thesis.

ME 710 - Conduction Heat Transfer (3 credits)
Prerequisite: ME 610 and ME 616 or equivalent. Heat transfer by conduction: differential and integral forms of the energy equation for isotropic and anisotropic material. Analytical and numerical studies of transient and steady one-, two-, and three-dimensional heat transfer problems for a variety of boundary conditions including phase change. In addition, variational and boundary element methods are applied to heat conduction problems.

ME 711 - Convection Heat Transfer (3 credits)
Prerequisites: ME 610 and ME 616 or equivalent. Development of convective heat transfer theory: currently available methods, analytical and numerical, for predicting heat rates in forced, natural, and mixed convection in laminar and turbulent flow regimes are thoroughly studied. Studied techniques are applied to the thermal design of complex systems.

ME 712 - Mechanics of Viscous Fluids (3 credits)
Prerequisite: ME 611 and ME 616. (May be taken concurrently.) Properties and behavior of real fluids in laminar and turbulent motion. Review of tensor analysis; current mathematical and empirical laws and methods; flows in ducts; exact solutions of Navier-Stokes equations; boundary layers over surfaces and flow past bodies.

ME 713 - Non-Newtonian Fluid Dynamics (3 credits)
Prerequisite: ME611, ME616. Review of Newtonian fluid mechanics. Time dependent response and transport properties of non-Newtonian fluids in simple shear and extensional flows. Experimental techniques for measuring dynamic response and transport properties. Continuum and micromechanical constitutive models; solutions of constitutive equations.

ME 714 - Principles of Particulate Multiphase Flows (3 credits)
Prerequisite: Courses in fluid mechanics or approval of the instructor. This course provides an introduction to the fundamental principles of mass, momentum and heat transfer in particulate multiphase flows. Theories and governing equations for distinctive responses and motions of each phase and the dynamic interactions among phases are formulated. Typical industrial applications will be illustrated.

ME 717 - Selected Topics in Mechanical Engineering I (3 credits)
Prerequisite: department approval. Given when interest develops. Topics may include advanced mechanisms, aerodynamics, analysis of ME systems, design optimization, and case studies in design.

ME 721 - Thermal Stresses (3 credits)
Prerequisites: vector analysis or ME 616 or equivalent and theory of elasticity or ME 785. Thermoelasticity; reduction of thermoelastic problems to constant temperature equivalents; fundamentals of heat transfer; and elastic and inelastic stress analysis.

ME 725, ME 726, ME 727 - Independent Study I, II, III (3 credits)
Prerequisites: written permission from department chairperson plus prerequisite courses prescribed by a supervising faculty member. Areas of study in which one or more students may be interested but which is not of sufficiently broad interest to warrant a regular course offering. A maximum of two independent studies courses may be applied to a degree.

ME 734 - Analysis and Synthesis for Design (3 credits)
Prerequisites: ME 616 and ME 620 or ME 610. Fundamental concepts of advanced mathematics and their application to analysis and synthesis of mechanics, electricity, thermodynamics, fluid mechanics, and heat transfer systems and their components.

ME 735 - Advanced Topics in Robotics (3 credits)
Prerequisite: ME 625. Introduction to advanced topics and techniques in robotics. Subjects covered include differential kinematics, calibration and accuracy, trajectory control, and compliant motion control as well as an in-depth treatment of topics discussed in ME 625.

ME 736 - Advanced Mechanism Design (3 credits)
Prerequisite: ME 636 and ME 616. Advanced methods for the synthesis of mechanisms. Topics include synthesis of planar mechanisms for three, four and five positions, multiloop linages, change of branch and order problems, and optimal synthesis of mechanisms. Synthesis of linkages for special types of motion including straight line motion, cusp points on coupler curves and adjustable mechanisms.

ME 752 - Design of Plates and Shells (3 credits)
Prerequisites: ME 616 or equivalent and ME 620. A study of plates and shells. Mechanical engineering design solutions for typical loading and boundary conditions through analytical and numerical methods. Plate and shell interfaces and vibration are also considered.

ME 754 - Pressure Vessel Design (3 credits)
Prerequisites: ME 616 or equivalent and ME 620. Theories in designing pressure vessels; analysis of circular plates; cylindrical and spherical shells; pressure vessel heads; pipe bends; and attachments. Consideration is also given to pressure vessel materials in fatigue and creep designs.

ME 755 - Adaptive Control Systems (3 credits)
Prerequisite: ME 655. Theory and application of self-tuning and model reference adaptive control for continuous and discrete-time deterministic systems. Topics include model-based methods for estimation and control, stability of nonlinear systems and adaptive laws. Applications of adaptive control in mechanical systems and manufacturing processes.

ME 776 - Dynamics of Polymeric Liquids (3 credits)
Prerequisites: ME 610 and ME 611. An advanced course in fluid dynamics which concentrates on the behavior of polymeric liquids. Topics include constitutive equations of polymeric liquids, fluid dynamics of rheometry and kinetic theory of polymeric fluid dynamics.

ME 785 - Theory of Deformable Solids in Mechanical Engineering I (3 credits)
Prerequisites: ME 616 or equivalent and ME 620. Measure of strain; strain tensor; stress tensor; equilibrium equations; constitutive relations; compatibility conditions; conditions for and formulation of three-dimensional problems; and the relationship of engineering theories for beams, plates, and shells to the equations of elasticity.

ME 786 - Theory of Deformable Solids in Mechanical Engineering II (3 credits)
Prerequisite: ME 785. Solutions for problems formulated in ME 785: eigenfunction solutions; operational methods; complex variables theory; three-dimensional problems; contact problems; wave propagation; and non-linear problems.

ME 790 - Doctoral Dissertation (Credits as designated)
Required of all students working toward the Doctor of Philosophy in Mechanical Engineering. A minimum of 36 credits is required. The student must register for at least 6 credits of dissertation per semester until 36 credits are reached and for 3 credits each semester thereafter.

ME 791 - Graduate Seminar and Professional Presentations (0 credits)
Regular attendance required of all students in the Mechanical Engineering PhD program. Each PhD student is required to make a 15 minute presentation on a topic related to the student's research with an additional 10 minutes to address audience questions. The seminar participants eveluate each speaker. **Effective From: Fall 2006**

ME 792 - Pre-Doctoral Research (3 credits)
Prerequisite: permission of department chairperson. For students admitted to the doctor of philosophy program in mechanical engineering who have not yet passed the qualifying examination. Research is carried out under the supervision of designated mechanical engineering faculty. If the student's research activity culminates in doctoral research in the same area, up to a maximum of 6 credits may be applied toward the 36 credits required under ME 790.

ME 794 - Mechanical Engineering Colloquium (Non-credit)
Prerequisite: graduate standing and major in mechanical engineering. National and international experts in mechanical engineering discuss their recent research. Required of all students enrolled in mechanical engineering graduate degree programs. Students must register in this course for at least two semesters and attend at least four lectures in each semester. All doctoral students and students with assistantships must register in this course each semester and attend regularly.

Mechanics: Offered by the Department of Civil and Environmental Engineering. See Civil Engineering course list for faculty

UNDERGRADUATE COURSES:

Mech 234 - Engineering Mechanics (2-0-2)
Prerequisites: Phys 111, Math 112. A course for industrial and mechanical engineering students in which the equilibrium of particles and rigid bodies subject to concentrated and distributed forces is studied.

Mech 235 - Statics (3-0-3)
Prerequisites: Phys 111, Math 112.Provides an understanding of equilibrium of particles and rigid bodies subject to concentrated and distributed forces.

Mech 236 - Dynamics (2-0-2)
Prerequisites: Mech 234 (or Mech 235 with a grade of C or better or Mech 320). Provides an understanding of the mathematics of the motion of particles and rigid bodies, and of the relation of forces and motion of particles. **Effective From: Fall 2011**

Mech 236H* - Honors Dynamics (2-0-2)**
Prerequisites: Mech 234 or Mech 235 and enrolled in the Honors College. Course material similar to Mech 236 except in addition, the student will be involved in a research project.

Mech 237 - Strength of Materials (3-0-3)
Prerequisites: Mech 235 with a grade of C or better (or Mech 234 for IE, ME majors) and 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 (3-0-3)
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.

Mech 320H - Honors Status and Strength of Materials (3-0-3)**
Prerequisites: Phys 111, Math 112, and enrolled in the Honors College. For chemical engineering, electrical engineering, and biomedical engineering majors. Course material similar to Mech 320 except in addition, the student will design and perform several laboratory tests.

GRADUATE COURSES:

Mech 540 - Advanced Strength of Materials (3 credits)
Prerequisite: mechanics of deformable bodies. Topics beyond the scope of elementary mechanics of deformable bodies are studied with particular emphasis on the assumptions, limitations, and applications to actual problems. **Effective Until: Fall 2011**

Mech 630 - Theory of Elasticity (3 credits)
Prerequisite: differential equations. Theory of elasticity as basis for both advanced stress analysis and for a critical examination of elementary stress analysis.

Nursing : Offered by the College of Nursing at Rutgers-Newark

UNDERGRADUATE COURSES:

NURS 301 - Theory and Practice of Professional Nursing (3-0-3)
Building on the historical and theoretical foundations of the profession, students explore the theme of health, the continuum of health illness, the sociocultural variations that influence health and response to illness, and the many dimensions of health. Nursing interventions are explored in relation to ethical, social, legal, political, and personal issues as students clarify their own professional identity, responsibility and power.

NURS 302 - Comprehensive Health Assessment (3-0-3)
Focuses on total health assessment with differentiation between normal and abnormal findings. The total health assessment content focuses on individuals across the life span. Emphasis is placed on data collection and analysis through history and physical examination.

NURS 304 - Nursing Informatics (4-0-4)
Computer applications for nursing. Exposes students to PC-based and mainframe computer systems through computer laboratory and field experiences.

NURS 305 - Adaptations and Alterations in Body Functions (3-0-3)
Reviews and extends fundamental concepts of physiology and changes that produce signs and symptoms and the body's remarkable ability to compensate for these illness-related changes. Findings will establish the database for formulating appropriate nursing strategies.

NURS 306 - Pharmacology (2-0-2)
Prerequisite or corequisite: NURS 305. Reviews and extends students? previous knowledge of pharmacological science. Explores mechanisms of actions of drugs used to treat various health conditions at the cellular level.

NURS 307 - Epidemiology in Nursing Practice (2-0-2)
An introduction to population-based approach to health care. Incorporate information on the etiology and predictors of events in order to design health promotion and disease prevention strategies.

NURS 401 - Patterns of Community Health (3-6-6)
Prerequisites: completion of all NURS 300-level courses. Focuses on nursing knowledge and interventions directed to enhance community health for diverse populations. Clinical practicum focusing on clients with diverse needs and in a variety of settings enhances classroom learning.

NURS 402 - Environmental and Occupational Health (4-0-4)
Prerequisites: completion of all NURS 300-level courses. Prepares students to assess changes in health status related to the environment or the workplace. Students are provided with the skills needed to evaluate, and recommend control strategies for the phenomena.

NURS 403 - Nursing Care Delivery Systems (3-6-6)
Prerequisites: completion of all NURS 300-level courses. Focuses on the professional nurse's leadership and management role within health care systems. The multi-faceted aspects of the role of the nurse as a leader and manager are explored in depth, with emphasis on the role of the nurse as change agent. Includes organizational behavior, decision-making, the change process, the management of health care delivery, and nursing care within health care organizations.

NURS 404 - Research Applications in Nursing Practice (3-0-3)
Prerequisites: Completion of all NURS 300-level courses. Prepares students to critically analyze nursing issues from an applied research perspective.

GRADUATE COURSES:

R705:504 - Human Diversity and Social Issues in the Community (3 credits)
For more details go to Rutgers Catalog.

R705:534 - Community Health Nursing Theory II (3 credits)
For more details go to Rutgers Catalog.

Operations Managment : Offered by the School of Management. See Management course list for faculty.

UNDERGRADUATE COURSES:

OM 375 - Management Science (3-0-3)
Prerequisite: Mgmt 216. Introduction to statistical and mathematical techniques used in management decision making. Develop the concepts of management science and use its techniques with unrestricted focus. Operations management applications are made in factory settings, health-care and other service industries, education and government agencies.

OM 475 - Production Planning and Control (3-0-3)
Prerequisites: OM 375, junior or senior standing. The components and functioning of in-production, planning, and control systems. Material, equipment, and labor requirements for optimizing continuous and intermittent manufacturing operations. The use of a computer to simulate such models.

OM 476 - Quality Control (3-0-3)
Prerequisites: OM 375, junior or senior standing. Deals with measuring, and improving the performance of the service and/or production processes being managed. Performance assessment is an important component of any management system's excellence. In managing a service-oriented or a manufacturing-based company, performance measurement and analysis should be built into the management processes of identifying and overcoming problems that are central to continuous improvement. The topics include cost analysis, control and improvement, continuous quality improvement, and the other assessment methods for planning and controlling production and service company-wide.

GRADUATE COURSES:

R711:585 - Control Models (3 credits)
For more details go to Rutgers Catalog.

Optical Science and Engineering Courses: Offered by the Physics Departments of NJIT.

UNDERGRADUATE COURSES:

OPSE 301 - Introduction to Optical Science and Engineering (3-0-3)
Prerequisites: 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 (3-0-3)
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 (3-0-3)
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 (3-0-3)
Prerequsite: Phys 121. An introduction to the interaction of light with biological tissues. Biophotonics for diagnostic and therapeutic applications will be discussed. Topics include propagation of light in turbid tissues, absorption, scattering, laser surgery, and optical rotation.

GRADUATE COURSES:

OPSE 601 - Advanced Topics in Optical Science and Engineering (3 credits)
In small groups or as an individual, students conduct three complete research experiments in the available topics of interest, from preliminary background research through data analysis. Use of modern optical research tools under close guidance of faculty and associated research team members in the faculty member's lab.

OPSE 610 - Virtual Instrumentation (3 credits)
Prerequisites: A college level programming course. Intended for all engineering, computer science, and science majors. Covers 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 acquisitions and instrument control, instrument status, and acquisition speed. **Effective From: Spring 2007**

Project-Based Learning: Offered by the Office of the Provost

UNDERGRADUATE COURSES:

PBL 101 - Project Based Learning (0-1-1)
Teams develop problem solving skills in a highly social and applied learning environment with emphasis on collaboration, innovation, leadership and a high degree of connectivity to community, industry and global issues. Topics include project management, business analysis, design skills, social skills, presentation skills, e-portfolio building, and principles of STEM. This course is intended for freshmen in the Community Connections learning community. **Effective From: Spring 2012**

PBL 201 - Project Based Learning II (1-2-2)
Prerequisite: PBL 101. Student build upon skills learned in PBL 101. Multidisciplinary topics include motivational theories, leadership theories, innovation theories, organization theory, and project management elements including refining a research question, defining measurable outcomes and evaluation criteria, and strategies for directing and controlling the project. Effective presentation skills, communication skills, leadership skills, and other career competencies are emphasized. **Effective From: Fall 2012**

Philosophy: Offered by the Department of Humanities. See Humanities course list for faculty.

UNDERGRADUATE COURSES:

Phil 300 - Philosophy of Law and Social Justice (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Introduction to philosophical issues concerning law, using lectures and case studies. Topics covered will include: the interpretation of legal texts; the foundation of moral obligation to obey the law; the nature of rights; and the function of punishment **Effective From: Spring 2009**

Phil 331 - Problems in Philosophy (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Phil 333 - Moral Philosophy (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Phil 334 - Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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? **Effective From: Spring 2009**

Phil 337 - World Religions (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Phil 340 - Ethical Issues in Public Policy (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Course premise is the inevitability of ethical issues in public policy decision making. Societal forces such as government, industry, economics, public interest, and science can play various roles in shaping public policy and are related to ethical concerns. Focuses on both historic and current public policy case studies. **Effective From: Spring 2009**

Phil 350 - Representative Philosophies (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Phil 351 - Biomedical Ethics (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or

better. 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." Honors Note: See HSS 101. **Effective From: Spring 2009**

Phil 355 - The Philosophy of Science (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Phil 380 - Philosophy of Language (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

Physical Education: Offered by the Division of Physical Education and Athletics

UNDERGRADUATE COURSES:

PE 103 - Swim Instruction (0-1-1)
Students develop aquatic skills, including various swimming strokes and rescue techniques, according to skill level. Limited to 10 students.

PE 104 - Survival Swimming (0-1-1)
Designed for the average, weak or non-swimmer and will emphasize survival swimming, basic rescue and water safety techniques, and swimming instruction.

PE 105 - Lifesaving/Lifeguard Training (0-1-1)
An American Red Cross certification course. The purchase of textbooks is required. Laboratory hours are established at first lecture.

PE 106 - Water Safety Instructor (0-1-1)
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 (0-1-1)
Covers strength and conditioning techniques and programs, goal setting, and record keeping.

PE 117 - Jogging (0-1-1)
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. **Effective From: Fall 2012**

PE 118 - Walking (0-1-1)
An approach to cardiovascular fitness and weight reduction. Walking tours may be offered.

PE 119 - Bicycling (0-1-1)
Emphasis on preparation for touring and recreational biking. May include some short tours. Students must have their own bikes.

PE 128 - Hydrofitness (0-1-1)
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 (0-1-1)
Specific training to meet the individual student's interest. Areas include techniques of strength training, goal setting and record keeping.

PE 131 - Step Aerobics (0-1-1)
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 (0-1-1)
Designed for cardiovascular conditioning, weight loss, and muscle toning.

PE 133 - Swim for Health (0-1-1)
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 (0-1-1)
Designed for the non-swimmer. Includes survival techniques and basic rescue.

PE 136 - Beginning Karate (0-1-1)
An introduction to shotokan karate. Includes basic self-defense. Gi (martial arts uniform) optional.

PE 137 - Intermediate Karate (0-1-1)
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 - Individual Fitness II (0-1-1)
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 (0-1-1)
Designed as a low-impact aerobic program utilizing weights to increase flexibility, coordination, muscle tone, and cardiovascular endurance.

PE 141 - Introduction to Dance (0-1-1)
An introduction to several styles of dance, including ballet, modern, jazz, tap, folk, ethnic, and social.

PE 145 - Aerobic Instructor Certification (0-1-1)
Prerequisite: approval of the instructor. Preparation for passing the certification test to become an aerobic instructor. Includes aerobic dance and stretching techniques, class format, music, and anatomy and physiology.

PE 146 - Air Force Physical Training I (0-1-1)
This is the first of two U.S. Air Force-sponsored physical training courses and is open to AFROTC-enrolled students only. Course activities include conditioning, exercises, calisthenics, a 1.5 mile run, Air Force sports, Warrior Runs, a Physical Fitness Diagnostic, and a Physical Fitness Assessment. **Effective From: Fall 2005**

PE 150 - Beginning Yoga (0-1-1)
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. **Effective From: Fall 2011**

PE 151 - Intermediate Yoga (0-1-1)
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. **Effective From: Fall 2013**

PE 170 - Modern Dance (0-1-1)
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. **Effective From: Fall 2013**

PE 171 - Latin Dance (0-1-1)
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. **Effective From: Fall 2013**

PE 180 - Zumba Fitness (0-1-1)
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. **Effective From: Fall 2013**

PE 201 - Introduction to Lifetime Sports I (0-1-1)
Offered only in the fall semester, introduces a variety of the individual, dual, and team sports available at NJIT.

PE 202 - Lifetime Sports II (0-1-1)
A continuation of PE 101. Participate in a variety of activities or develop an area(s) of concentration.

PE 208 - Sports for Women (0-1-1)
Designed specifically for women interested in learning and competing in individual, dual and team sports.

PE 210 - Skiing (0-1-1)
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 (0-1-1)
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 (0-1-1)
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 (0-1-1)
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 (0-1-1)
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 (0-1-1)
Includes the rules, skills, strokes, and strategies of badminton, and provides an opportunity for competition.

PE 223 - Tennis for Beginners (0-1-1)
Introduces students to the rules and basic techniques and strategies of tennis.

PE 224 - Intermediate Tennis (0-1-1)
Prerequisite: PE 223 or permission of the instructor. Emphasizes correcting problem strokes, strategies, drills, and tournament play.

PE 225 - Golf (0-1-1)
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 (0-1-1)
Prerequisite:PE 225 or permission of the instructor. Designed to strengthen and advance the skills and theory learned in PE 125.

PE 227 - Sailing and Windsurfing (0-1-1)
Learn the basics of small boat sailing and windsurfing. Includes principles of sailing, rules of the road and boat maintenance with practical experience at Spruce Run Reservoir. Transportation may be provided.

PE 234 - Beginning Fencing (0-1-1)
Introduces fencing as both a lifetime and intercollegiate sport. Basic equipment is provided.

PE 242 - Introduction to Racquetball (0-1-1)
An introduction to rules, skill development, strategies and tournament play.

PE 243 - Introduction to Volleyball (0-1-1)
An introduction to rules, skill development, strategies, and tournament play.

PE 244 - Advanced Racquetball (0-1-1)
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 246 - Air Force Physical Training II (0-1-1)
This is the second of two U.S. Air Force-sponsored physical training courses and is open to AFROTC-enrolled students only. Course activities include conditioning, exercises, calisthenics, a 1.5 mile run, Air Force sports, Warrior Runs, a Physical Fitness Diagnostic, and a Physical Fitness Assessment. **Effective From: Fall 2005**

Phys 106W - Physics B Workshop (0-1-0)
Workshop for Phys 106 B.

Physics: Offered by the Physics Departments of NJIT and Rutgers-Newark

UNDERGRADUATE COURSES:

Phys 102 - General Physics (3-0-3)
Prerequisite: None. 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. **Effective From: Spring 2009**

Phys 102A - General Physics Laboratory (0-2-1)
Prerequisite: None. This course is the laboratory component of Phys 102 and must be taken concurrently. **Effective From: Spring 2009**

Phys 103 - General Physics (3-0-3)
Prerequisite: Phys 102 with grade of C or better. 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. **Effective From: Spring 2009**

Phys 103A - General Physics Laboratory (0-2-1)
Prerequisite: Phys 102 with grade of C or better. This course is the laboratory component of Phys 103 and must be taken concurrently. **Effective From: Spring 2009**

Phys 105 - Physics A (3-0-3)
Corequisite: Math 108. First semester of a two-semester sequence with Phys 106. The sequence is equivalent to Phys 111. Placement is determined by performance on standardized entrance examinations. A study of elementary mechanics with emphasis on the fundamental laws of mechanics and conservation laws. Topics include scalar and vector quantities, rectilinear motion, equilibrium and Newton's laws of motion, friction, work and energy, impulse, and momentum. Lab must be taken concurrently. **Effective From: Spring 2009 Until: Fall 2011**

Phys 105A - Physics A Laboratory (0-2-1)
Corequisite: Math 108. Placement in this course is determined by performance on standardized entrance examinations. This course is the laboratory component of Phys 105 and must be taken concurrently. **Effective From: Spring 2009 Until: Fall 2011**

Phys 105W - Physics A Workshop (0-1-0)
Corequisite: Math 108. **Effective From: Spring 2009 Until: Fall 2011**

Phys 106 - Physics B (3-0-3)
Prerequisite: Phys 105 and Math 108 or Math 109 or Math 110, with grade of C or better. Second semester of a two-semester sequence with Phys 105. An extension of Phys 105 in the area of mechanics. Topics include rotational motion, torque, inertia and angular momentum, static equilibrium, gravity, and a full review of mechanics at the level equivalent to Phys 111. Lab must be taken concurrently. **Effective From: Spring 2009**

Phys 106A - Physics B Laboratory (0-2-1)
Prerequisite: same as Phys 106. This course is the laboratory component of Phys 106 and must be taken concurrently. **Effective From: Spring 2009 Until: Fall 2011**

Phys 111 - Physics I (3-0-3)
Prerequisite: Math 131; Corequisite: Math 111 or Math 132. 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. **Effective From: Spring 2009**

Phys 111A - Physics I Laboratory (0-2-1)
Corequisite: Math 111. Laboratory component of Phys 111 and Phys 111H. Lab must be taken concurrently with Phys 111 or Phys 111H. **Effective From: Spring 2009**

Phys 111H - Honors Physics I (3-0-3)
Prerequisite: Math 131; Corequisite: Math 111 or Math 111H or Math 132. Admission to this course is by invitation, based on class standing and standardized entrance exams. First semester of a three-semester program in Honors Physics. Covers the material in Phys 111, but topics are treated more comprehensively and in greater depth. More extensive use of mathematics. Lab must be taken concurrently. See Phys 111A. **Effective From: Spring 2009**

Phys 111W - Physics I Workshop (0-1-0)
Corequisite: Math 111 or Math 111H. Workshop for Phys 111. **Effective From: Spring 2009 Until: Fall 2011**

Phys 114 - Introduction to Data Reduction with Applications (3-0-3)
Prerequisite: Math 131; Corequisite: Math 111 or Math 132. 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. **Effective From: Spring 2009**

Phys 121 - Physics II (3-0-3)
Prerequisites: PHYS 111 with a grade of C or better. Math 111 or 111H or 132. Co-requisite: Math 112 or Math 133. 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. **Effective From: Spring 2012**

Phys 121A - Physics II Laboratory (0-2-1)
Prerequisites: Phys 111 or Phys 111H or Phys 106 and Math 111 or Math 111H all with grade of C or better. Corequisite: Math 112. **Effective From: Spring 2009**

Phys 121H - Honors Physics II (3-0-3)
Prerequisites: PHYS 111 with a grade of C or better. Math 111 or 111H or 132. Co-requisite: Math 112 or Math 133. This is the second semester of a three-semester program in Honors Physics. The course covers the material given in Phys 121. Greater use is made of vector analysis. In addition, an introduction to Maxwell's equations for the electromagnetic field and their application to physical problems is given. Lab must be taken concurrently.See Phys 121A. **Effective From: Spring 2012**

Phys 202 - Introductory Astronomy and Cosmology (3-0-3)
Prerequisite: None. 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.? **Effective From: Spring 2009**

Phys 202A - Astronomy and Cosmology Laboratory (0-2-1)
Corequisite: Phys 202. Includes demonstration of physical principles applicable to astronomy. Use of telescope for lunar, solar and planetary observations. **Effective From: Spring 2009**

Phys 203 - The Earth in Space (3-0-3)
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. **Effective From: Spring 2009**

Phys 203A - The Earth in Space Laboratory (0-2-1)
Corequisite: Phys 203. Optional laboratory course associated with Phys 203. **Effective From: Spring 2009**

Phys 204 - Biophysics of Life (3-0-3)
A non-mathematical view of how living entities work in terms of the basic concepts of physics. The course will discuss how these concepts underline topics ranging from birth to death, from touch to pleasure, from vision to beauty, and from a thought to a heartbeat. **Effective From: Fall 2013**

Phys 231A - Physics III Laboratory (0-2-1)
Prerequisite: Phys 121 or Phys 121H and Math 112 or Math 112H, all with grade of C or better. **Effective From: Spring 2009**

Phys 231H - Honors Physics III (4-0-4)
Prerequisite: Phys 121 or Phys 121H and Math 112 or Math 112H, 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. **Effective From: Spring 2009**

Phys 233 - Physics III (3-0-3)
Prerequisite: Phys 121. Intended for students in chemical engineering only. Topics include elements of simple harmonic motion, wave motion, interference and diffraction, quantum mechanics, semiconductor models, carrier distribution, Fermi functions, and selected topics. **Effective From: Spring 2002 Until: Spring 2008**

Phys 234 - Physics III (3-0-3)
Prerequisite: Math 112 or Math 112H. 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. **Effective From: Spring 2009**

Phys 234H - Honors Physics III (3-0-3)
Prerequisites: Math 112 or Math 112H. 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. **Effective From: Spring 2009**

Phys 235 - Physics III (4-0-4)
Prerequisites: Phys 121 and 121A. Intended for students in computer engineering. Topics include simple harmonic motion, wave motion, interference and diffraction, photons, electrons, and the wave particle duality. Thermodynamics and heat transfer are introduced. **Effective Until: Spring 2008**

Phys 310 - Introduction to Atomic and Nuclear Physics (3-0-3)
Prerequisites: Phys 234 or Phys 234H; Math 222 or Math 222H, 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. 21&62:750:403 may be substituted for this course. **Effective From: Spring 2009**

Phys 311 - Co-op Work Experience I (3 credits)
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 **Effective From: Spring 2013**

Phys 320 - Astronomy and Astrophysics I (3-0-3)
Prerequisites: Phys 121 or Phys 121H, 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. **Effective From: Spring 2009**

Phys 321 - Astronomy and Astrophysics II (3-0-3)
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. **Effective From: Spring 2009**

Phys 322 - Observational Astronomy (3-0-3)
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. **Effective From: Spring 2009**

Phys 335 - Introductory Thermodynamics (3-0-3)
Prerequisites: Phys 234 or Phys 234H or Phys 231H and Math 211 or Math 213 or Math 213H, 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. 21&62:750:315 may be substituted for this course. **Effective From: Spring 2009**

Phys 350 - Biophysics I (3-0-3)

Prerequisite: Phys 121 or Phys 121H with a grade of C or better. This course presents an introduction to general biophysics and a preparation for medical school and biotechnology careers. It features molecules, viruses and cells racing to form enormous electric fields, succumbing to diseases and creating life. It explains how key medical devices preserve life. It asses students? progress using questions just like those on the medical school entrance exams and seeks an understanding of a few, simple principles of life science. **Effective From: Spring 2009**

Phys 390 - Selected Topics of Current Interest in Physics (1-0-1)
Prerequisite: Phys 234 or Phys 234H, 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. **Effective From: Spring 2009**

Phys 411 - Co-op Work Experience II (3 credits)
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 **Effective From: Spring 2013**

Phys 418 - Fundamentals of Optical Imaging (2-2-3)
Prerequisites: Phys234 or Phys 234H or Phys 231H, 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. **Effective From: Spring 2009**

Phys 420 - Special Relativity (3-0-3)
Prerequisites: Phys 234 or Phys 234H or Phys 231H and Math 222 or Math 222H, 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. **Effective From: Spring 2009**

Phys 421 - General Relativity (3-0-3)
Prerequisites: Phys 234 or Phys 234H or Phys 231H and Math 222 or Math 222H, 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. **Effective From: Spring 2009**

Phys 430 - Classical Mechanics I (3-0-3)
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. Newtonian mechanics of particles and systems. Lagrange's and Hamilton's approaches. Continuous systems. 21&62:750:361 may be substituted for this course. **Effective From: Spring 2009**

Phys 431 - Classical Mechanics II (3-0-3)
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. 21&62:750:362 may be substituted for this course. **Effective From: Spring 2009**

Phys 432 - Electromagnetism I (3-0-3)
Prerequisite: 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. **Effective From: Spring 2009**

Phys 433 - Electromagnetism II (3-0-3)
Prerequisite: Phys 432, with grade of C or better. Maxwell's equations with applications and electrodynamics. **Effective From: Spring 2009**

Phys 441 - Modern Physics (3-0-3)
Prerequisites: Phys 234 or Phys 234H or Phys 231H and Math 222 or Math 222H, 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. 21&62:750:316 may be substituted for this course. **Effective From: Spring 2009**

Phys 442 - Introduction to Quantum Mechanics (3-0-3)
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. 21&62:750:404 may be substituted for this course. **Effective From: Spring 2009**

Phys 443 - Modern Optics (3-0-3)
Prerequisites: Phys 234 or Phys 234H or Phys 231H and Math 222 or Math 222H, 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. **Effective From: Spring 2009**

Phys 444 - Fluid and Plasma Dynamics (3-0-3)
Prerequisites: Phys 234 or Phys 234H or Phys 231H and Math 222 or Math 222H, 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. **Effective From: Spring 2009**

Phys 446 - Solid State Physics (3-0-3)
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. 21&62:750:406 may be substituted for this course. **Effective From: Spring 2009**

Phys 448 - Semiconductor Physics (3-0-3)
Prerequisites: Phys 234 or Phys 234H or Phys 231H and Math 222 or Math 222H, all with grade of C or better. The physics of semiconductors is examined and applied to problems of interest to the engineer. The course includes the following topics: the band theory of solids, conduction in solids, hole and electron statistics, and P-N junction theory with emphasis placed upon low-level and high-level injection. Metal semiconductor contacts and P-N-P transistor theory are also discussed. **Effective From: Spring 2009**

Phys 450 - Advanced Physics Laboratory (1-4-3)
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. **Effective From: Spring 2009**

Phys 451 - Biophysics II (3-0-3)
Prerequisites: Phys 121 with a grade of C or better. An introduction to electrical aspects of biophysics and a preparation for medical school and biotechnology careers. Covering how medical devices work and using active learning with reports on new research. **Effective From: Spring 2013**

Phys 452 - Atomic and Nuclear Physics (3-0-3)
Prerequisites: Phys 234 or Phys 234H or Phys 231H and Math 222 or Math 222H, all with grade of C or better. Topics include atomic spectra, atomic structure, and nuclear physics. **Effective From: Spring 2009**

Phys 456 - Introduction to Solid State Physics (3-0-3)
Prerequisites: Phys 234 or Phys 234H or Phys 231H and Math 222 or Math 222H, 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. **Effective From: Spring 2009**

Phys 461 - Mathematical Methods of Theoretical Physics (3-0-3)
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. **Effective From: Spring 2009**

Phys 480 - Topics in Applied Physics (3-0-3)
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. **Effective From: Spring 2009**

Phys 481 - Applied Solid State Physics: Microelectronics I (3-0-3)
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. **Effective From: Spring 2009**

Phys 482 - Applied Solid State Physics: Microelectronics II (3-0-3)
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. **Effective From: Spring 2009**

Phys 483 - Applied Solid State Physics (0-6-3)
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. **Effective From: Spring 2009**

Phys 485 - Computer Modeling of Applied Physics Problems (3-0-3)
Prerequisites: Phys 234 or Phys 234H or Phys 231H and Math 222 or Math 222H, 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. 21&62:750:461 may be substituted for this course. **Effective From: Spring 2009**

Phys 490 - Independent Study (3-0-3)
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. **Effective From: Spring 2009**

Phys 490H - Honors Independent Study (3-0-3)
By arrangement with a physics faculty member. Fulfills Honors College capstone course requirement.

R750:315 - Introductory Thermodynamics (3)
For more details go to Rutgers Catalog.

R750:316 - Introduction to Modern Physics (3)
For more details go to Rutgers Catalog.

R750:333 - Applications of Mathematics to Physics (3)
For more details go to Rutgers Catalog.

R750:403 - Introduction to Atomic and Nuclear Physics (3)
For more details go to Rutgers Catalog.

R750:404 - Quantum Mechanics (3)
For more details go to Rutgers Catalog.

R750:406 - Introductory Solid-State Physics (3)
For more details go to Rutgers Catalog.

R750:407 - Advanced Physics Laboratory I (1)
For more details go to Rutgers Catalog.

R750:408 - Advanced Physics Laboratory II (1)
For more details go to Rutgers Catalog.

R750:461 - Computational Methods in Applied Physics (3)
For more details go to Rutgers Catalog.

R750:485 - Individual Research in Physics (BA,BA)
For more details go to Rutgers Catalog.

R750:493 - Readings in Physics (BA,BA)
For more details go to Rutgers Catalog.

GRADUATE COURSES:

Phys 555 - Physics Laboratory Techniques (3 credits)
Prerequisite: B.S. or B.A. with course emphasis in a pure science or major engineering discipline. A training workshop in principles in mechanics, electricity and magnetism, wave motion, geometric and physical optics, and modern physics; experiments involving hands-on use of laboratory apparatus to solve numerous practical physics problems.

Phys 593 - Graduate Co-op Work Experience IV (0 credits)
Prerequisites: One immediately prior 3-credit registration for graduate co-op work experience with the same employer. Requires approval of departmental co-op advisor and the Division of Career Development Services. Must have accompanying registration in a minimum of 3 credits of course work. **Effective From: Fall 2006**

Phys 601 - Mechanics I (3 credits)
Concepts and basic methods for the treatment of equilibrium and accelerated motion; Newton's Laws and the Free Body Diagram applied to problems in statics and dynamics; vectors, vector quantities, and their application in mechanics.

Phys 602 - Mechanics II (3 credits)
Prerequisite: Phys 601 or equivalent. Laws of conservation of energy and conservation of momentum in work and energy, power, impulse and momentum, collisions, recoil, and rocket propulsion. Angular motion, torque, moment of inertia, work and energy in rotational motion, and the application of Newton's laws and the law of conservation of angular momentum to problems in rotational dynamics are studied.

Phys 603 - Electricity and Magnetism I (3 credits)
Prerequisite: Phys 602 or equivalent. Electric charge, electric field, Gauss's law, electric potential, potential energy difference, current, resistance, and emf are studied. Also considers the law of conservation of charge and Kirchoff's laws, direct current circuits and instrumentation. Class includes demonstration lectures, related supervised computation problems, and recitations.

Phys 604 - Electricity and Magnetism II (3 credits)
Prerequisite: Phys 603 or equivalent. Magnetic field, force on moving charges, force on current-carrying conductor, and torque on a current-carrying coil; the Hall effect, magnetic field due to moving changes, induced emf, Faraday's and Lenz's laws, mutual and self-inductance, R-L, L-C, and R-L-C circuits, ferromagnetism and permanent magnets. Also considers alternating currents, circuits with resistance, inductance, and capacitance, average and RMS values, phasors, power, resonance, and transformers. Class includes demonstration lectures, supervised computation problems, and recitation.

Phys 607 - Topics in Astronomy and Cosmology (3 credits)
Prerequisites: college-level physics and mathematics. A survey of recent progress in astronomy, the physical principles involved, and the impact these new discoveries have on our understanding of the universe. Includes results from recent and ongoing planetary probes of our solar system, discovery of planetary systems around other stars, the evolution of stars, exotic objects such as neutron stars and black holes, the formation of galaxies, and current understanding of the birth and final fate of the universe. Observing sessions familiarize students with the sun, moon, and night sky.

Phys 687 - Physics of Materials (3 credits)
Prerequisite: Phys 441 or equivalent (see undergraduate catalog for description). Fundamentals of quantum mechanics; energy bands in crystals; electrical conduction in metals and alloys, semiconductors; optical properties of materials; quantum mechanical treatment of optical properties; magnetic properties of materials; thermal properties, heat capacity, and thermal expansion in solids.

Phys 688 - Mathematical and Statistical Methods in Materials Science (3 credits)
More emphasis on analytical methods and statistics. Course will be required for Ph.D. students in Materials Science. **Effective From: Fall 2006**

Phys 700 - Master's Project (3 credits)
Prerequisite: Written approval from graduate advisor. For students admitted to the Master of Science program in applied physics who do not take Phys 701 Master's Thesis. An extensive paper involving experimental or theoretical investigation of a topic in microelectronics or other applied physics area is required. Cooperative projects with industry or government agencies may be acceptable. The project is carried out under the supervision of a designated physics graduate faculty member.

Phys 701 - Master's Thesis (3 credits)
Prerequisite: Written approval from graduate advisor. For students admitted to the Master of Science program in applied physics. Experimental or theoretical investigation of a topic in microelectronics or other applied physics area. Cooperative projects with industry or government agencies may be acceptable. The thesis is written under the supervision of a designated physics graduate faculty member. The completed written thesis should be of sufficient merit to warrant publication in a scientific or technical journal. The student must register for a minimum of 3 credits per semester. Degree credit is limited to 6 credits indicated for the thesis.

Phys 721 - Classical Electrodynamics II (3 credits)
Prerequisite: Phys 621 or equivalent; basic knowledge of tensor analysis. Simple radiating systems, scattering and diffraction; special theory of relativity; dynamics of relativistic particles and electromagnetic fields; collisions between charged particles, energy loss, and scattering; radiation from accelerated charge, synchrotron radiation, and bremsstrahlung. **Effective From: Fall 2009**

Phys 725 - Independent Study (3 credits)
Prerequisites: permission from the graduate advisor (not thesis advisor) in Physics, as well as courses prescribed by a supervising faculty member (who is not the student's thesis advisor). This special course covers areas of study in which one or more students may be interested, but which isn't of sufficiently broad interest to warrant a regular course offering. Students may not register for this course more than once with the same supervising faculty member.

Phys 728 - Radio Astronomy (3 credits)
Prerequisites: Phys 621and 641 or the equivalent, or approval of the instructor. An introduction to radio emission processes, radiative transfer, radio diagnostics, and radio instrumentation. Topics include radio flux measurements with single antenna, radio imaging with interferometer arrays (Fourier Transform imaging), and image reconstruction techniques (CLEAN, MEM). Application is to astronomical objects with special emphasis on the Sun.

Phys 731 - Quantum Mechanics II (3 credits)
Prerequisite: Phys 631 or equivalent. Review of quantum mechanics and theory of special relativity; second quantization; relativistic one-particle problem; Klein-Gordon equation and Dirac equation; canonical field theory; relativistic scattering theory; introduction to quantum electrodynamics and quantum field theory; Feynman diagrams and applications. **Effective From: Fall 2009**

Phys 774 - Fundamentals of Spectroscopy (3 Credits)
The major objectives of this course are to integrate theory and practice and to bring together different branches of Academic Studies and Industrial Research through the presentation of critical aspects of modern Spectroscopy. The course will provide a valuable theoretical introduction and an overview of modern topics in spectroscopy, which are of current interest and importance in Semiconductor Industry and Biomedicine. A wide range of techniques is considered, including optical Near field spectroscopy, X-ray, Raman, Neutron scattering, and FT-IR spectroscopy. **Effective From: Fall 2006**

Phys 789 - Physics of Advanced Semiconductor Device Processing (3 credits)
Prerequisites: NJIT: EE 657, 26:755:687; or equivalent. Intended for doctoral students in applied physics, electrical engineering, and materials science. (Rutgers = 26:755:789)Silicon and GaAs technologies: crystal growth methods, epitaxy, oxidation, lithography, dry and wet etching techniques, polysilicon, diffusion, ion implantation, metallization (including silicidation), process integration, analytical characterization techniques, assembly and packaging, and yield and reliability. **Effective From: Fall 2009**

Phys 790 - Doctoral Dissertation and Research (Credits as designated, 1st and 2nd sem.)
Prerequisites: passing grade on departmental qualifying examination and approval of doctoral candidacy. Corequisite: Phys 791. A minimum of 36 credits is required. The student must register for at least 6 credits of dissertation per semester. Registration for additional credits, up to 12 per semester, is permitted with the approval of the department graduate advisor. Experimental or theoretical investigation of a topic in applied physics, including microelectronics, materials science, and laser physics. Cooperative projects with industry or government agencies may be acceptable. Research and writing are carried out under the supervision of a designated graduate faculty member. The completed written dissertation should be a substantial contribution to the knowledge of the topic under research, and should be of sufficient merit to warrant publication in a leading scientific or technical journal.

R755:611 - Advanced Classical Mechanics (3 credits)
For more details go to Rutgers Catalog.

R755:621 - Classical Electrodynamics (3 credits)
For more details go to Rutgers Catalog.

R755:631 - Quantum Mechanics (3 credits)
For more details go to Rutgers Catalog.

R755:641 - Statistical Mechanics (3 credits)
For more details go to Rutgers Catalog.

R755:651 - Atomic and Molecular Physics (3 credits)
For more details go to Rutgers Catalog.

R755:654 - Nuclear and Particle Physics (3 credits)
For more details go to Rutgers Catalog.

R755:661 - Solid-State Physics (3 credits)
For more details go to Rutgers Catalog.

R755:667 - Modern Experimental Techniques for Materials Processing and Characterization (3 credits)
For more details go to Rutgers Catalog.

R755:671 - Applied Optics (3 credits)
For more details go to Rutgers Catalog.

R755:675 - Cellular Biophysics (3 credits)
For more details go to Rutgers Catalog.

R755:687 - Physics of Materials (3 credits)
For more details go to Rutgers Catalog.

R755:689 - Simulations of Electronic Device Structures (3 credits)
For more details go to Rutgers Catalog.

R755:690 - Directed Study of Applied Physics (3 credits)
For more details go to Rutgers Catalog.

R755:700 - Master's Project (3 credits)
For more details go to Rutgers Catalog.

R755:701 - Master's Thesis (6 credits)
For more details go to Rutgers Catalog.

R755:721 - Classical Electrodynamics II (3 credits)
For more details go to Rutgers Catalog.

R755:731 - Quantum Mechanics II (3 credits)
For more details go to Rutgers Catalog.

R755:732 - General Relativity and Gravitation (3 credits)
For more details go to Rutgers Catalog.

R755:761 - Solid-State Theory (3 credits)
For more details go to Rutgers Catalog.

R755:762 - Electronic Structure of Solids (3 credits)
For more details go to Rutgers Catalog.

R755:763 - Surface and Interface Physics (3 credits)
For more details go to Rutgers Catalog.

R755:771 - Quantum Electronics (3 credits)
For more details go to Rutgers Catalog.

R755:772 - Applied Plasma Physics (3 credits)
For more details go to Rutgers Catalog.

R755:773 - Particle-Solid Interactions (3 credits)
For more details go to Rutgers Catalog.

R755:774 - Principles of Spectroscopy (3 credits)
For more details go to Rutgers Catalog.

R755:775 - Electrical Properties of Polymers (3 credits)
For more details go to Rutgers Catalog.

R755:780 - Current Topics of Applied Physics (3 credits)
For more details go to Rutgers Catalog.

R755:781 - Physics of Advanced Semiconductor Devices (3 credits)
For more details go to Rutgers Catalog.

R755:787 - Physics of Sensors and Actuators (3 credits)
For more details go to Rutgers Catalog.

R755:789 - Physics of Advanced Semiconductor Device Processing (3 credits)

For more details go to Rutgers Catalog.

R755:790 - Doctoral Dissertation (Credits as designated)
For more details go to Rutgers Catalog.

R755:791 - Applied Physics Seminar (Non-credit)
For more details go to Rutgers Catalog.

R755:792 - Pre-Doctoral Research (3 credits)
For more details go to Rutgers Catalog.

Political Science: Offered by the Department of Political Science at Rutgers-Newark. Hill Hall (973/353-5105)

UNDERGRADUATE COURSES:

R790:201 - American National Government (3)
For more details go to Rutgers Catalog.

R790:304 - Introduction to Law and Legal Research (3)
For more details go to Rutgers Catalog.

R790:310 - Science, Technology, and Public Policy (3)
For more details go to Rutgers Catalog.

R790:321 - World Politics (3)
For more details go to Rutgers Catalog.

R790:330 - Eastern European Governments and Politics (3)
For more details go to Rutgers Catalog.

R790:334 - International Relations of the Middle East (3)
For more details go to Rutgers Catalog.

R790:338 - Political Economy of Government-Business Relations (3)
For more details go to Rutgers Catalog.

R790:356 - Sex, Law, and Public Policy (3)
For more details go to Rutgers Catalog.

R790:360 - Urban Politics and Public Policy (3)
For more details go to Rutgers Catalog.

R790:367 - Jurisprudence and Legal Theory (3)
For more details go to Rutgers Catalog.

R790:371 - Early Political Theory (3)
For more details go to Rutgers Catalog.

R790:372 - Modern Political Theory (3)
For more details go to Rutgers Catalog.

R790:377 - Ideology and Politics (3)
For more details go to Rutgers Catalog.

R790:387 - International Law (3)
For more details go to Rutgers Catalog.

R790:395 - Contemporary American Foreign Policy (3)
For more details go to Rutgers Catalog.

R790:417 - Problems in International Relations (3)
For more details go to Rutgers Catalog.

R790:435 - The American Presidency (3)

For more details go to Rutgers Catalog.

R790:436 - Legislatures and the Legislative Process (3)
For more details go to Rutgers Catalog.

R790:441 - Civil Liberties (3)
For more details go to Rutgers Catalog.

Psychology: Offered by the Department of Psychology at Rutgers-Newark

UNDERGRADUATE COURSES:

R62:830 - Cognitive Science II (3)
For more details go to Rutgers Catalog. (Archived Versions)

R62:830 - Cognitive Science I (3)
For more details go to Rutgers Catalog. (Archived Versions)

R830:301 - Empirical Methods in Psychology (4,4)
For more details go to Rutgers Catalog.

R830:335 - Social Psychology (3)
For more details go to Rutgers Catalog.

R830:372 - Perception (3)
For more details go to Rutgers Catalog.

Science, Technology and Society :

Offered by the Department of Humanities. See Humanities course list for faculty.

UNDERGRADUATE COURSES:

STS 100 - Social Science and CSLA Research (3-0-3)
This course introduces the content and methodologies of CSLA disciplines, provides examples of research problems through the lens of the social sciences and gives students an understanding of each major and an overview of the social, historical, and ethical influences on contemporary sciences, and the changing relationships among science, technology and culture. Each week CSLA researchers lecture on applied approaches to problem solving in their domains. **Effective From: Fall 2010**

STS 101 - Foundations of Science, Technology and Society (3-0-3)
Prerequisite: None. This course introduces students to the multi-disciplinary study of science, technology and society. Through a combination of lectures by the STS teaching staff and external speakers, as well as classic and contemporary readings and case studies that exemplify the field's core content, students examine the social, aesthetic, environmental, economic and political constructs that contextualize the development and proliferation of mechanical and digital technologies with which we interact. **Effective From: Spring 2009**

STS 201 - Understanding Technological Society (3-0-3)
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. **Effective From: Spring 2012**

STS 210 - General Psychology (3-0-3)
Prerequisites: HUM 102 and STS 201 with a grade of C or better. 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. **Effective From: Spring 2012**

STS 221 - Sociology (3-0-3)
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, state), social processes (conflicts and harmony, cohesion and dissolution, power, authority, and revolution), urbanization, industrialization, and technological change. **Effective From: Spring 2013**

STS 257 - Technology, Society and Culture: An American View (3-0-3)
Prerequisite: None. 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? **Effective From: Spring 2009**

STS 258 - Technology, Society and Culture: A Global View (3-0-3)
Prerequisite: None. 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 others 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? **Effective From: Spring 2009**

STS 300 - Legal Reasoning, Writing, and Technology (3-0-3)
Prerequisite: HUM 101. 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. **Effective From: Summer 2011**

STS 301 - Independent Study (1 credit)
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. **Effective From: Spring 2009**

STS 302 - Independent Study (2 credits)
Prerequisites: junior standing in the STS program and written approval of the program director. See STS 301. **Effective From: Spring 2009**

STS 303 - Independent Study (3 credits)
Prerequisites: junior standing in the STS program and written approval of the program director. See STS 301 **Effective From: Spring 2009**

STS 304 - Writing about Science, Technology and Society (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. Develop abilities to write lucidly and speak forcefully about the interrelationship of science, technology and society. Learn to articulate a sense of purpose in order to choose the appropriate methods for reporting issues in a technological society. Effective development and transfer of technical knowledge in a complex world. **Effective From: Spring 2009**

STS 305 - Engineers in Society (2-1-2)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. Corequisite: CoE 394 with a grade of C or better. For students majoring in computer engineering. The professional aspects of an engineering career. Topics include ethics and responsibility, the role of the professional society, the importance of communication, and the realities of the workplace. Certain writing projects are correlated with the linked lab CoE 394. Field studies of working engineers are conducted by student teams. Co-listed as CoE 301. **Effective From: Spring 2009**

STS 306 - American Mosaic: Understanding Cultural Diversity (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

STS 307 - Fundamentals of Research in STS (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. Focuses on research methods in the field of science, technology and society. Focuses on the following methods: problem statement and hypothesis formulation; research design in science, technology and society; data sources; and data acquisition and analysis. **Effective From: Spring 2009**

STS 308** - Technology and Global Development: Introduction to STS (3-0-3)**
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. Introduces the important public issues that technology brings to the modern world, such as energy development and environmental pollution. Emphasizes the close connections between science and technology, social institutions, and cultural values. Also analyzes today's "global village", the changing relations between East and West and the Third World, and worldwide development and environmental issues. **Effective From: Spring 2009**

STS 309 - Advocacy and the Law (3-0-3)
Prerequisites: Eng 300, SS 300 both with a grade of C or better. 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. **Effective From: Spring 2009**

STS 310** - Technology and Human Values (3-0-3)**
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

STS 311 - Co-op Work Experience I (3 credits)

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 **Effective From: Spring 2013**

STS 312** - Technology and Policy in Contemporary America (3-0-3)**
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

STS 313** - Environmental History and Policy (3-0-3)**
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

STS 316 - Mass Communications, Technology and Culture (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

STS 318 - Educational Media Design (3-0-3)
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 IT 380. **Effective From: Fall 2009**

STS 320 - Global Evolution of Scientific Thought I: Case Studies from Antiquity through the 19th Century (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. Traces the global development of scientific ways of thinking and demonstrates how scientific ideas, methods, and theories both reflect and influence thought in other areas. Special emphasis is on the biographical approach to scientific innovation through analysis of key figures in relation to the societies in which they lived. Attention is paid to the roles of class and gender in scientific practice. Begins with the study of science in the ancient nations of Babylonia, China, and India and ends with an examination of the rise of scientific approaches to social problems in the nineteenth century. **Effective From: Spring 2009**

STS 321 - Global Evolution of Scientific Thought II: 20th-Century Case Studies (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. A continuation of STS 320, traces the global development of scientific ways of thinking and demonstrates how scientific ideas, methods, and theories both reflect and influence thought in other areas. Begins with the study of Einstein, continues with an analysis of United States and Soviet relations during the Cold War, and concludes with an examination of trends in today's global scientific community. **Effective From: Spring 2009**

STS 325-329 - Special Topics in Science, Technology and Society (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. An in-depth examination of a current STS issue. A new topic is addressed each time the course is offered. **Effective From: Spring 2009**

STS 330 - The Professional Engineer: History and Context (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. An examination of the origins of modern engineering and the context in which engineering has developed. The course includes an analysis of the contemporary engineering culture?its structure and the values which drive it. The student will be expected to confront both the constraints and opportunities presented by the professional world of engineering. **Effective From: Spring 2009**

STS 331 - Teaching in Urban Schools (3-0-3)

This course introduces students to critical issues of teaching in urban schools. Readings and seminar discussions will focus on: the urban setting, children's lives in the inner city, urban schools, teachers' experiences in urban schools, the classroom, the curriculum, culturally responsive pedagogy, special education in the urban context, bilingual education, immigrant children in American schools, and Newark as an example of some of the topics studied in the course. **Effective From: Fall 2007 Until: Fall 2007**

STS 333 - Science LIteracy and Pedagogy (3-0-3)
This course investigates the principles of scientific literacy for the general public and how it can be achieved. Particular attention is paid to identifying a personal pedagogy, method of teaching, and how this can be capitalized upon to assist others to become more scientifically literate and aware. **Effective From: Fall 2007**

STS 335 - ICT in Secondary Schools (3-0-3)
This course examines the integration of Information and Communication Technology (ICT) into instruction to foster community, collaboration, conceptual development, and exceptional academic performance. The course pays particular attention to present and potential access and academic uses of ICT in under-resourced urban schools with racially, ethnically, and linguistically diverse students whose families tend not to be participants in the US society's culture of power. **Effective From: Fall 2007**

STS 337 - Obstacle to Understanding Science and Technology (3-0-3)
This course examines the scientific disciplines typically taught to primary and secondary school children as part of standards-based education in America. It seeks to identify those factual inaccuracies, misconceptions, and other incorrect notions held by students-up-to and through college. Methods for identifying and overcoming incorrect notions will be presented. **Effective From: Fall 2007**

STS 338 - Paradigm Shifts in Science, Technology and Society (3-0-3)
This course examines how to approach, discuss and debate controversial issues in science and technology in order to facilitate civil discourse and policy-formation in a democratic society. Various types of controversies will be addressed illustrating various aspects of debate and discourse needed to arrive at compromise, understanding, and consensus. Students will learn how to moderate group discussion dealing with current science and technology issues facing society and learn to moderate discussions for themselves and for others. **Effective From: Fall 2007**

STS 339 - Philosophy and Psychology of Race and Gender (3-0-3)
Prerequisites: STS 201 and STS 210, each with a grade of C or better. Course examines the psychological elements of prejudice, with emphasis on racial cognition and gender bias. Topics covered include the history of essentialism about race and gender; implicit bias; stereotype threat; interventions against biased attitudes; and ethics of race and gender bias. Readings from contemporary philosophy and psychology. **Effective From: Spring 2013**

STS 340 - Multiculturalism in a Technological Society (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. Explores the roles of culture and ethnicity in our increasingly technological and global society. The interplay between scientific developments and the specific sociocultural contexts is addressed. Specific case studies from various countries are explored, covering differing levels of technological achievement. Upon completion of the course, students will be able to competently analyze the interaction between a country's scientific development and its political and sociological climate. Special topics are negotiated with students at the start of each class, with the goal of covering all continents and a variety of scientific fields. At least one case study each semester carefully reviews multiculturalism in the American technological culture. Emphasis also is given to the particular roles and responsibilities of the United States as a technological and political leader. **Effective From: Spring 2009**

STS 342 - Women in Technological Culture (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. Takes an interdisciplinary and multicultural approach to issues of gender in science and technology. The issues include the current status and problems of women in non-traditional professions; the historical contributions of women in science and technology; images of women in Western and non-Western cultures; theories of gender difference, past and present; the impact of cultural gender coding on the epistemologies of science and technology; women and Third World development. Course materials include case studies and autobiographical narratives, films, and science fiction as well as historical and sociological analyses. Expressive student writing and group projects are encouraged. **Effective From: Spring 2009**

STS 344 - Communications Policy (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

STS 346 - Pragmatism and Technology (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

STS 347 - Introduction to Music (3-0-3)
Prerequisite: HUM 101 with a grade of C or better. This course is an introduction to the history of music, from ancient to present times, Western, Eastern, folk, world, classical, jazz, rock, and electronic. The class aims to develop in the student an informed and critical ear to make sense of the vast array of music available to our ears today. We also cover how technology has transformed how we experience and create music, from the development of the piano to the computer. The course involves extensive music listening and writing about music. It is a prerequisite for the hands-on electronic music classes that NJIT offeres, STS 349 and STS 325. **Effective From: Fall 2012**

STS 348 - Esthetics and Modern Technology (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. The central focus of this course is on the changing conception of beauty as influenced by technological development, especially in twentieth-century United States society. The course examines how technology is echoed in art and philosophy, and how they, in turn, influence future technological considerations. **Effective From: Spring 2009**

STS 349 - Advanced Music Technology (3-0-3)
Prerequisite: STS 347. 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 home computer. Computer requirements: A PC or Macintosh system running Ableton Live. **Effective From: Spring 2009**

STS 350 - Computers and Society (3-0-3)
Prerequisites: HUM 101, one SS course, completion of a 100-level GUR course in CS, all with a grade of C or better. Examines the historical evolution of computer and information systems and explores their implications in the home, business, government, medicine, and education. Topics include auto-mation and job impact, privacy, and legal and ethical issues. **Effective From: Spring 2009**

STS 351 - Minds and Machines (3-0-3)
Prerequisites: STS 201 and STS 210, each with a grade of C or better. 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. **Effective From: Spring 2013**

STS 358 - Moral Psychology (3-0-3)
Prerequisites: STS 201 and STS 210 each with a grade of C or better. An introduction to moral philosophy with emphasis on the biological and psychological mechanisms underlying moral thought, judgment an 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. **Effective From: Spring 2013**

STS 359 - Cyberpsychology (3-0-3)
Prerequisites: Hum 102 with a grade of C or better and STS 201 or STS 210 or equivalent with a grade of C or better. 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, online gender-switching, etc. **Effective From: Spring 2012**

STS 360** - Ethics and the Environment (3-0-3)**
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

STS 362** - Environmental Economics (3-0-3)**
Prerequisites: HUM 101, EPS 202, Econ 201 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2009**

STS 363 - Introduction to Sustainability Studies (3-0-3)
Prerequisites: STS 201 and EPS 202, each with a grade of C or better. 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. **Effective From: Spring 2013**

STS 364 - Sustainability Policy and Practice (3-0-3)
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. **Effective From: Spring 2013**

STS 378 - Literature and Nature (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

STS 380 - Policy Issues in the Coastal Environment (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

STS 381 - Field Techniques and Research Methods (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

STS 382 - Geographical Perspectives on the Environment (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

STS 411 - Co-op Work Experience II (3 credits)
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 **Effective From: Spring 2013**

STS 490** - Project and Seminar I (3 credits)**
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. **Effective From: Spring 2009**

STS 491** - Project and Seminar II (3 credits)**
Prerequisite: STS 490. A continuation of STS 490. **Effective From: Spring 2009**

**** Special Honors sections are available; permission of Honors College or Humanities Department required.

Social Science and Policy Studies: Offered by the Department of Chemistry and Environmental Science. See Humanities and Social Sciences course list for faculty

UNDERGRADUATE COURSES:

SS 201 - Economics (3-0-3)
Prerequisites: HSS 101, HSS 202 or their equivalents. The nature of a market economy. Microeconomics?demand theory, production possibilities, cost and price, equilibrium anal-ysis, 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 SS 201. **Effective Until: Summer 2009**

SS 201H - Honors Economics (3-0-3)
Prerequisite: enrolled in the Honors College or permission of the instructor. Covers the material in SS 201, but topics are treated more comprehensively and in greater depth.

SS 300 - Basic Principles of Law and the Judicial System (3-0-3)
Prerequisites: HUM 101, HSS 202 or their equivalents, two from HSS 211, HSS 212, HSS 213 or their equivalents. Explores controversial legal issues focusing upon fundamental principles of law that have evolved in such bodies of law as contract, tort, criminal real and intellectual property, and in specialized areas such as environmental and labor/business law. Covers implementation of law in the judicial system, which includes examination of administrative regulations and due process. **Effective From: Summer 2011**

SS 318 - International Economic Policy (3-0-3)
Prerequisites: HUM 101, HSS 202, SS 201 or their equivalents. Examines the increasing effects international economic affairs have on our lives; the choices economic policy analysts must make; the economic policies that promote or restrain trade; and causes of economic growth or decline. **Effective From: Summer 2011**

SS 338 - Issues in Public Policy (3-0-3)
Prerequisites: HSS 101, HSS 202, SS 201 or equivalents. A survey of key social and political issues within a public policy perspective. Topics covered include policy problems with an emphasis on economics, urban and regional planning, sociology-psychology, natural science or engineering, and problems with a political science emphasis.

SS 343 - Rise of Modern Diplomacy (3-0-3)
Examines the origins and mechanisms of modern diplomacy and their historic connection with the state. Topics include resident embassies, the development of diplomatic procedures and conventions, international law, diplomatic theory, and the relationship between diplomacy and war.

SS 351 - International Relations (3-0-3)
Prerequisites: HUM 101, HSS 202, SS 201 or equivalents. Analysis of the factors affecting relations among nations. Emphasis on the growing interdependence of the world system. Examination of international agencies, such as the United Nations, the World Bank, and the International Monetary Fund. International political and economic conflict. Patterns of power, and the roles of diplomacy, war, and international terror. Attempts to ameliorate conflicts among nations. **Effective From: Summer 2011**

SS 352 - Race and Ethnicity: Contemporary Issues (3-0-3)
Prerequisites: HUM 101, HSS 202, SS 201 or their equivalents. 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. **Effective From: Summer 2011**

SS 362 - Environmental Economics (3-0-3)
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. Co-listed as STS 362. **Effective From: Summer 2011**

SS 362H - Honors Environmental Economics (3-0-3)
Prerequisites: admission to the Honors College or permission of the instructor. An honors course parallel to SS 362. Co-listed as STS 362H.

SS 363 - Natural Resources Economics (3-0-3)
Prerequisites: HUM 101, HSS 202, SS 201 or equivalents. Natural resource economics is concerned with supply and demand, theory, pricing under various market conditions, the commodity aspects of exchange and the effects of government intervention on depletion and profits. Case studies and examples of natural resource usage will be demonstrated; also substitution and recycling strategies will be examined **Effective From: Summer 2011**

Sociology: Offered by the Department of Sociology and Anthropology at Rutgers-Newark. See Anthropology course list for faculty.

UNDERGRADUATE COURSES:

R920:201 - Sociology I: Contemporary Society (3)
For more details go to Rutgers Catalog.

R920:208 - Social Problems (3)
For more details go to Rutgers Catalog.

R920:301 - Introduction to Social Research I, II (4,4)
For more details go to Rutgers Catalog.

R920:306 - Marriage and the Family (3)
For more details go to Rutgers Catalog.

R920:308 - Social Movements (3)
For more details go to Rutgers Catalog.

R920:314 - Sociology of Organizations (3)
For more details go to Rutgers Catalog.

R920:315 - Self and Society (3)
For more details go to Rutgers Catalog.

R920:332 - Social Stratification (3)
For more details go to Rutgers Catalog.

R920:337 - Sociology of Sex and Roles (3)
For more details go to Rutgers Catalog.

R920:345 - Sociology of Education (3)
For more details go to Rutgers Catalog.

R920:375 - Sociology of Development (3)
For more details go to Rutgers Catalog.

R920:386 - Sociology of Science (3)
For more details go to Rutgers Catalog.

R920:409 - Classical Sociological Theory (3)
For more details go to Rutgers Catalog.

R920:415 - Contemporary Sociological Theory (3)
For more details go to Rutgers Catalog.

Spanish: Offered by the Department of Classical and Modern Languages and Literatures at Rutgers-Newark. See Classics course list for faculty.

UNDERGRADUATE COURSES:

R940:311 - Spanish Literature in English Translation (3,3)
For more details go to Rutgers Catalog.

R940:341 - Hispanic Civilization (3,3)
For more details go to Rutgers Catalog.

R940:343 - Latin American Literature in English Translation (3,3)
For more details go to Rutgers Catalog.

R940:383 - Ibero-American Thought in English Translation (3,3)
For more details go to Rutgers Catalog.

R940:421 - Spanish Theater of the Golden Age (3)
For more details go to Rutgers Catalog.

R940:452 - Twentieth-Century Spanish Literature: Contemporary Spanish Poetry and Prose (3)
For more details go to Rutgers Catalog.

R940:462 - Spanish-American Literature: Twentieth-Century Poetry and Prose (3)
For more details go to Rutgers Catalog.

Support Courses: Offered by the Office of the Dean, Freshman Studies

UNDERGRADUATE COURSES:

Tutr 089 - Freshman Tutorial I (1-0-0)
Prerequisite: special permission. For first-semester freshmen. Develop appropriate study skills that will lead to success at NJIT. Pays particular attention to problem solving, study skills, abstract and cognitive skills development, using a collaborative learning approach.

Tutr 090 - Freshman Tutorial II (1-0-0)
Prerequisite: Tutr 089. A continuation of Tutr 089. Further enhances student's skills through evaluation of current study habits and reinforcement of collaborative learning techniques that prepare students for successful completion of coursework.

Theatre Arts and Technology: Offered by the Department of Humanities and the Department of Arts, Culture and Media at Rutgers-Newark. See Humanities course list for NJIT faculty. See Art course list for Rutgers-Newark faculty.

UNDERGRADUATE COURSES:

Rutgers Theatre - Courses Offered Through NJIT/Rutgers cross registration (null)
Rutgers Catalog. **Effective From: Fall 2012**

Thtr 101 - Living Theatre (3-0-3)
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. **Effective From: Spring 2011**

Thtr 102 - Acting Fundamentals (3-0-3)
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. **Effective From: Spring 2011**

Thtr 208 - Movement for Theatre (3-0-3)
Prerequisites: HUM 101, 102, and Cultural History (select from HUM 211, 212 or Hist 213). 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 basedon the cultural history of the times the plays were written or the historical period they represent. **Effective From: Spring 2011**

Thtr 209 - Voice and Speech for Theatre I (3-0-3)
Prerequisites: HUM 101, 102, and Cultural History (select from Hum 211, 212 or Hist 213). 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. **Effective From: Spring 2011**

Thtr 210 - Voice and Speech for Theatre II (3-0-3)
Working with plays, poetry, and narratives, students learn to analyze texts vocally and to explore the relationship between physical and vocal expression. **Effective From: Spring 2011**

Thtr 212 - From Page to Stage (3-0-3)
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. **Effective From: Spring 2011**

Thtr 213 - Directing I (3-0-3)
Prerequisites: HUM 101, 102, and Cultural History (select from HUM 211, 212, or Hist 213). 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. **Effective From: Spring 2011**

Thtr 215 - Acting II (3-0-3)
Prerequisite: Thtr 102 or permission of instructor. 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. **Effective From: Spring 2011**

Thtr 216 - Improvisational Theatre Short Form (3-0-3)
Prerequisites: Hum 102 and Cultural History (select from HUM 211, 212 or HIST 213). 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. **Effective From: Spring 2013**

Thtr 217 - Improvisational Theatre Long Form (3-0-3)
Prerequisites: Hum 102 and cultural History (select from Hum 211, 212 or Hist 213). 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. **Effective From: Spring 2013**

Thtr 261 - Performance I (3-0-3)
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. **Effective From: Spring 2011**

Thtr 262 - Performance II (3-0-3)
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. **Effective From: Spring 2011**

Thtr 310 - Theatre History I (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2010**

Thtr 311 - Living Theater (3-0-3)
Prerequisites: EPS 202 or its equivalent with a grade of C or better; two from among HUM 102, HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. Elements of stage presentation: acting, design, theater history, and lighting and other technologies using the resources of the NJIT and Rutgers-Newark theaters. **Effective From: Spring 2009 Until: Fall 2010**

Thtr 312 - Movement for Theatre (3-0-3)
Prerequisites: HUM 101, 102, and Cultural History (select from HUM 211, 212 or Hist 213). 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 basedon the cultural history of the times the plays were written or the historical period they represent. **Effective Until: Fall 2010**

Thtr 313 - Voice and Speech for Theater I (3-0-3)
Prerequisites: HUM 101, 102, and Cultural History (select from Hum 211, 212 or Hist 213). 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. **Effective Until: Fall 2010**

Thtr 315 - Theatre History II (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2011**

Thtr 317 - Directing (3-0-3)
Prerequisites: HUM 101, 102, and Cultural History (select from HUM 211, 212, or Hist 213). 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. **Effective Until: Fall 2010**

Thtr 325 - Special Topics in Theater (3-0-3)
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. **Effective From: Spring 2010 Until: Fall 2010**

Thtr 344 - American Musical Theater (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. EPS 202 or its equivalent with a grade of C or better. 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. **Effective From: Spring 2009**

Thtr 350 - Principles of Playwriting (3-0-3)
Prerequisites: HUM 101, 102, and Cultural History (select from HUM 211, 212, or 213). 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 exercies. The original plays developed in class will be submitted by the student for playwriting competitions at the end of the semester. **Effective Until: Fall 2010**

Thtr 365 - Principles of Playwriting (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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 exercies. The original plays developed in class will be submitted by the student for playwriting competitions at the end of the semester. **Effective From: Spring 2011**

Thtr 396 - Internship-Theater (3-0-3)
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. **Effective From: Fall 2011**

Thtr 411 - Special Topics in Theatre (3-0-3)
Prerequisites: HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2011**

Thtr 414 - Directing II (3-0-3)
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. **Effective From: Spring 2011**

Thtr 465 - Performance II (3-0-3)
Prerequisites: Thtr 261 or Thtr 262 and HUM 102 and one from among HUM 211, HUM 212 and Hist 213 or their equivalents, all with a grade of C or better. 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. **Effective From: Spring 2011**

Thtr 483 - Independent Study in Theater I (3-0-3)
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. **Effective From: Fall 2011**

Thtr 484 - Independent Study in Theater II (3-0-3)
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. **Effective From: Fall 2011**

Theatre Arts: Offered by the Department of Art, Culture and Media at Rutgers-Newark and the Department of Humanities. See Art course list for Rutgers-Newark faculty. See Humanities course list for Rutgers-Newark faculty.

UNDERGRADUATE COURSES:

R950:271 - Voice and Articulation (3,3)
For more details go to Rutgers Catalog.

R950:289 - Principles of Oral Interpretation (3,3)
For more details go to Rutgers Catalog.

R965:202 - Journalism and Communications Media (3)
For more details go to Rutgers Catalog.

R965:261 - Dramatic Invention (3,3)
For more details go to Rutgers Catalog.

R965:271 - Acting Fundamentals (3)
For more details go to Rutgers Catalog.

R965:313 - Theater Technology I (3)
For more details go to Rutgers Catalog.

R965:314 - Scenic Art for Theater and Television (3)
For more details go to Rutgers Catalog.

R965:315 - Intermediate Acting (3)
For more details go to Rutgers Catalog.

R965:394 - Internship?Television (3)
For more details go to Rutgers Catalog.

R965:395 - Internship: Radio (3)
For more details go to Rutgers Catalog.

R965:396 - Internship: Theater (3)
For more details go to Rutgers Catalog.

R965:397 - Internship: Film (3)
For more details go to Rutgers Catalog.

R965:410 - Theory and Practice of Video Art (3)
For more details go to Rutgers Catalog.

R965:413 - Directing (3,3)
For more details go to Rutgers Catalog.

R965:415 - Problems in Performance Styles (3)
For more details go to Rutgers Catalog.

R965:417 - Problems in Theatrical Design (3,3)
For more details go to Rutgers Catalog.

R965:419 - Production Laboratory (3,3)
For more details go to Rutgers Catalog.

R965:433 - Advanced Television Production (4)
For more details go to Rutgers Catalog.

R965:434 - Advanced Television Production (3)
For more details go to Rutgers Catalog.

R965:440 - Topics in Television (3,3)
For more details go to Rutgers Catalog.

R965:442 - Corporate and Instructional Television (3)
For more details go to Rutgers Catalog.

R965:451 - American Theater (3)
For more details go to Rutgers Catalog.

R965:453 - Traditional Theaters of Asia (3)
For more details go to Rutgers Catalog.

R965:481 - Seminar in Theater Art and History (3,3)
For more details go to Rutgers Catalog.