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New Jersey Institute of Technology, Undergraduate Catalog, 1985-1987

New Jersey Institute of Technology

UNDERGRADUATE CATALOG 1985-1987

New Jersey Institute of Technology

The Technological University of New Jersey

Contents

The educational process necessitates change. Each step of the educational process, from admission through graduation, requires continuing review and appropriate approval by Institute officials. This catalog represents a flexible program of the current curriculums, educational plans, offerings, and requirements which may be altered from time to time to carry out the purposes and objectives of the Institute. The provisions of this catalog do not constitute an offer for a contract which may be accepted by students through registration and enrollment in the Institute. The Institute reserves the right to change any provision, offering, or requirement at any time within the student's period of study at NJIT. The Institute further reserves the right to require a student to withdraw from the Institute for cause at any time.

Tradition and Change

New Jersey Institute of Technology has entered its second century as the largest technological university in the metropolitan area, with more than 7,000 students enrolled in degree programs from the baccalaureate through the doctorate and a total of 11,000 students attending courses ranging from pre-college to postgraduate continuing professional studies.

NJIT's traditions of service date back to 1881, when Newark Technical School was founded to provide an academic background for the apprentices of a growing industrial center. Keeping pace with the developing urban region, the school began offering bachelor's degrees in engineering in 1919, and subsequently changed its name to Newark College of Engineering. After World War II, the school expanded rapidly, reflecting the increasingly sophisticated technological base of our society. Graduate programs in engineering were introduced, and the school began a program of physical expansion.

In 1968, the school began to diversify its academic offerings. New programs were developed in science, management, engineering technology, and computer science. In 1974 the School of Architecture was opened. Interdisciplinary research centers were developed, devoted to information age technology, the protection and management of air and water resources, and the management of hazardous and toxic wastes. Centers were established for research in computer conferencing and law and technology.

In 1975, the new name, New Jersey Institute of Technology, was selected to reflect a broadened mission.

Education for a Technological Age

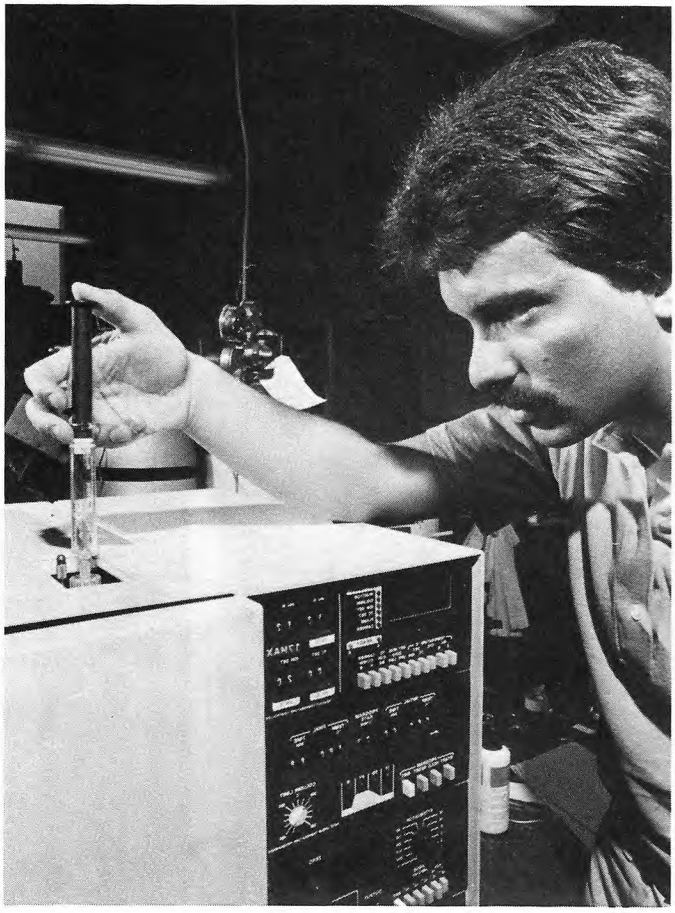
NJIT now offers 14 programs leading to the bachelor's degree. Many feature a variety of elective courses and permit students to develop programs suited to their interests and career objectives. All programs include a mix of courses representing both technology and the liberal arts in order to provide an effective education for today's complex technological society.

Bachelor's degree programs are offered in:

Applied Chemistry
Architecture
Computer Science
Engineering
- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Industrial Engineering
- Mechanical Engineering

Engineering Science
Engineering Technology
Industrial Administration
Man and Technology
Statistics and Actuarial Science
Surveying

You will find full descriptions of these programs on pages 17-33.

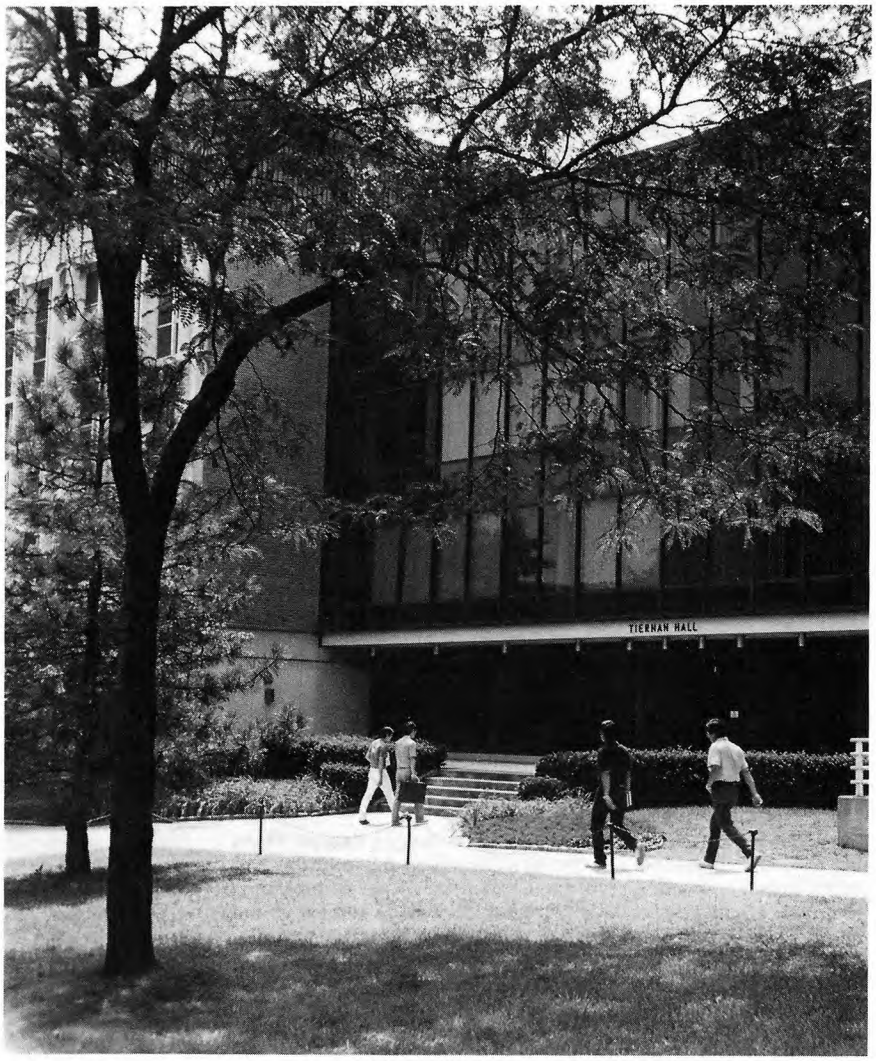


Accreditation

NJIT is accredited by the Middle States Association of Colleges and Schools. The engineering and engineering technology programs are accredited by the Accreditation Board for Engineering and Technology (formerly Engineers Council for Professional Development). The programs in Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering, and Mechanical Engineering are accredited by the Engineering Accreditation Commission, and the options under Engineering Technology are accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology. The architecture program is accredited by the National Architectural Accreditation Board.

Interested students may read the letter from the accrediting bodies in the office of the dean of the appropriate college or school.

The business and administrative offices of the Institute are open between the hours of 8:30 a.m. and 4:30 p.m., Monday through Friday, during the academic year. Summer hours differ and students should contact offices in advance to determine changes.


TIERNAN HALL

The Campus and Student Life

The NJIT Campus

High on a hill overlooking the modern office buildings that make up the Newark and New York City skylines, stands Eberhardt Hall, NJIT's "castle". Once the Newark orphanage, it now houses the Institute's administrative offices. The red brick building was constructed in 1865 and was designated an historic landmark in 1973.

Behind the grace and charm of antiquity stands a campus of sleek contemporary lines, its glass and granite structures punctuated by the treeshaded Campus Green. The campus is located close to NJIT's sister institutions, the Newark campus of Rutgers University, Essex County College, and the University of Medicine and Dentistry of New Jersey.

NJIT is only a few blocks from Route 280 and is easily reached by public transportation from many points in New Jersey, New York, and Pennsylvania.

The oldest of NJIT's original buildings still in use is Colton Hall, built in 1911 and now housing the completely renovated modern studios of the School of Architecture. Next to Colton is Campbell Hall, built in 1926, and its Annex, built in 1930. Rapid growth after World War II led to the construction of Weston Hall, now the home of NJIT's computer center, and Cullimore Hall, a classroom and office building.

In 1966, NJIT's expanded campus was dedicated, increasing the land area from two acres to more than twenty, and the number of buildings from six to eleven. Opened simultaneously were an electrical engineering building, campus and student center, alumni center, operations building, and complete physical education plant including a large gymnasium, swimming pool, specialized sports areas, athletic field, and tennis courts. Subsequent construction included a library/theater building and chemical engineering/chemistry complex. Most recently the campus has been enlarged to thirty-two acres; new facilities include the first campus residence hall in Newark, a 210-bed dormitory, as well as a modern mechanical engineering center. A second residence hall, housing 250 students in a modern high-rise, was completed in 1984.

Computing Center

The Institute provides students and faculty with training in and access to a full range of computers and computer services.

Students may utilize the modern, centralized computing system maintained at the Computing Center as well as mini- and microcomputers housed in various departments. The Institute has an on-campus main-frame computer and acts as the northern node of the New Jersey Educational Computer Network which provides an impressive spectrum of computer capabilities. Remote access to the computing facility is available from terminals located at various sites on campus for on-line timesharing, as well as from non-centralized peripherals for job entry into open batch.

Undergraduate students are encouraged to integrate computer use into their degree programs and many courses are offered at the Institute which provide training in computer use.

A large library of selected applications programs and program preparation facilities has been collected and is available on-line to the computer system for easy ccessing. The staff at the Center can be consulted on the use of the computer acilities and for help in determining appropriate solutions for particular problems.

Library

The Institute's Robert W. Van Houten Library, centrally located on the campus, provides facilities for study, research, and browsing. Approximately 130,000 volumes are available for student use, and 1,350 periodical subscriptions are received. Also on file are many indexing and abstracting services which give access to the literature of engineering, science, management, architecture, and other subject areas.

To supplement the resources of the Institute Library, students have the privilege of borrowing material from the Newark Public Library and the Rutgers-Newark Library as well as the libraries of the other nearby institutions of higher learning. Other libraries in the area, such as those of the Chemists' Club and the Engineering Societies, may be used for reference purposes. Inter-library loan arrangements with more distant institutions are also available.

Memorial gifts from the personal libraries of people formerly associated with the Institute have been received. Foremost among these gifts are books and periodicals from the collections of charter trustee Dr. Edward Weston and State Senator Roy V. Wright. The rare book collection of Dr. Edward Weston is maintained by the Library and is available to scholars and others interested in the history of science and technology.

A Look at Student Life

The extracurricular programs at New Jersey Institute of Technology span a wide range of interests from sports to professional societies to cultural activities.

Intercollegiate sports include baseball, basketball, bowling, fencing, golf, gymnastics, ice hockey, soccer, judo, karate, wrestling, pistol, rifle, skiing, swimming, tennis, volleyball, weight lifting, and team handball, An intramural program includes all sports available at the varsity team level plus sailing, track and field, paddleball, flag football, innertub water polo, badminton, softball, and archery.

There are 20 social fraternities and sororities, most with residential facilities, 15 honor societies, and 12 professional recognition societies. The latter include Tau Alpha Pi, Phi Eta Sigma, and the American Chemical Society, the American Institute of Aeronautics and Astronautics, the Society for Technology, and the Society for the Advancement of Management, to name just a few. There is an active professional society for almost every major field of study offered by the Institute.

The Student Senate administers a wide range of programs through the Activities Council, Publications Council, Class Councils, Interclub Council, Honor Societies Council, and Professional Societies Council. Some of these activities include chess, scuba diving, mountain climbing, ham radio, photography, theater, and radio broadcasting. NJIT's close proximity to New York City allows students to take advantage of the recreational and cultural life of the city. There are frequent distributions of discount tickets to shows, museums, concerts, and sports events. The Motor-sports Club, Outing Club, Ski Club, and Ten Fathoms Club follow their various interests on weekend trips throughout the Northeastern United States.

And there's The Center, where students gather to eat, plan programs and activities, socialize, work on publications, bowl, shoot pool, play chess, or just relax.

NJIT's students learn that academic and nonacademic values go hand in hand, producing graduates who are well educated and self-assured, ready to make a significant contribution to the economic, social, and intellectual life of the nation.

STUDENT SERVICES

The Office of the Dean of Student Services administers and coordinates the activities of the Student Services Division which includes the Counseling Center, the Evening Division, Health Services, Residence Life, Physical Education and Athletics, Placement, and the Campus Center. The office also administers special programs for women, veterans, foreign students, and handicapped students. The office is located on the third floor of Eberhardt Hall, Room 33E.

The following supportive services are available to students. Detailed information may be obtained by contacting the respective directors.

The Center

The Center Information Desk personnel provide information about the campus and community events, public transportation and I.D. cards. In addition to these activities, they sell tickets and parking tokens and provide phone directories. The Center is open Monday through Thursday from 8 a.m. to 7:30 p.m. and Friday from 8 a.m. to 5 p.m.

A wide variety of events, including displays, films and concerts occur in The Center. Downstairs there is a recreation area complete with billiards, common table tennis, bowling and pinball. In addition, there is a photographic laboratory for the use of students who can demonstrate that they know how to use the equipment. Student organization offices and the Bookstore are also located on the lower level.

Two separate food operations are available in The Center. The cafeteria is an Institute-operated dining facility providing breakfasts, lunches and dinners. The Pub, a non-profit corporation, offers moderately priced sandwiches and snacks, and beer and wine, to those 21 years of age and older.

Counseling Center

The Counseling Center, staffed by experienced counselors, is available to any student seeking confidential personal, academic, or career counseling. In addition to the professional counseling staff, a psychiatrist is available for consultation as needed. The Counseling Center also conducts various group workshops, maintains a library of career and graduate school information, and administers supportive testing. Students are welcome to come in and browse through the informational materials or speak with a counselor. Counseling services are also available to evening students who may be experiencing stress from academic, personal, family or employment responsibilities. The Center is on the third floor of Eberhardt Hall, Room 37E, and is open from 8 a.m. to 6:30 p.m. Monday through Thursday and until 5 p.m. on Friday; the phone number is 596-3414.

Stop-In Center

The Stop-In Center, staffed by trained student-counselors, provides on-the-spot information and assistance about all aspects of college life. Peer counselors are prepared to talk with fellow students about any questions or concerns—academic or personal—as well as providing general information. If they are unable to resolve a problem directly, they refer students to the person or office that can. No appointment is necessary and students are invited to stop by (downstairs in the Student Center, Room 124) and become familiar with the staff and services available. The phone number is 596-3422, 3421 and the Stop-In Center is open weekdays from 8 a.m. to 6:30 p.m. (Fridays to 5 p.m.).

Tutoring

A tutoring program is available, both day and evening, to help students understand basic concepts and develop those skills necessary for academic success. The program is designed principally to assist freshmen in their math, physics, reading, writing, and chemistry courses, but some help is available for sophomore and junior level courses. Students who wish to receive tutoring should contact the tutoring coordinator in the Humanities Building, Room 101.

Placement

The Placement Office is designed to assist students and alumni who are seeking or wish to obtain advice about employment. Among the services offered are: providing extensive information and counseling concerning career planning, job opportunities, employer characteristics, and employment trends; scheduling of interviews with em-

ployers visiting the campus; maintaining an active list of full-time employment opportunities for evening students and alumni; compiling a continuous listing of summer and part-time jobs; and conducting appropriate surveys of alumni career progress. It is the function of the placement office to help students achieve career goals consistent with their interests, initiative, and ability.

The Placement Office is located on the 2nd floor of Cullimore Hall (Room 212M) and is open as follows: Tuesday and Wednesday from 8:30 a.m. to 7 p.m.; Monday, Thursday, and Friday from 8:30 a.m. to 4:30 p.m.

RESIDENCE LIFE

On Campus

NJIT provides on campus housing for men and women undergraduate and graduate students. Housing is based on a community concept where much of the responsibility falls on the students. The university provides full-time professional and student staff to promote a good residential experience.

Students may apply for on-campus housing after being accepted for admission. Assignments are guaranteed for one year only. Students given residence for the Fall semester are automatically contracted for the Spring semester. Housing space is allocated on a point system that weighs commuting time and class standing. However, a number of spaces are reserved for new students each year.

Rooms in the Residence Hall I are generally two-person rooms. Each room is equipped with a bed, desk, chair, dresser, closet, and lamp. Students may rent linens and a pillow or provide their own. Students living in Residence Hall I are required to participate in the meal plan.

On July 1, 1984 NJIT opened Residence Hall II to an additional 265 students. The 8-story apartment building accommodates mostly upperclass and graduate students.

To apply for housing, simply check off the housing information block on your NJIT admissions application. After you are accepted, you will receive all the necessary information and forms.

Off Campus

For students who wish to live off campus, the Office of Residence Life maintains a list of available housing. An up-to-date listing can be acquired before the start of any given semester.

SERVICES TO EVENING STUDENTS

The evening staff of the Dean of Student Services Office is available from 5 p.m. to 7 p.m., Monday through Thursday, at the Center desk to provide information and counseling. A complete activity schedule, as well as personal growth programs, are available on weekends and various evenings throughout the year. A monthly newsletter, highlighting special events, important information, and the programs and services that are offered, is mailed to evening students. In addition, the Counseling Center (37E) is open until 6:30 p.m. Monday through Thursday to help adult students facing stress from academic, personal, family or employment responsibilities.

PHYSICAL EDUCATION AND ATHLETICS

The major objectives of the Division of Physical Education and Athletics are to encourage undergraduates to develop individual physical skills that can be utilized throughout life, and to provide a variety of programs that will meet the diverse needs and interests of the NJIT community. These objectives are met by programs of skills instruction, intramural and intercollegiate competition sports clubs and open recreation.

Two semesters of physical education are required as part of all curricula. This requirement, which should be completed in the freshman year, must be met by all students who have registered as full-time undergraduate students for two or more consecutive semesters. This requirement can only be waived by the Director of the Division of Physical Education and Athletics.

DISABLED STUDENTS

The Institute provides the following services to disabled students: counseling services in the Counseling Center for general information and assistance in problem-solving, legal issues, parking and registration; instructional aids, such as the Kurzweill reading machine at the library, available to blind and learning disabled students; and the Mechanical Engineering department's Microlab facility, open to disabled and non-disabled students who wish to make necessary modifications in their labs.

HEALTH AND ACCIDENT INSURANCE

The Institute offers health and accident insurance coverage to students at low cost. International students are required to obtain adequate coverage. Further information may be obtained from the Dean of Students.

HEALTH SERVICES

The Health Services Office is located on the second floor of the Entwisle Physical Education Building and is charged with the responsibility of providing a comprehensive Health Service Program for the NJIT community.

Professional medical services are available by the following:

Registered Nurse, Ext. 3622, between 8 a.m. and 4 p.m. weekdays.

Physician consultations on and off campus by arrangement through Health Services.

Emergency Medical Technician, Ext. 3622, between 8 a.m. and 9 p.m. weekdays.

Public Safety, Ext. 3115, between 9 p.m. and 8 a.m. weekdays and on 24 hour basis on weekends (restricted to emergency transportation to local hospitals).

Certified Athletic Trainer, Ext. 3636, between 3 p.m. and 9 p.m. (restricted to intercollegiate athletics)

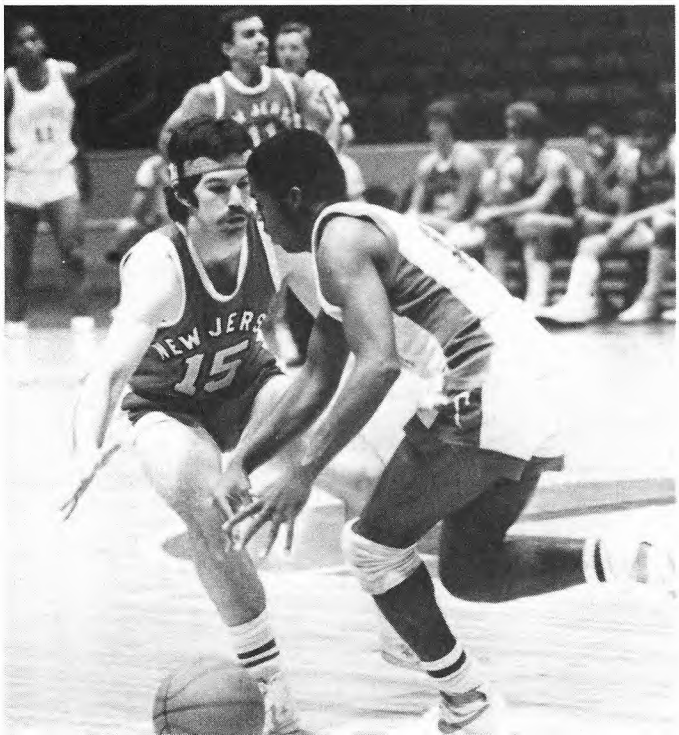
Information about the nature of services rendered can be obtained by contacting the Health Service Office at Ext. 3622, 8 a.m. and 4 p.m. weekdays.

HEALTH STATUS

All new full-time students are required to complete a confidential Health Questionnaire prior to registration. The Institute's insurers may also require a physical examination of those students whose family history indicates a serious current or potential medical condition. Confidential health records are maintained in the health services office.

PROPERTY LOSS

The Institute is not responsible for loss of property by fire or theft in its buildings or grounds.




NJIT
WOMENS

Admissions

Applying to NJIT

If you are considering applying for admission to any of the undergraduate programs at NJIT, you should read the detailed requirements and procedures set out on 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 Institute works closely with New Jersey county colleges and other institutions to facilitate transfer of students.

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

The Institute strongly encourages applicants to visit. The Office of Admissions will be happy to arrange a group interview and student-guided tour for you. Individual interviews can also be arranged.

An interview may be required as we attempt to evaluate your capability to complete a program at NJIT.

For further information contact:
Office of Admissions
New Jersey Institute of Technology
323 Dr. Martin Luther King Jr. Blvd.
Newark, New Jersey 07102
(201) 596-3300

General Admission Requirements

Applied Chemistry Architecture Chemical Engineering Civil Engineering Computer Science Electrical Engineering Engineering Science Industrial Engineering Mechanical Engineering Statistics and Actuarial Science Surveying (open to transfers only at this time)	HIGH SCHOOL REQUIREMENTS At least 16 high school units are required including—English: 4 units/ Mathematics: 3-1/2 units including advanced algebra and trigonometry/ Science: 2 units of laboratory science; physics and chemistry strongly recommended except for architecture where physics and biology are recommended. Other units should be college preparatory courses in social studies, foreign language, mathematics, or science. EXAMINATION REQUIREMENTS All applicants must take both the Scholastic Aptitude Test and the Mathematics Achievement Test (Level I or II) of the College Board. NOTE: Prospective students who have not taken all these units may be considered for admission but may be required to complete preparatory courses in the summer and/or pursue a modified program in the freshman year.
Industrial Administration	Same general requirements as above EXCEPT that high school science units may be in any field and only two high school math units are required. The Mathematics Achievement Test is not required.
Man and Technology	Same general requirements as above EXCEPT that: high school units should include physics or chemistry and only two high school math units are required (three units are preferred). The Mathematics Achievement Test is not required.
Engineering Technology	Applicants must hold an associate degree or its equivalent in an appropriate field of technology from a community college or similar institution. No admissions testing is required.
Industrial Administration	Same general requirements as above EXCEPT that high school science units may be in any field and only two high school math units are required. The Mathematics Achievement Test is not required. NOTE: Transfer applicants should consult page 8 for special admission instructions. Information about these examinations may be obtained from the College Board, Box 592, Princeton, NJ 08540.

Freshman Admissions

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 offered. To apply for admission, you must complete an Application for Undergraduate Admission form and pay a non-refundable application fee of $20. Applicants for the School of Architecture may be requested to submit additional information. Please review the admissions application for further details. Your application will be considered on the basis of your high school record, your performance on College Board examinations, and other pertinent information.

Admission as a Sophomore

A limited number of outstanding incoming high school graduates will be granted credit for the freshman year and will be placed in the sophomore year of study. Decisions are based on outstanding secondary school records, statement of support, test scores, interviews, and college testing.

Early Admittance

Exceptional students who meet the appropriate testing and course requirements for a particular program of a freshman year 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 Admissions.

Advanced Placement

Accepted Students may be awarded credit for freshmen course work in a number of areas by taking the proper courses in secondary school and/or attaining satisfactory scores on appropriate Advanced Placement Examinations. It is possible in some cases for an applicant to receive credit for two semesters in a subject and begin studies in that subject at the sophomore level.

Course Placement

Students enter at many levels of achievement. The credentials of all accepted students are reviewed before specific courses are assigned. The coursework available ranges from the review (refresher) level to honors 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 academic year.

Transfer Admissions

In order to be considered for admission as a transfer student you must submit an Application for Undergraduate Admission and a $20 non-refundable application fee. In addition, the following are required of applicants to the stipulated programs. (Additional details on transcript and testing requirements are found in the instruction sheet which accompanies the Application for Undergraduate Admissions.)

Applied Chemistry, Computer Science, Engineering, Engineering Science, Statistics and Actuarial Science, and Surveying

1. Transcripts of secondary and post-secondary school work.
2. Results of the Scholastic Aptitude Test
3. Results of the Mathematics Achievement Test (Level I or II)

NOTE: Transfer candidates who have completed the equivalent of two or more years of full-time study in the same discipline as the one they plan to enter at NJIT at an accredited U.S. college or university are not required to submit entrance examination results or secondary school records except in cases where it is deemed necessary by the Office of Admissions. Students who have completed two or more semesters of college level calculus at an accredited U.S. college or university are not required to submit Achievement Test results.

Industrial Administration, Man and Technology

Same as above except that the Mathematics Achievement Test (Level I or II) is not required.

Engineering Technology

Candidates for admission to the program leading to the Bachelor of Science degree in Engineering Technology must submit a transcript indicating that they hold an associate degree in technology (A.A.S.) or in the physical or life science technologies. The Institute will consider applicants who are well qualified and have an educational background equivalent to an appropriate associate 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 Technology program. A knowledge of elementary applied calculus is desirable for all options and required for the Electrical and Mechanical Systems options.

Students who apply to the Construction and Contracting 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 Electrical Systems 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 Environmental option must demonstrate successful completion of a two-year program (or an approved equivalent) in a discipline such as: biology, chemistry, or engineering technology.

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 Systems option, must have completed a two-year program (or an approved equivalent) in mechanical technology.

The Scholastic Aptitude Test and the Achievement Tests of the College Board are not required of Engineering Technology applicants.

School of Architecture

1. Transcripts of secondary and post-secondary school work
2. Results of the Scholastic Aptitude Test
3. Results of the Mathematics Achievement Test (Level I or II)

The five-year architecture curriculum consists of a one-year introductory program in design followed by a four-year professional architecture program. Transfer applicants who desire credit for design work are required to submit a portfolio of their work and should follow instructions which may be obtained from the School of Architecture (201) 596-3080.

NOTE: Transfer candidates who have completed the equivalent of two or more years of full-time study in an architecture program are not required to submit entrance examination results or secondary school records except in cases where it is deemed necessary by the Office of Admissions. Students who have completed two or more semesters of college level calculus are not required to submit achievement test results.

Foreign Student Admissions

Foreign students and others whose native language is not English may be required to submit their results from the Test of English as a Foreign Language (TOEFL) examination and may also be required to take a course in English as a Second Language.

Students who wish to receive transfer credit for coursework completed in a country other than the United States are required to submit their credentials to World Education Services, Inc. at P.O. Box 745, Old Chelsea Station, New York, New York 10011 or a similar agency in order to have their previously completed course work evaluated. Evaluation by such agencies provides information which can be used by members of the Institute faculty as they decide on the transferrability of courses. The cost for evaluations of foreign records is borne by the student. Further details are included with the Application for Admission.

All students who will maintain F-1 (student) visa status while attending New Jersey Institute of Technology must submit a Confidential Statement and Confirmation of Finances form as part of their application. This form is included with the application sent to such students.

No Form I-20 will be issued to students who have gained F-1 (student) status via another institution until one year has been completed at that institution, unless the program attended was designed solely to increase a student's proficiency in the English language.

Non-Matriculated Students

Academically qualified students who do not desire to enter degree programs may enroll for credit in certain individual 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 of $20 is required for each semester in which a student registers.

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.

Non-matriculated students who are approved for enrollment will be permitted to register for courses only if room is available after all degree candidates have completed their registration. Contact the Office of Admissions for more information.

Credit by Examination

Accepted candidates may be granted credit for advanced departmental courses by successfully passing a departmental examination to demonstrate proficiency in a subject area. Interested candidates should contact the Counseling Center for further information.

Credit by Transfer

Credit may be given for completed courses which are equivalent to those in the NJIT curriculum for which a student has been accepted and in which final grades higher than the lowest passing grade have been earned.

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: (201) 596-3414.

Tuition, Fees and Financial Aid

New Jersey Institute of Technology reserves the right to revise its charges for tuition and fees and to establish fees as may be required by increased educational costs. Tuition includes charges for services other than instruction, such as library, publications, counseling, placement, etc., but does not cover the cost of damage to or loss of Institute property.

Fees provide funds for the operation of Health Services, Students Services and Activities, inter-collegiate athletics, and various facilities and services.

TUITION

As of September 1984 the charges for tuition and fees for undergraduate programs are as follows:

	N.J. Resident	Non Resident
Full-time	$898/semester	$1796/semester
Part-time	65/credit	130/credit

NOTES: 1. Part time = 1-11 credits per semester. Full time = 12-18 credits per semester. Above 18 credits: each credit is paid for in addition to the full-time tuition rate and is charged at the part-time rate.
2. Requirements for residency are defined in NJAC 9:14.1 et seq. Applications for New Jersey resident status are available in the Office of the Registrar. Final determination of a student's resident status will be made by the registrar.

FEES

Fees are based on the number of credits for which a student is registered according to the following schedule:

12 or more credits	$220
9-11 credits	159
6-8 credits	116
3-5 credits	78
1-2 credits	44

NOTE: Students holding F-1 visas are charged an additional $15 for mandatory insurance.

APPLICATION, MATRICULATION, AND SPECIAL FEES

Admission Application Fee

Applications for admission must be accompanied by a non-refundable fee of $20. This fee contributes to the cost of evaluating and processing applications.

Insurance

The Institute has compulsory accident insurance for all full-time undergraduate students and accident and major medical insurance for all foreign students. The cost of this is included in the full-time fee. Non-mandatory insurance is available to all who wish to purchase it. Application should be made to the Bursar's office.

Late Payment Fee

Students may be charged a late payment fee of $35 if they do not pay all tuition and fee charges by the deadline noted in the payment instructions.

Late Registration Fee

Registration is required for each semester. A late registration fee of $35 is required of those who register late.

Maintaining Registration Fee

Students enrolled in degree programs who find it necessary to discontinue their studies temporarily must maintain their registration by paying a $10 fee each semester. Students maintaining their registration will not be required to reapply for admission and will be allowed to register in advance.

Readmission Application Fee

Applications for readmission must be accompanied by a non-refundable fee of $20. This fee contributes to the cost of evaluating and processing applications.

Schedule Change Fee

A schedule change fee of $10 is charged when students change their schedule after the beginning of a semester.

Special Examination Fee

For special examinations, taken at times other than those regularly scheduled, a fee of $5 is charged.

REFUND OF FEES

Fees are not refundable.

REFUND OF TUITION

Students who notify the Institute in writing of their withdrawal will be eligible for a refund of tuition based upon the following schedule.

During the first week of the semester	80%
During the second week	80%
During the third week	60%
During the fourth week	40%
During the fifth week	20%
During the remainder of session	0%

The calculation of refunds will be based upon the date of receipt of a written notification of withdrawal.

Book Purchases

Students are advised to defer purchase of books until the official list of text books has been posted at the Institute Bookstore.

Financial Aid

The Office of Financial Aid provides counseling and administers loans, scholarships, grants, and part-time employment to qualified students. Federal and State Programs, private, industrial, and university resources are utilized to support the Institute's financial aid programs. Approximately 75% of the full-time students receive some sort of financial assistance.

A pamphlet giving complete information on State, Federal, and Institute financial aid is available. The pamphlet describes the various forms of aid and lists donors and other sources of scholarship funds.

ALUMNI ASSOCIATION OF NJIT SCHOLARSHIPS

The Alumni Association of NJIT annually awards the following scholarships and grants.

Alex C. Becker Memorial Scholarship
An award of $500 is given annually. To be eligible, students must have high scholastic standing and demonstrate financial need.

Class of 1943 Scholarship
One scholarship for $250 is awarded annually. Student must be an undergraduate, demonstrate financial need, and have high academic standing.

Colton Memorial Scholarship
One full tuition scholarship is given annually in memory of Dr. Charles A. Colton, founder and first director of the Newark Technical School. It is given each year to an incoming freshman based upon academic achievement and financial need.

Allan R. Cullimore Memorial Scholarships
Several full and half tuition awards are made annually in memory of Dr. Allan R. Cullimore, former president of Newark College of Engineering. The scholarship must be awarded to students enrolled within one of the divisions of NJIT that existed prior to 1972. The awards are based upon academic merit (minimum cumulative GPA of 2.8 or higher) and financial need. The first full tuition scholarship is awarded annually to a junior who has earned the highest GPA during his/her first six semesters of engineering studies at NJIT.

Arthur D'Espies Memorial Scholarships
Several awards are given annually in memory of Arthur D'Espies, Class of 1905. To be eligible, students must demonstrate an interest in welding, high academic achievement, and financial need. Application is to be made during the sophomore year for the junior year with possible reapplication for the senior year.

Drexler Foundation Scholarships
Several awards are made available annually by the Drexler Foundation to students majoring in electrical engineering. Preference is given to advanced electrical engineering students working in the Drexler Research Laboratory. The award is based upon academic merit and may be given to undergraduate or graduate students. Dr. Jerome Drexler, Class of 1955, is president of the Foundation.

John M. Hague Memorial Scholarships
Several full and half tuition awards are given annually in memory of John M. Hague, Class of 1935. To be eligible, students must have high scholastic standing and demonstrate financial need.

Clifton J. Keating Memorial Scholarship
One full tuition scholarship is given annually in memory of Clifton J. Keating, Class of 1928. The award is based upon academic excellence. To be eligible, incoming freshmen must rank in the top 20% of their high school class; students currently attending NJIT must have a minimum cumulative GPA of 3.0.

Jane Tulley-Kelcey Memorial Scholarship
One full tuition scholarship is given annually in honor of Jane Tulley-Kelcey, a friend of NJIT. The award is based upon academic achievement and financial need.

Elson T. Killam Scholarships
Several full and half tuition awards are made available annually by Elson T. Killam Associates, Inc. First preference provides scholarship assistance to children of employees of Killam Associates, regardless of major. If no such candidate exists, selection will be restricted to undergraduates majoring in the Department of Civil and Environmental Engineering, preferably with an interest in sanitary engineering.

Steven M. Loeb Memorial Scholarship
An annual award is made in memory of Steven M. Loeb, Classes of 1972 (BSCE) and 1973 (MSCE). The scholarship provides assistance to undergraduates majoring in civil engineering, preferably with an interest in transportation engineering. Selection is based upon academic merit and the recipient is nominated by the Department of Civil and Environmental Engineering. Students shall be nominated for the award by the Department faculty during their junior year and the scholarship will be awarded during the senior year.

Marcus Mainardi Memorial Scholarship
One full scholarship is given annually in memory of Marcus N. Mainardi, Class of 1935. The award is based upon academic excellence. To be eligible, incoming freshmen must rank in the top 20% of their high school class; students currently attending NJIT must have a minimum cumulative GPA of 3.0.

Samuel and Anna Miller Scholarship
This award is given annually. First preference is given to minority students currently living in Newark, New Jersey and majoring in Mechanical Engineering. If no such candidate exists, preference will be given to students majoring in other engineering disciplines.

Samuel W. Niedorf Scholarship
One scholarship is made available annually through the Niedorf Scholarship Fund, established by Samuel W. Niedorf, Class of 1937. The award is based on financial need and academic excellence.

William J. Opdyke Memorial Scholarship
One full tuition scholarship is given annually in memory of William J. Opdyke, Class of 1927. The award is based upon academic achievement and financial need.

Richard A. Tartaglia Memorial Scholarship
An annual award is made in memory of Richard A. Tartaglia, Class of 1945. The award covers full tuition and other miscellaneous expenses. To be eligible, students must have high academic achievement and demonstrate financial need. First preference provides assistance to children of employees of Peerless Tube Co., regardless of major. If no such candidate exists, selection will be restricted to students majoring in the Department of Mechanical Engineering. Application can be made prior to entry with possible reapplication for following years.

OTHER ALUMNI ASSOCIATION SCHOLARSHIPS

The Alumni Association Trustees make other annual awards and grants available.

Chemical Engineering and Chemistry Awards
The Department of Chemical Engineering and Chemistry annually awards scholarships and grants to students majoring in chemical engineering. Selections are based on academic excellence and financial need, when funds have been made available by the industrial corporations.

American Cyanamid Co. Scholarships
Annual awards are made by American Cyanamid to minority students majoring in chemical engineering. Awards are based upon academic achievement and financial need.

Chevron U.S.A. Inc., Eastern Division Scholarships
Annual awards are given to students majoring in chemical engineering. Awards are based on academic merit and financial need. Preference is given to students from the Perth Amboy and Woodbridge, New Jersey area.

Conoco Chemicals Company Scholarships
Two $500 scholarships are given annually to students majoring in chemical engineering. Awards are based upon academic achievement and financial need.

Diamond Shamrock Corp. Scholarships
Annual awards are given to students majoring in chemical engineering. Awards are based upon academic merit and financial need.

Oden S. Knight and Ralph Cohen Memorial Scholarship
The North Jersey Section, American Institute of Chemical Engineers, annually awards the Oden S. Knight and Ralph Cohen Scholarship to senior chemical engineering students. The awards are based upon academic achievement, financial need, and AICHE participation. The awards are announced during the Spring semester of the junior year and are arranged by the North Jersey Section of AICHE.

Stauffer Chemical Company Scholarships
Each year the Stauffer Chemical Foundation offers five scholarships to chemical engineering students for the junior and senior years. Preference is given to children of Stauffer Chemical employees and/or affiliated companies. Awards are based upon academic achievement and financial need.

CHEMICAL ENGINEERING AND CHEMISTRY MERIT AWARDS

Each year the Department of Chemical Engineering and Chemistry makes merit awards to students who have outstanding academic achievement.

The following companies make funds available to the department to provide financial assistance to the graduate and undergraduate programs in Chemical Engineering:

Air Products and Chemicals, Inc.
Allied Corp.
American Cyanamid Co.
Atlantic Richfield Co.
BASF Badische Corp.
BASF Wyandotte Corp.
Celanese Corp.
Chevron Oil Company, Eastern Division
Conoco Chemicals Company
Diamond Shamrock Corporation
Dow Chemical U.S.A.
E.I. Du Pont de Nemours and Company
Exxon Education Foundation
FMC Corporation
GAF Corporation
The Merck Company Foundation
Mobil Foundation
National Starch and Chemical Corporation
Standard Oil Company of Ohio
Stauffer Chemical Company
Union Carbide Corporation

CIVIL AND ENVIRONMENTAL ENGINEERING AWARDS

The Department of Civil and Environmental Engineering annually awards scholarships to students majoring in this program.

Ebasco Services Inc. Scholarship
Ebasco Services Inc. recently established a scholarship award for students majoring in civil, electrical, or mechanical engineering. The award is based upon merit, community involvement, as well as interest in the power industry.

Edwards and Kelcey, Inc. Scholarship
Edwards and Kelcey, Inc. annually awards a scholarship to an entering freshman seeking a career in civil engineering. The award is based on SAT scores, grades, recommendations from teachers and a 1,000 word essay on "Challenges in the Civil Engineering Field."

ELECTRICAL ENGINEERING AWARDS

The Department of Electrical engineering annually awards scholarships to students majoring in electrical engineering. Awards are based upon academic achievement and financial need.

Ebasco Services Inc. Scholarship
See Civil and Environmental Engineering Awards

Essex Electrical League Scholarships
The Essex Electrical League annually awards scholarships to electrical engineering students in the junior class for the senior year. Applicants must be residents of Essex County, and demonstrate academic achievement and financial need.

Walter Lambert Scholarship
The Thermo Electric Co. Inc. annually provides a scholarship for tuition and fees to a junior or senior electrical engineering student from the Bergen County, New Jersey area. Award is based upon academic achievement and financial need.

RCA Corp. Scholarship
Annually an award is given to an outstanding junior electrical engineering student for the senior year by the RCA Education Aid Committee.

INDUSTRIAL AND MANAGEMENT ENGINEERING AWARDS

The Department of Industrial and Management Engineering annually awards scholarships to students majoring in this area of study.

American Association of Cost Engineers Scholarships
The AACE annually awards two scholarships to sophomores who plan to major in industrial engineering.

Materials Handling Award
The Silent Hoist & Crane Co. annually presents the Materials Handling Award for the best paper on the subject of materials handling. The award is made available from a trust established by the Wuensch Foundation Inc. of Brooklyn, New York.

MECHANICAL ENGINEERING AWARDS

The Department of Mechanical Engineering makes awards annually to students majoring in this program.

American Society of Heating, Refrigeration, and Air Conditioning Engineers Award
Annual awards are made by the society to mechanical engineering majors interested in heating, ventilation, and air conditioning. The awards are based upon academic achievement and financial need.

AMMCO Scholarship Fund
The fund was established in memory of Gustave A. and Charles J. Johnson by Mr. and Mrs. Albert Oliner. The fund provides four-year scholarships ranging from $1,500-2,000 annually. Preference is given to graduates of Irvington High School. The awards are based upon scholastic achievement and financial need.

James Frances Cochrane Scholarship Fund
The scholarship fund was established in memory of James Frances Cochrane, an alumnus, by his mother Mrs. Josephine M. Cochrane. Preference is given to graduates of East Orange High School and Clifford J. Scott High School. If a qualified candidate cannot be found from these high schools, the Director of Financial Aid may select a candidate from another New Jersey high school. The award is based upon academic excellence and financial need.

Eva Cohn Scholarship Fund
By the will of Eva Cohn, funds are made available to worthy and capable students who need financial assistance.

John Christopher Denman Scholarship Fund
The Denman Fund was established to provide a scholarship for students enrolled in a professional program at NJIT who need financial assistance.

Peter A. Jensen Memorial Scholarship Fund
The Brothers of Beta Alpha Chapter of Pi Kappa Phi Fraternity established this scholarship fund in memory of Peter A. Jensen Frater, to provide awards for deserving students who have not received financial assistance.

Fred and Esther Kucklinsky Foundation Scholarship Fund
This fund was established to provide scholarships for students who are making good academic progress and have financial need.

Olga J. Murphy Scholarship Fund
The fund was established by the will of the late Chawncey R. Murphy in memory of Olga J. Murphy to provide scholarships for students based upon academic achievement and financial need.

Robert M. Perkins Scholarship Fund
The fund provides an annual scholarship established by the A. P. Smith Manufacturing Company in honor of Robert M. Perkins. Preference is given to a candidate who is either an employee, a former employee, or the child of an employee or a former employee of the A. P. Smith Manufacturing Company or Linker Machines, Inc. The award is based upon academic achievement and financial need.

Henry J. Ruesch Scholarship Fund
The fund was established in memory of Henry J. Ruesch, Class of 1891, to provide financial assistance to a day undergraduate who has demonstrated good academic progress and who needs financial assistance.

John A. Schiek Memorial Scholarship Fund
The fund was established by Caroline D. Schiek in memory of her brother, John A. Schiek, to provide financial assistance to students who demonstrate good academic progress and have financial need.

William L. Schoonover Scholarship Fund
By the will of William L. Schoonover, several awards are made annually based upon academic achievement and financial need.

Peter Small Memorial Scholarship Fund
An annual scholarship for tuition is awarded to a student who best exemplifies the life of Peter Small. Students must demonstrate financial need and have a high academic achievement.

George R. Spaulding Scholarship
A full tuition scholarship is provided by the Hackensack Water Company for undergraduate students entering their junior year and who demonstrate interest in pursuing a career in the water industry. Students must be majoring in one of the following fields: civil, chemical, or mechanical engineering; computer science; or, in those program areas which are applicable to the water industry.

NJIT LOAN FUNDS

NJIT loan funds are derived from gifts to the Institute which have been designated for loans to students. To be eligible applicants must have good academic standing, demonstrate evidence that they will graduate from NJIT, and show that they need the loan for the purpose of meeting educational expenses. Loans are repayable after graduation at either no interest or at a low interest rate depending upon the preference of the donor. Failure to meet the agreed repayment schedule can result in additional charges.

Funds which provide loans to NJIT students include the following:

Cipriano Loan Fund
A loan established by Rose and Peter R. Cipriano, a former NJIT Trustee.

Continental Electric Co. Loan Fund
The fund was established by Arthur W. Peterson, president of the Continental Electric Co. Loans are made to students demonstrating financial need.

Fritts Scholarship Loan Fund
The fund was established by Steward S. Fritts, Class of 1933, in memory of his relatives, John S. Fritts, his father and Ada C. Fritts and Florence M. McCready, his aunts whom were instrumental in financing his education. It is the primary intention of the fund to provide assistance in the form of a loan to students in the general engineering program.

John S. Judd Memorial Loan Fund
The fund was established by John S. Judd, Class of 1936, in recognition of the education he received at Newark College of Engineering.

Sanford L. Kahn Loan Fund
The fund was established by the Sobrochar Society in memory of Sanford Lester Kahn, alumnus, who lost his life in World War II.

Abraham Rothschild Loan Fund
The fund provides small loans to financially needy students for emergency situations.

Steinman Foundation Loan Fund
The fund was established in 1955 by the David B. Steinman Foundation Inc.

NJIT Student Senate Loan Fund
Small cash loans are made possible by the Student Senate Loan Fund, which is supported by voluntary contributions from the students of NJIT. Students may arrange for the loan at the Dean of Student Services Office, located in Room 33, Eberhardt Hall. The loan may not exceed $50 and must be repaid within 30 days. Failure to repay will cause a hold on all grades and transcripts. In addition, students will not be allowed to register and diplomas will be held until payment is made.

Part-time students will be expected to make the same proportional progress as full-time students. Appropriate adjustments will be made when students change their status from full-time to part-time, or part-time to full-time.

Students who are declared ineligible for financial aid may appeal in writing to the Director of Financial Aid within one month of the date of the notice of ineligibility. Students whose written appeals are denied may request hearings by an appeals panel consisting of the Dean of Student Services and the Director of Financial Aid.

Graduate students must register for a minimum of six credits each semester to be eligible for any federal and/or state programs.

The standard used to measure student aid recipient's progress will be the same as standards used to measure a non-student aid recipient who is enrolled in the same degree program.

STUDENT EMPLOYMENT

Campus jobs are open to students registered at NJIT who are full-time or part-time undergraduates and graduates. Students must file an application for employment with the Student Employment Center and a Financial Aid Form (FAF) with CSS in Princeton before they accept employment and must report to the Student Employment Center before beginning work.

ACADEMIC PROGRESS

Federal and state regulations governing financial aid require that students who receive aid from those sources must meet academic performance and progress requirements as defined by the institution and approved by those governments.

Listed below are NJIT's policies and procedures related to satisfactory academic progress:

Full-time undergraduate students must complete a minimum of 24 credits towards the degree requirements at the end of the first year, 57 at the end of the second year, 92 at the end of the third year and 137 at the end of the fourth year. Students at the School of Architecture must complete a minimum of 24 credits at the end of the first year, 57 at the end of the second year, 93 at the end of the third year, 129 at the end of the fourth year and 160 at the end of the fifth year. EOF students must complete all the credit requirements at the end of six years.

Students who withdraw from or fail courses will maintain their eligibility only if they can demonstrate that they can meet their educational goals within the originally defined time frame. Students repeating courses in which credit had been earned previously will not receive financial aid to help meet the cost of these courses.

Students who receive financial aid will have their records reviewed prior to each award period to determine if satisfactory progress is being made and if their educational objectives will be completed within the prescribed time period.

Policies and Procedures

Registration

NJIT has an advance registration system. This places an obligation upon all students currently enrolled in degree granting departments to preregister for their courses. The submission of an approved registration form guarantees the reservation of class seats until the first class meeting. Students who do not attend the first class meeting may have their seats reassigned. Registration is required each semester.

NEW STUDENTS will be informed of registration procedures by the registrar's office after being granted admission.

CURRENTLY ENROLLED STUDENTS will be informed of advance registration details by the Registrar's Office.

READMITTED STUDENTS will be informed of registration procedures by the Registrar's Office after being granted permission to register by the Office of Admissions.

Registration by an undergraduate student is not considered complete until all financial obligations have been satisfied or appropriate arrangements made with the finance office. Students are not permitted to register for a portion of a course but must register and pay tuition for the entire course.

REGISTRATION AT ANOTHER COLLEGE*

Students wishing to take courses at a college or university other than those included in the cross-registration program must:

1. Obtain "Approval for Courses at other Colleges" form from the Registrar's Office.
2. Obtain approval from the NJIT department giving comparable course prior to enrolling for the course. Be prepared to show the department chair a catalog description of the course(s) you intend to take.
3. Have the form countersigned by the Registrar and 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 to the Registrar, NJIT. Upon receipt, your NJIT grade record will be updated, provided that your grade is higher than the lowest passing grade at the host college.

*Exclusive of cross-registration at Rutgers—NCAS, Essex County College, University of Medicine and Dentistry of New Jersey.

FULL-TIME STATUS

Full-time status will only be accorded to students enrolled for 12 or more credits.

RESIDENCE REQUIREMENTS

Students transferring to New Jersey Institute of Technology must take at least 33 credits approved by the department of their major study to be eligible for graduation.

CROSS REGISTRATION PROCEDURES FOR DAY STUDENTS

Full-time students may take courses at one of the participating schools (Essex County College, the University of Medicine and Dentistry of New Jersey, and Rutgers—NCAS) at no additional cost provided that the following criteria are met:

1. The course must be used toward a degree.
2. The course is not offered at NJIT, or because of a conflict in schedule cannot be taken at NJIT.

Permission must be obtained from a departmental representative as indicated below:

For a humanities or social science elective: the representative of the respective department.

For a technical elective: the represen tative of the degree granting department.

For an engineering science student: either the student's advisor or the head of the Engineering Science Program.

For a man and technology student: the Humanities Department representative.

For an architecture student: permission is given through the School of Architecture.

For BSIA students: permission is given through the OSS Department.

Forms may be obtained from the School of Architecture, or the Office of the Registrar. Once approval is received, as outlined above, the form must be signed by the Dean of the Third College or of the School of Architecture. The green copy is removed and the student takes the form to the host school for registration there. Note that courses taken through cross-registration must also be included on the NJIT registration form.

Students adding, changing, or withdrawing from courses at the host school must also complete an authorized NJIT Schedule Change Form.

CROSS REGISTRATION PROCEDURES FOR SUMMER/EVENING STUDENTS

The above procedure applies only to day undergraduate courses. For evening or summer courses, a green form entitled "Permission to Take Courses at Other Colleges" should be processed through the Registrar's Office and the student must pay the applicable tuition to the host school.

COURSE ADDITIONS

Students who add a course to their program will be charged the full tuition and fee for the course added. If, within the first five class days of the semester, students change their schedule, they must fill out a schedule change form, present it to the Registrar, and pay a $10 schedule change fee. Tuition will then be recalculated and any refund or credit due will be made.

After the first five class days of the semester, any change of program will be considered a withdrawal from a course (or from the Institute) and the student should follow the procedures stipulated under the section on withdrawals. Courses cannot be added after the fifth day of the semester. Students attending courses for which they are not properly registered will not receive credit for such courses.

AUDITING A COURSE

Students who wish to audit a course must state their intention to do so at the time of registration. A change to auditor status is not permitted once a semester has begun. Students who audit a course will be required to pay the full tuition and fees for the course audited.

WITHDRAWALS FROM COURSE(S)

Students who wish to withdraw from one or more courses may do so without penalty by completing and submitting a Schedule Change Form to the Office of the Registrar by the end of the ninth week of the semester. This form requires the signature of both the instructor(s) and the Dean. It is available at the Dean of Student Services Office, the Counseling Center, and the Registrar's Office. Failure to submit this form to the Dean by the deadline will result in a final grade other than "W".

COURSE CANCELLATIONS

Courses for which fewer than 15 students register may be cancelled.

Verbal Skills

New Jersey Institute of Technology places prime importance on its students' ability to use language to communicate ideas and information. The capacity to express well what has been learned in a course is an essential component of that course, and so the Institute requires students to master the verbal skills necessary for writing and speaking clear, correct English. Appropriate remedial work may be assigned to students who are unable to demonstrate the mastery of these skills. To the extent appropriate to the course, instructors in all disciplines stress the importance of verbal ability.

CORRECTIVE WRITING PROGRAM

The Department of Humanities conducts a special non-credit tutorial program for students whose writing has been judged deficient by the instructor of any of their courses within the Institute and by a Department of Humanities committee. Such students may continue in their courses, but will be required to follow a corrective program for writing. Students will be referred by their instructor to an appropriate faculty member who will hold tutorial conferences with them as necessary.

ENGLISH AS A SECOND LANGUAGE

All students whose native language is not English will be required to take a special examination in English. Students unable to meet the minimum standard of the examination will be required to take Eng 096,097 during their first year. Such students will not be permitted to enroll in Eng 111 of Hum 112 until they have achieved satisfactory grades in Eng 096,097.

Academic Standing

GRADES

The following grades will be used:

GRADE	SIGNIFICANCE
4	Superior
3	Above average
2	Satisfactory
1	Minimum for credit
0	No credit
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 0 will result. Once a grade of 0 has been issued, it cannot be changed. The course must be repeated.
W	Withdrawn
S	Satisfactory
U	Unsatisfactory

Grade Reports

The Registrar mails a grade report to each student at the end of each semester.

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 the chair of 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 2.0 in the course. Students who have failed a course may not take an examination for credit in that course. A fee of $25 will be charged for the examination and an additional fee for granting credit will be required.

ACADEMIC HONORS DAY DIVISION

To qualify for academic honors in the Day Division, matriculated students must be taking a minimum of 13 credits in a regular program of study, maintain a weighted average of 3.0, and have no grade lower than 2.0.

ACADEMIC HONORS EVENING DIVISION

To qualify for academic honors in the Evening Division, matriculated students must be taking a minimum of six credits in a regular program of study maintain a weighted average of 3.0 and have no grade lower than 2.0.

TRANSCRIPT OF GRADES

Students who wish to obtain a transcript issued on their behalf must submit a request in writing to the Recorder. (Only unofficial copies will be supplied directly to students.) Transcript requests must be accompanied by a fee for each copy of $1. Please allow 5-10 days to process the request. Transcripts will not be issued to or on behalf of a student with outstanding financial obligation to the Institute.

GRADUATION

New Jersey Institute of Technology is authorized to grant degrees by the New Jersey State Board of Higher Education.

Each degree is certified by a diploma bearing the Institute seal and the signatures of officers of the Institute.

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 Candidacy on or before the deadline date set by the Institute.

In order to graduate, students must attain a grade point average of 2.0 in all the courses listed in the catalog as being required in the third and fourth years of the appropriate curriculum. In architecture, the grade point average is determined for the third, fourth, and fifth years.

Candidates for any degree granted by the Institute shall appear in person upon the appointed commencement day to receive the degree, unless excused by the president.

The academic honors of cum laude (GPA of 3.40-3.64), magna cum laude (GPA of 3.65-3.84), and summa cum laude (GPA of 3.85-4.00) are awarded to qualified students at graduation.

EXTENUATING CIRCUMSTANCES

Students should bring to the attention of the Dean of Student Services any extenuating circumstances which may adversely affect their academic standing. This action should be taken as soon as such circumstances develop.

ACADEMIC STANDING/PROBATION

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 placed in the academic status termed "probation." Probationary status will be removed when the cumulative GPA is raised to 2.0.

ACADEMIC SUSPENSION

The academic record of students will be reviewed by the Committee on Academic Standing, and students will be subject to suspension from the Institute 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 Institute; 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.

APPEALS

Decisions relating to a student's status are made in accordance with regulations approved by faculty. Students are afforded a right of appeal against adverse decisions and should consult with the Office of Student Services within five days of receiving notice of the decision being appealed.

Appeals will be heard by the Committee on Student Appeals whose decision is final. The decision of the Committee will be communicated 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 for feeling 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 Institute 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 Admissions.

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

Courses taken at another college while a student is under academic suspension at NJIT will only be counted as transfer credits.

WITHDRAWAL FROM INSTITUTE

Students wishing to withdraw entirely from the Institute may do so without penalty by the end of the twelfth week of the semester. A Schedule Change Form must be completed and submitted to the Registrar by this deadline. Failure to do so will result in grades other than "W".

READMISSION

Students seeking readmission must apply to the Office of Admissions on the form provided. Applications must be accompanied by a nonrefundable fee of $20 and received by:

For the fall semester ..... June 1
For the spring semester ..... November 1
For the summer session ..... April 1

Applicants will be informed of their readmission status by the Office of Admissions. Those who are advised of acceptance for readmission will be sent registration instructions by the Registrar.

Degree Options

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 chair of the two departments, 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 degree programs. While the student's transcript will specify that two majors have been completed, only one degree, selected by the student, will appear on the student's diploma.

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.

B.S./M.S. PROGRAM

Students may apply for admission to enter the special program which normally leads to a Master of Science and Bachelor of Science degree at the end of their fifth year. Students accepted into the program will substitute six graduate credits for two departmental undergraduate courses and/or technical electives. (The courses for which the graduate courses substitute are specified by the department the student enters.) Students will take 24 more graduate credits to complete the requirement for the M.S. degree. The advantages of this program over the regular M.S. program are that students may start their M.S. work in their senior year, and that they need only 24 credits after completion of the credits required for the B.S. degree as opposed to 30 credits for a regular M.S. student.

Students may, if they choose, receive the B.S. degree separately after all the requirements for that degree have been completed.

NOTE: Students in this program will be eligible for graduate student financial assistance in their fifth year.

Rights and Responsibilities

STANDARDS OF CONDUCT

New Jersey Institute of Technology requires students to conduct themselves with decorum and to adhere to high standards of ethical and professional behavior. The Institute 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, Log NJIT, and are deemed incorporated into this catalog. A copy of Log NJIT is supplied to all new students and may be obtained from the Office of the Dean of Student Services.

FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT

The Federal Family Educational Rights and Privacy Act of 1974 gives students the right to inspect educational records maintained about them by the Institute, the right to a hearing to challenge the contents of these records, and the right to make explanation for challenged information. The law also requires the Institute to maintain the confidentiality of student records except with respect to special cases noted in the legislation.

The Registrar of New Jersey Institute of Technology is responsible for student records. Educational records include transcripts, admission files and registration forms. Students wishing to review their files must make a written request to the Registrar listing the items of interest. Student health records are maintained by the Director of Health Services and may only be examined by a health professional of the student's choice. Files covered by the Act will be made available within 45 days of the request. Students may have copies made of their records at their own expense at reasonable rates to be determined by the records custodian. A catalog of educational records maintained by the Institute is available from the Registrar. Exceptions to the right of inspection include financial aid records and records of institutional, supervisory and administrative personnel, and educational personnel ancillary thereto, which are in the sole possesion of the maker.

Within the Institute community, only those members acting in the student's interest are allowed access to student files. These include 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 Act, no one outside the Institute shall have access to a particular student's educational record without the written consent of the student, except in extraordinary 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 Institute and will be available to the student.

The Institute at its discretion may provide directory information, in accordance with the provisions of the Act, to include: the 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 Institute for ONLY ONE ACADEMIC YEAR. Therefore, authorization to withhold directory information must be filed annually in the Office of the Registrar.

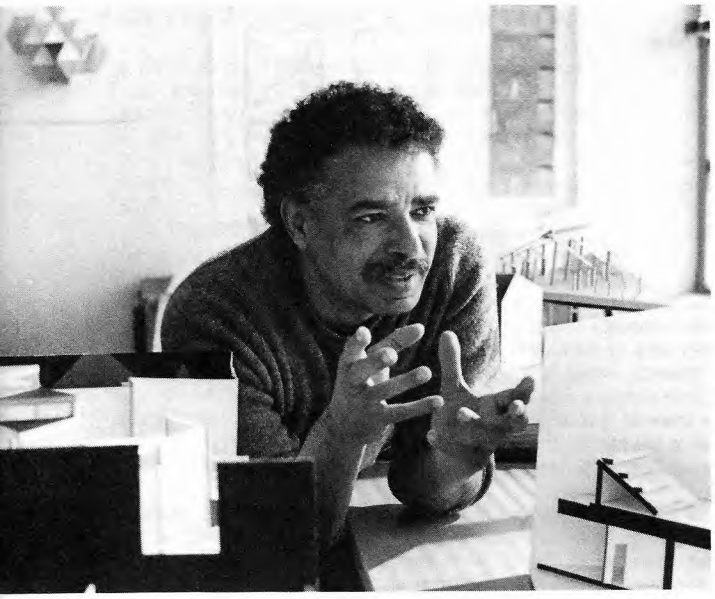
Students who disagree with an entry should attempt to resolve the question with the Office of the Registrar. Failing this, either the school or the student may request a formal hearing. In accordance with the Act's requirements, the hearing will be held within 30 days of the request, and will be conducted by a school official or other person without a direct interest in the outcome. Students will be given a full and fair opportunity to present relevant evidence and to provide their own counsel.

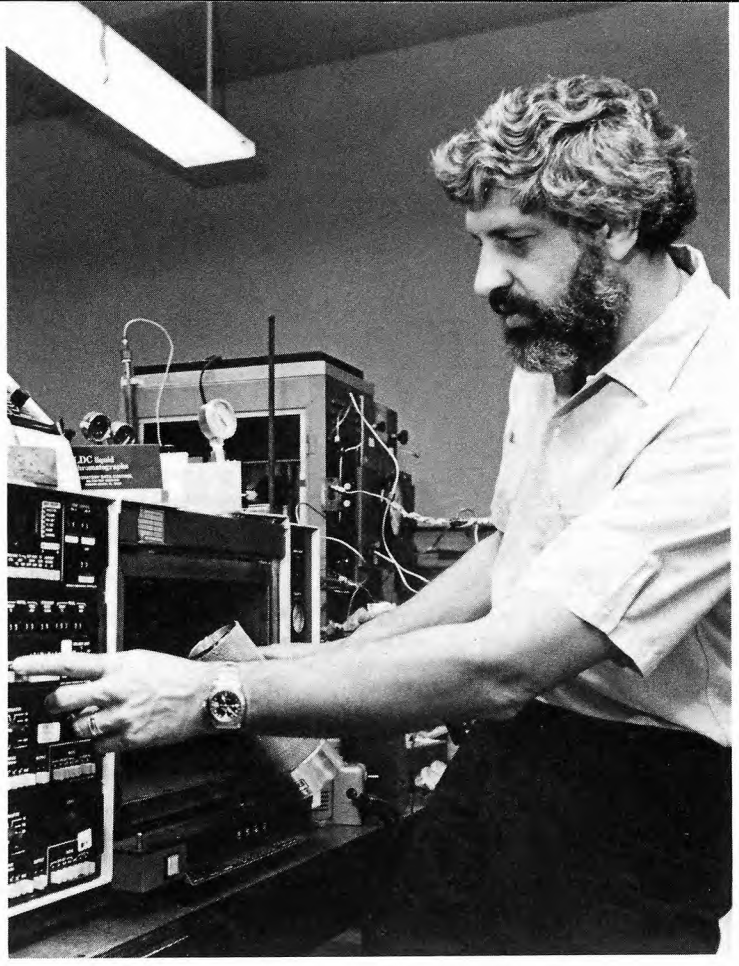
Students may include a written statement in their file explaining a disputed entry following an unfavorable determination of an appeal. A written decision will be rendered within 15 working days after the hearing of an appeal.

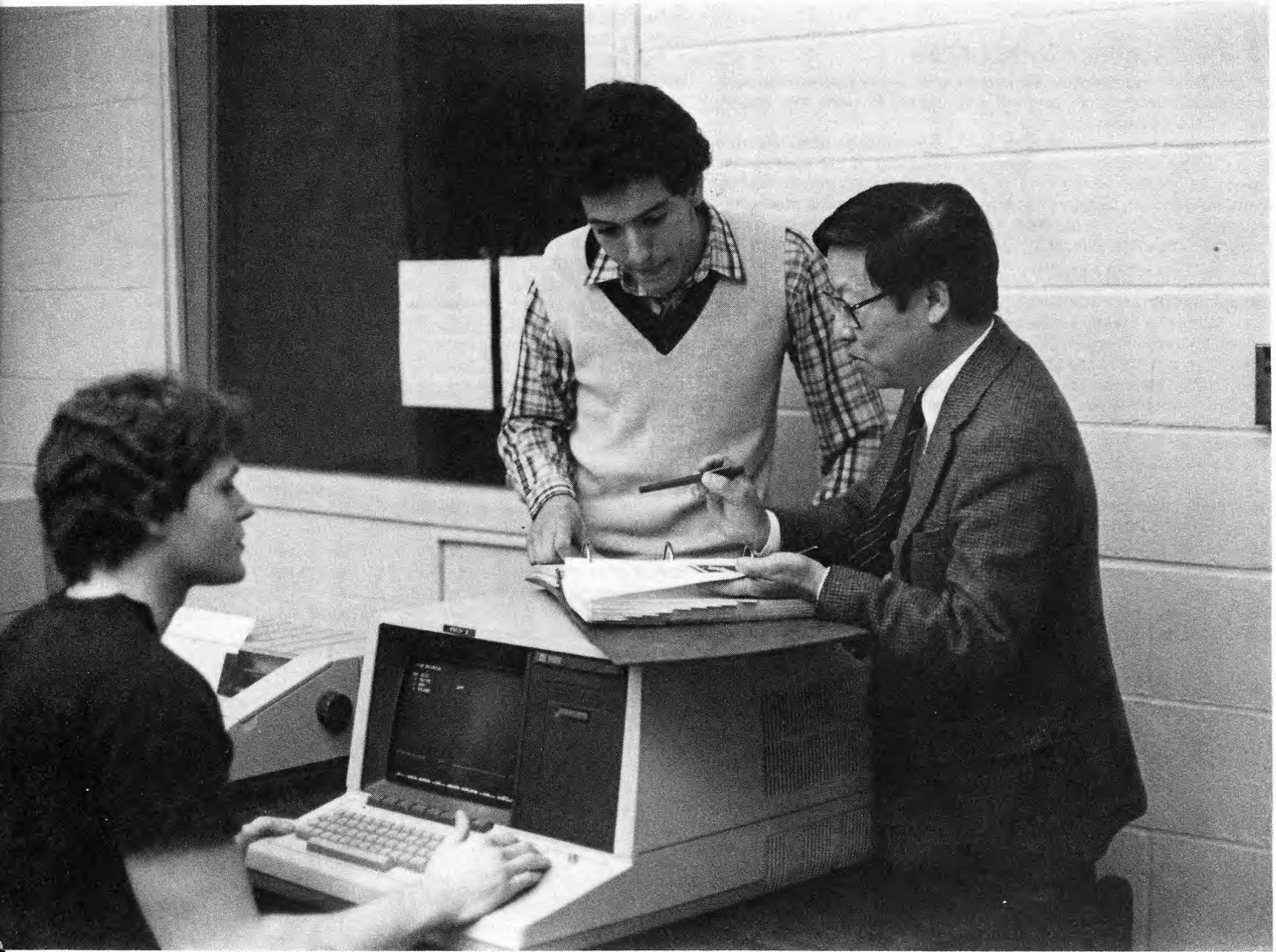
Students who believe that the adjudication of their challenges was unfair or contrary to the provisions of the Act may request, in writing, assistance from the President of the Institute. Further, students who believe that their rights have been abridged may file complaints with the appropriate federal agency.

AFFIRMATIVE ACTION

NJIT does not discriminate on the basis of sex, race, age, religion, national origin, or handicap in its educational programs, activities, or employment policies. The Institute has committed itself to a program of affirmative action and is in compliance with Title IX.







Academic Programs

The Institute offers 14 programs leading to the bachelor's degree. The specific degree requirements shown on the following pages are the latest revisions. More detailed information on course requirements for each degree can be found in the individual curriculum sections of this catalog.

On the following pages program sequences are given for both day and evening students. Students may carry less than a full course load by extending their program completion date.

KEY TO COURSE TITLES

In the curriculum listings, the numbers following the course title represent, in order, lecture-recitation hours per week, laboratory hours per week, and credits for the semester. Course descriptions are found at the end of the catalog.

COOPERATIVE EDUCATION

The Institute's Cooperative Education Program began in 1976 and has increased in scope so that at the present time students in engineering, computer science, and industrial administration programs can become involved. The Cooperative Education Program enhances the education of the student with the introduction of two six-month work periods in cooperating businesses, industries, and government agencies. Such experience enables the student to examine the variety of areas available within a major professional field. The salary earned during the work periods helps defray college and other expenses.

Both work experiences are scheduled during the junior year of the curriculum which extends the time required to complete a full-time degree program to five years.

Basic requirements for admission into the program include good academic standing with a grade point average of at least 2.2. Students must apply for admission to the Cooperative Education Program at the beginning of the second semester of their sophomore year. Additional information is available from the Director of Cooperative Education.

EVENING STUDY

With the exception of the program in architecture, all undergraduate degree programs are also available for part-time evening study. Evening students typically carry about half of the full-time course load, and hence require longer to complete a degree.

Degree requirements for evening students are essentially the same as those shown for full-time day students. Where differences exist, they are noted. In general, physical education in the freshman year is not required of evening students. To learn specific degree requirements for the year in which they plan to graduate, evening students should consult with an advisor in their major field.

Not all courses required for a degree are offered every year in the evening, and the selection of electives is limited. Evening students should consult the Schedule of Evening Courses and are advised to plan their program of study a year in advance. Careful planning and consultation with an advisor will avoid unnecessary delays.

HONORS COURSES

A variety of special honors is offered in the day schedule to well-qualified students. An honors course typically covers in greater depth the content of the regular course it replaces. In the first two years, honors courses are available in chemistry, computer science, humanities, mathematics, and physics. Students are invited to participate on the basis of their high school records and aptitude test scores.

In their junior and senior years, students with outstanding college performance may elect a variety of honors courses. In certain cases, qualified students may elect to substitute graduate courses for courses in the regular undergraduate program.

Honors courses are listed in Courses of Instruction later in this catalog. Interested students should consult with the department offering the honors courses.

EDUCATIONAL OPPORTUNITY PROGRAM

The Educational Opportunity Program provides special academic and financial assistance for students who come from economically and educationally disadvantaged backgrounds. The EOP begins with a program of intensive study during the summer preceding the freshman year to prepare students for any of the various programs offered in the day schedule. It also provides scholarship support and tutorial and counseling services. Further information may be obtained from the Director of the Educational Opportunity Program.

INSTITUTE HONORS PROGRAM

The Institute Honors Program provides unique opportunities for outstanding students who are designated Institute Scholars. During their first two years all Institute Scholars earn a specified number of credits in honors courses and attend a biweekly, non-credit colloquium featuring lectures, presentations, and discussions on a wide variety of topics. Upper-level students in the program register for special honors seminars in the humanities and social sciences while fulfilling the specific requirements for honors in their major fields of study—which often include opportunities to take graduate-level courses and to work on advanced research projects. Students who successfully complete this program graduate with the distinction of Institute Honors.

In addition to opportunities for academic excellence and acceleration, Institute Scholars enjoy a number of benefits and privileges. These include the exclusive use of Institute Scholars Center; priority in course scheduling and securing residence hall accommodations; an annual merit award granted to each student regardless of financial need; and the satisfaction of belonging to a select community of scholars. For further information contact the Director of the Institute Honors Program.

CERTIFICATE PROGRAMS

The Division of Technology offers part-time, evening certificate programs in five areas of technology: architecture, construction, electrical, mechanical, and plastics.

Admission to these programs is available to individuals who have a high school diploma or a New Jersey High School Equivalency Certificate and have satisfactorily completed one year of high school college-preparatory algebra.

A separate admissions application must be completed for entrance into the Certificate Program. A catalog fully describing the various curricula and course offerings available may be obtained by writing or phoning:

Division of Technology
New Jersey Institute of Technology
Newark, New Jersey 07102
596-3224

School of Architecture

Architecture

Accredited by the National Architecture Accreditation Board.

The practice of architecture is a design and decision-making process (utilizing technological skills and knowledge), aimed at solving an environmental problem. It is the thoughtful making of spaces which serve people.

The architecture program at NJIT considers a wide variety of environmental problems—certainly more than just buildings. A solution could begin with choosing a site, or opening undeveloped land to its best and most appropriate uses, or in keeping that land in its natural state. The scope of a problem might be that of a piece of furniture, a room, an entire neighborhood, a central business district, or an entire community or city. The designer's solution could be a long-range plan or guidelines for future growth. The key may be in preserving or adaptively using existing elements of the built environment which are currently misused or discarded.

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

Credit distribution for the Bachelor of Architecture degree:

Required architecture credits	100
Electives*	18
Computer Sciences	2
Freehand drawing	3
Mathematics	7
Humanities**	12
Physics	8
English	3
OSS***	9
Total	162

*3 credits must be chosen from either Humanities or OSS area.
**Includes Hum 112, Hum 231, and two elective Humanities courses.
***Includes SS 201 and two elective OSS courses.

Note: Elective Requirements
The curriculum of the SOA requires the completion of 15 unrestricted elective credits. Students will select these 15 credits in consultation with their faculty advisors.

Suggested Guide for Architecture Program

FIRST YEAR
1st Semester

Arch 103	People and Their Environment I	3-0-3
Arch 161	Introduction to Design I	0-9-3
Eng 111	English Composition	3-0-3
Math 111	Calculus I*	4-0-4 *or*
Math 113	Finite Math & Calculus	4-0-4
Rutgers 080:133	Intro to Drawing**	0-6-3
	Physical Education	0-1-0
	Orientation	1-0-0

2nd Semester

Arch 104	People and Their Environment II	3-0-3
Arch 154	Architectural Graphics**	1-3-2
Arch 162	Introduction to Design II	0-9-3
Hum 112	Man and Culture I	3-0-3 *or*
Math 116	Mathematics of the Environment	3-0-3
	Physical Education	0-1-0
CIS 101	Computer Programming and Problem Solving	2-1-2

*Placement in math courses is determined by testing of all incoming freshman architecture students.
**These courses can be taken either first or second semester.

Professional Program

SECOND YEAR
1st Semester

Arch 251	History of Arch I	3-0-3
Arch 255	Architectural Construction I	2-0-2
Arch 261	Architecture Studio I	1-12-5
Phys 102	General Physics	3-2-4
Chem 231	Man and Culture II	3-0-3

2nd Semester

Arch 252	History of Architecture II	3-0-3
Arch 254	Structures I	2-0-2
Arch 256	Architectural Construction II	2-0-2
Arch 262	Architecture Studio II	1-12-5
Phys 103	General Physics	3-2-4

THIRD YEAR
1st Semester

Arch 351	Landscape I	2-0-2
Arch 353	Building Performance	2-0-2
Arch 355	Structures II	2-0-2
Arch 359	Architecture in Society	2-0-2
Arch 363	Architecture Studio III	1-12-5
SS 201	Economics	3-0-3

2nd Semester

Arch 352	Landscape II	2-0-2
Arch 354	Building Performance II	2-0-2
Arch 356	Structures III	2-0-2
Arch 364	Architecture Studio IV	1-12-5
Arch 370	Architectural Programming	2-0-2
	Elective	3

FOURTH YEAR
1st Semester

Arch 451	History of Arch III	3-0-3
Arch 453	Environmental Control Systems	2-0-2
Arch 455	Architectural Construction III	2-0-2
Arch 463	Architecture Studio V	1-12-5
	Electives	3

2nd Semester

Arch 452	History of Architecture IV	3-0-3
Arch 454	Environmental Control Systems II	2-0-2
Arch 456	Structures IV	2-0-2
Arch 464	Architecture Studio VI	1-12-5
	Electives	6

FIFTH YEAR
1st Semester

Arch 551	Problems in Modern Housing	2-0-2
Arch 563	Architectural Studio VII	1-12-5
	Electives	9

2nd Semester

Arch 554	Professional Arch Practice	0-2-1
Arch 464	Architectural Studio VIII	1-12-5 *or*
Arch 566	Senior Thesis	0-15-5
	Electives	9

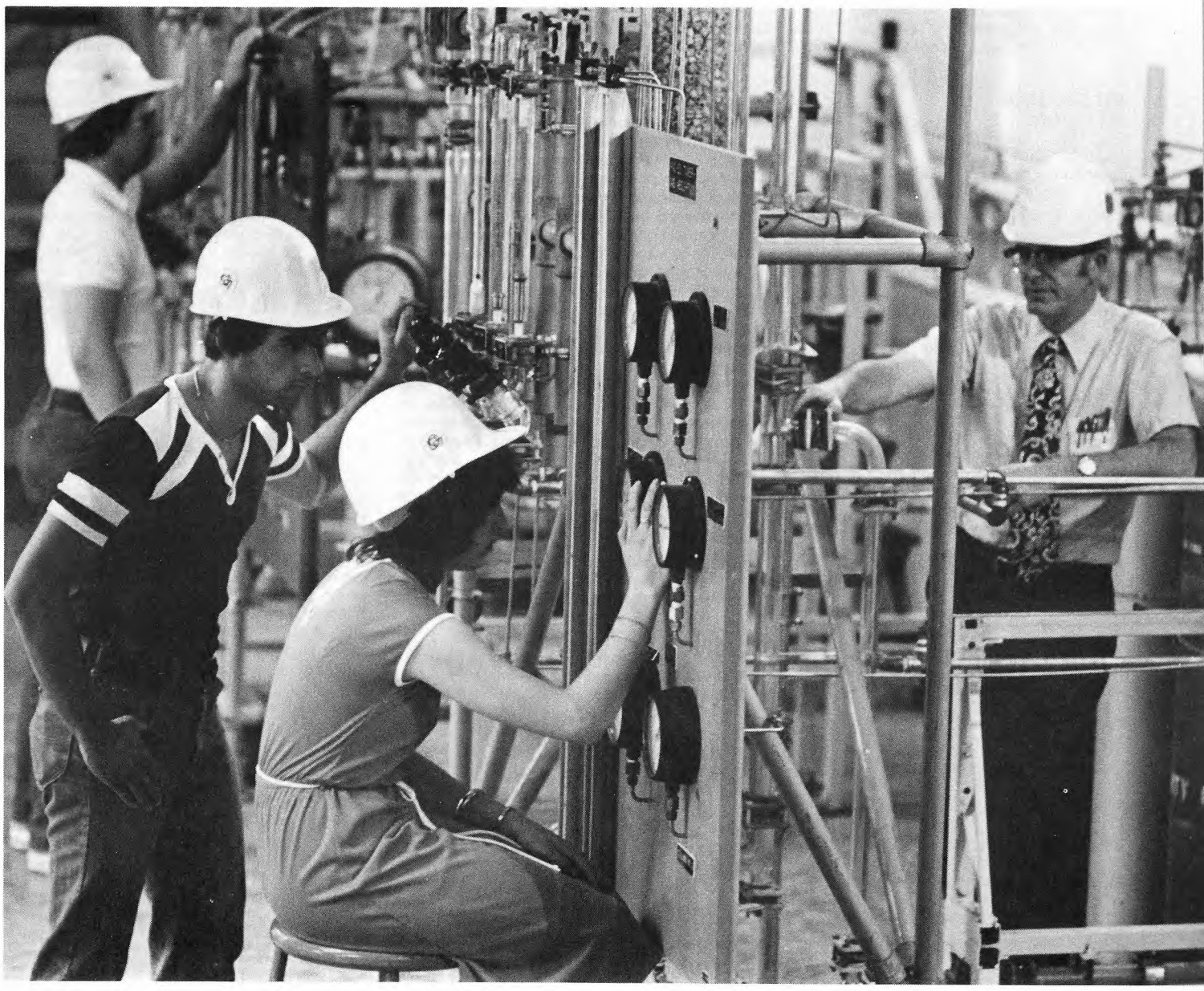
Newark College of Engineering

Applied Chemistry

The B.S. Program in Applied Chemistry prepares students for careers in industry or for entry to graduate school or professional training in such areas as medicine, dentistry, or law. The primary strength and uniqueness of the Applied Chemistry Program is the involvement of the expertise of both chemistry and chemical engineering faculty who are members of a combined department.

The program places strong emphasis on presenting chemistry as a means of solving problems which have practical application both in and out of the chemical industry. Some of these applications include energy, the environment, health, polymers, and properties of materials.

The program has a heavy emphasis on laboratory skills, science, mathematics, and engineering subjects, and in the practical, industrially-oriented areas of chemistry, while not neglecting the basic principles needed to understand the applications. The core of technical electives allows students to specialize in an area of interest or take the necessary courses for a professional school. Thus graduates are able to work in such areas as corporate management, plant production, industrial health and safety, patent law and information sciences, as well as in industrial laboratories.



Applied Chemistry

FIRST YEAR
1st Semester

Chem 115	Chemistry & Materials I 4-2-5	
EG 101	Engineering Graphics	1-2-2
Eng 111	English Composition	3-0-3
Math 111	Calculus I 4-0-4	
Phys 111	Physics I 3-2-4	
	Physical Education	0-1-0
	Orientation	

2nd Semester

Chem 116	Chemistry & Materials II 3-2-4	
CIS 101	Computer Programming 2-1-2	
Hum 112	Man & Culture I	3-0-3
Math 112	Calculus II 4-0-4	
Phys 121	Physics II 3-2-4	
	Physical Education	0-1-0

SECOND YEAR
1st Semester

ChE 227	Chem Process Prin I	3-0-3
Math 221	Calculus III 4-0-4	
Chem 343	Organic Chem I	3-0-3
Phys 231	Physics III 4-2-5	
Hum 231	Man & Culture II	3-0-3

2nd Semester

Chem 232	Phys Chem I 3-2-4	
ChE 228	Chemical Process Principles II 3-0-3	
Math 223	El Diff Equations & Stat 4-0-4	
Chem 344	Organic Chem II 4-3-5	

THIRD YEAR
1st Semester

Chem 335	Phys Chem II 4-3-5	
ChE 345	Chem Eng Thermo I	3-0-3
SS	Elective (choose from 202, 210, 221, 231)	3-0-3
Hum	Elective (Lit/Hist/Phil)	3-0-3
	Technical Elective	3-0-3

2nd Semester

ChE 349	Reaction Kinetics	3-0-3
Chem 449	Prep & Anal of Org Compounds 1-4-3	
ChE 346	Chem Eng Thermo II	3-0-3
Hum	Elective (Lit/Hist/Phil)	3-0-3
	Technical Elective	3-0-3
SS 201	Economics	3-0-3

FOURTH YEAR
1st Semester

Chem 440	Fundamentals of Polymers 3-0-3	
Chem 491	Research & Independent Study 0-6-3	
Chem 412	Inorganic Reactions Processes 2-3-3	
EnE 360	Environmental Engrg	3-0-3
	Technical Elective	3-0-3
IE 335	Eng Cost Analysis & Control 3-0-3	

2nd Semester

Chem 484	Modern Analytical Chem 1-4-3	
Chem 443	Polymer Laboratory	1-4-3
Hum/SS/OS	Elective	3-0-3
	Technical Elective	3-0-3
SS/OS	Elective	3-0-3

Total Credits: 137

Engineering

Both day and evening programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC/ABET)

Engineering programs are offered in the five major professional fields: chemical, civil, electrical, industrial, and mechanical. Each curriculum is sufficiently broad to permit a graduate to enter the engineering profession immediately, or to continue on to advanced study in the fields of engineering, science, or management. While most graduates remain in the engineering profession, a significant number use their engineering background as a foundation for professional careers in such areas as law, medicine, business, education, or science.

Because the engineer applies scientific principles and practical judgment to the solution of many problems concerned with human welfare, engineering programs include courses in the basic sciences and in the humanities and social sciences in addition to courses in engineering analysis and design. Thus, the overall program provides students with a liberal education, designed to permit them to make important contributions not only toward the solution of specific technical problems, such as those found in automobile engine or computer circuit design, but also toward the solution of such compelling problems of society as are evidenced in energy conservation, urban redevelopment, and pollution control.

Students enrolled in engineering and engineering science pursue a common first year, as outlined below. Much of the second year is common, but two or three courses differ for each curriculum. As a result, students may change their objectives among these curriculums during the first or second year with little or no lost time. The regular day mathematics sequence (Math 111, 112, 221, 222) is extended over six semesters for evening students (Math 109, 110, 219, 220, 329, 330).

FIRST YEAR
1st Semester

Chem 115	Chemistry & Materials 1 4-2-5	
EG 101	Engr. Graphics*	1-2-2
Eng 111	English Composition	3-0-3
Math 111	Calculus 1 4-0-4	
Phys 111	Physics I 3-2-4	
	Physical Education	0-1-0
	Orientation	1-0-0

2nd Semester

Chem 116	Chemistry & Materials II 3-2-4	
CIS 101	Computer Prog*	2-1-2
Hum 112	Man & Culture I	3-0-3
Math 112	Calculus II 4-0-4	
Phys 121	Physics II 3-2-4	
	Physical Education	0-1-0

*Paired courses. Half of the students will take these in reverse order.

All engineering programs include a minimum of five humanities courses; additional humanities courses are required by some departments as specified in the following pages. First year students take Eng 111 and Hum 112. (Students who enter the Institute with test scores indicating deficiency in writing, reading, or both, will be required to take one or more English courses prior to Eng 111.) Sophomores take Hum 231. Once this sequence is completed, students in their junior and senior year select 400 level electives. At least two of these electives must be chosen from predominantly verbal disciplines—Literature, History, Philosophy—but not both from the same field. Any additional electives may be chosen from the full range of junior or senior humanities offerings, except Eng 342 (Technical Writing).

Social Science Requirements

Courses in the social and organizational sciences examine human behavior, the principles and forces that underlie and give direction to modern society, and the effects of science and technology on current social issues such as urban planning and development, rapid population growth, and deterioration of the environment.

Students in all curriculums will be required to complete SS 201—Economics, and one other basic social science course from among the following four: SS 202—Labor Relations, SS 210—General Psychology, SS 221—Sociology, SS 231—Political Science. All students will be required to complete one or two additional courses in the organizational and social sciences, as specified in the following pages.

Chemical Engineering

The chemical engineer is involved in the design and operation of plants which manufacture a wide variety of chemicals, including plastics, textile fibers, gasoline, and pharmaceuticals. The work of the chemical engineer can be highly diverse, ranging from research on air pollution to sales of a new detergent.

The chemical engineering curriculum is designed to give the student a thorough background in the fundamental sciences and in engineering subjects. It prepares the student for a professional career in chemical engineering or for graduate study in chemical engineering and other fields.

The chemical engineering student acquires a strong foundation in chemistry, physics, and mathematics, with the emphasis gradually shifting toward chemical engineering courses in the junior and senior years. The senior course in process and plant design coordinates and brings into focus the technical aspects of the chemical engineering curriculum.

Chemical Engineering Day Program

FIRST YEAR (see page 20)

SECOND YEAR
1st Semester

ChE 227	Chem Proc. Prin I	3-0-3
Math 221	Calculus III 4-0-4	
Mech 230	Statics & Dynamics	4-0-4
SS	Basic Soc Sci Reqt*	3-0-3
Hum 231	Man & Culture II	3-0-3

2nd Semester

Chem 232	Phys Chem I	3-2-4
ChE 228	Chem. Proc. Princ II	3-0-3
Math 222	Differential Equations	4-0-4
Phys 230	Physics III	4-1-4
SS 201	Economics	3-0-3

THIRD YEAR

1st Semester

Chem 335	Phys Chemistry II	4-3-5
Chem 343	Org Chemistry I	3-0-3
ChE 345	ChE Thermo I	3-0-3
	Elective (Soc Sci)*	3-0-3
ChE 363	Transport Oper I	3-0-3

2nd Semester

Chem 344	Org. Chemistry II	4-3-5
ChE 346	ChE Thermo II	3-0-3
ChE 349	Reaction Kinetics	3-0-3
	Elective (Lit/Hist/Phil)*	3-0-3
ChE 364	Transport Oper II	3-0-3

FOURTH YEAR

1st Semester

ChE 467	Transport Oper III	4-0-4
ChE 475	Proc Dyn & Control	4-2-5
ChE 481	Chem Engr Lab	2-4-4
	Elective Technical (ChE)*	3-0-3

2nd Semester

ChE 482	Chem Engr Lab	2-4-4
ChE 472	Proc & Plant Design*	4-0-4
	Elective (ChE/Technical)*	3-0-3
	Elective (Lit/Hist/Phil)*	3-0-3
	Elective (Hum/SS/OS)*	3-0-3

Chemical Engineering Evening Program

FIRST YEAR

1st Semester

EG 101	Engineering Graphics	1-2-2
Eng 111	English Composition	3-0-3
Math 109	Introductory Math IE	2-1-2

2nd Semester

CIS 101	Computer Programming	2-1-2
Hum 112	Man and Culture I	3-0-3
Math 110	Calculus IE	2-1-2

SECOND YEAR

1st Semester

Chem 115	Chemistry & Materials	4-2-4
Math 219	Calculus II E	3-0-3
Hum 231	Man & Culture II	3-0-3

2nd Semester

Chem 116	Chemistry & Materials II	3-2-4
Math 220	Calculus III E	3-0-3

THIRD YEAR

1st Semester

Math 329	Calculus IV E	3-0-3
Phys 111	Physics 1	3-2-4
SS 201	Economics	3-0-3

2nd Semester

Math 330	Differential Equations E	3-0-3
Phys 121	Physics II	3-2-4
SS	Basic Soc Sci Reqt*	3-0-3

FOURTH YEAR

1st Semester

Chem 232	Phys Chem I	3-2-4
Phys 230	Physics III	4-1-4
ChE 227	Chem Proc Princ 1	3-0-3

2nd Semester

Chem 335	Phys Chem II	4-3-5
Mech 230	Statics & Dynamics	4-0-4
Chem 228	Proc Princ II	3-0-3

FIFTH YEAR

1st Semester

Chem 343	Org. Chem 1	3-0-3
ChE 345	ChE Thermo 1	3-0-3
SS	Elective	3-0-3

2nd Semester

Chem 344	Org Chem II	4-3-5
ChE 346	ChE Thermo 11	3-0-3

SIXTH YEAR

1st Semester

ChE 363	Transport Oper 1	3-0-3
Hum	Elective (Lit/Hist/Phil)*	3-0-3
Hum	Elective (Lit/Hist/Phil)*	3-0-3

2nd Semester

ChE 364	Transport Oper II	3-0-3
ChE 349	Reaction Kinetics	3-0-3

SEVENTH YEAR

1st Semester

ChE 475	Proc Dyn & Control	4-2-5
ChE 467	Transport Oper III	4-0-4

2nd Semester

	Elective (Hum/SS/OS)*	3-0-3
ChE 472	Proc & Plant Design	4-0-4

EIGHTH YEAR

1st Semester

ChE 481	Chem Engr Lab	2-4-4
	Elective (Technical/ChE)*	3-0-3

2nd Semester

ChE 482	Chem Engr Lab	2-4-4
	Elective (ChE/Technical)*	3-0-3

**Social Sciences Electives:* For the basic social science required in the sophomore year students may choose from SS 202, 210, 221 or 231. The junior year social science must be chosen from SS 301, 311, 314, 403, 431, 433 or OS 451, 452, 453, 454, 455, 456.

Humanities Electives: These 400 level electives must be chosen from two of the following fields: literature, history, philosophy, but not both from the same field.

Hum/SS/OS Elective: If the SS or OS option is taken, this elective may be chosen from any 300 level SS course or any OS course except OS 171, 457, 458, 471. If the Humanities option is taken, any 300 or 400 level Hum course may be chosen (including Arts) except Eng 342.

ChE/Technical Electives: In general, one elective must be a ChE course while the other is open. For more details on special courses see the ChE curriculum pamphlet. In this pamphlet special options also are stated.

Departmental Regulations

Departmental Regulations on prerequisites, grades and GPA, repeating courses, and starting courses are given in the Curriculum Pamphlet and are available on request.

Five Year Program (BS/MS)

Choice of ChE 491 and 492, Research and Independent Study, can enable students to enter a five year program for a Master of Science degree.

Civil Engineering

Civil engineering is concerned with the planning, design, and construction phases of an engineering project, including energy, environmental and economic considerations. It involves dealing with people and cities, producing clean air and water, providing for the disposal of wastes, and developing efficient transportation, housing and water supply systems.

The undergraduate program includes work in field measurements, construction materials and procedures, structural analysis and design, soil behavior, transportation engineering, water supply, and pollution control. The department offers a set of elective courses through which the student can specialize in such areas as environmental control, soils and foundations, urban planning and urban systems, construction engineering, and surveying.

The civil engineering graduate is well prepared to enter the job market through federal, state, and municipal agencies, in the many consulting firms in the metropolitan area and throughout the country, or with the major industrial firms involved with aspects of planning design, construction, or environmental control. Students may also pursue careers in research and development.

Civil Engineering Day Program

FIRST YEAR (see page 20)

SECOND YEAR

1st Semester

CE 200	Surveying*	3-3-4
EG 204	Civil Engr Graphics	1-2-2
Math 221	Calculus III	4-0-4
Mech 230	Statics & Dynamics	4-0-4
SS 201	Economics	3-0-3

2nd Semester

CE 210	Constr Matls & Procedures	3-0-3
CE 231	Strength of Materials	4-3-5
Hum 231	Man & Culture II	3-0-3
Math 223	Elem Diff Eq & Stat	4-0-4
Phys 231	Physics III	4-2-5

THIRD YEAR

1st Semester

CE 320	Fluid Mechanics**	4-0-4
CE 332	Structures I	3-2-4
CE 342	Geology+	3-0-3
CE 350	Transportation Engr*	3-0-3
	Elective (Lit/Hist/Phil)+++	3-0-3

2nd Semester

CE 321	Water & Wastewater Engr*	3-0-3
CE 341	Soil Mech**	3-3-4
CE 430	Structures II	3-0-3
SS	Basic SS Requirement***++	3-0-3
Eng 342	Tech Report Writing+	3-0-3
	Elective (Technical)	3-0-3

FOURTH YEAR

1st Semester

CE 432	Structural Design	3-0-3
OS 471	Management Practice	3-0-3
CE 494	CE Design I	3-0-3
	Elective (Technical)	3-0-3
	Elective (Lit/Hist/Phil)+++	3-0-3

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* ** *** + Paired courses. Half of the students will take these in reverse order.

++Choose from SS 202, SS 210, SS 221, or SS 231 for basic requirement.

+++Student may choose from history, literature, or philosophy, but not both from the same field.

2nd Semester
IE 497 Enterprise Management 3-0-3
EE405/ME463 3-0-3
CE495-CE Design II 3-0-3
Elective (Technical) 3-0-3
Elective (Hum/SS/OS) 3-0-3

Civil Engineering Evening Program (even year start)

FIRST YEAR
1st Semester
EG 101 Engr Graphics 1-2-2
Eng 111 English Composition 3-0-3
Math 109 Introductory Math IE 2-1-2
2nd Semester
CIS 101 Computer Programming 2-1-2
Hum 112 Man & Culture I 3-0-3
Math 110 Calculus IE 2-1-2

SECOND YEAR
1st Semester
Chem 115 Chemistry & Matls I 4-2-5
Math 219 Calculus IIE 3-0-3
Hum 231 Man & Culture II 3-0-3
2nd Semester
Chem 116 Chemistry & Matls II 3-2-4
Math 220 Calculus IIIE 3-0-3

THIRD YEAR
1st Semester
Math 329 Calculus IV E 3-0-3
Phys 111 Physics I 3-2-4
SS Basic Soc Sci Reqt* 3-0-3
2nd Semester
Math 330 Differential Equations E 3-0-3
Phys 121 Physics II 3-2-4
EG 204 Civil Engr Graphics 1-2-2

FOURTH YEAR
1st Semester
CE 200 Surveying 3-3-4
Mech 230 Statics & Dynamics 4-0-4
2nd Semester
CE 210 Constr Matls & Procedures 3-0-3
SS 201 Economics 3-0-3
Phys 231 Physics III 4-2-5

FIFTH YEAR
1st Semester
CE 342 Geology 3-0-3
CE 321 Water & Wastewater Engineering 3-0-3
Hum Elective (Lit/Hist/Phil)** 3-0-3
2nd Semester
CE 320 Fluid Mechanics 4-0-4
IE 497 Enterprise Mgmt 3-0-3
CE 231 Strengths of Matls 4-3-5

SIXTH YEAR
1st Semester
CE 350 Transportation Engr 3-0-3
ME 463 Appl Thermo 3-0-3 *or*
EE 405 Elec Engr Princ 3-0-3
2nd Semester
CE 332 Structures 1 3-2-4
Hum Elective (Lit/Hist/Phil)** 3-0-3

SEVENTH YEAR
1st Semester
CE 495 CE Design II 3-0-3
CE 341 Soil Mechanics 3-3-4
Technical Elective 3-0-3
2nd Semester
CE 494 CE Design I 3-0-3
Hum/SS/OS Elective 3-0-3

EIGHTH YEAR
1st Semester
CE 430 Structures II 3-0-3
OS 471 Mgmt Practice 3-0-3
Technical Elective 3-0-3
2nd Semester
CE 432 Structural Design 3-0-3
Eng 342 Tech. Report Writing 3-0-3
Technical Elective 3-0-3

*Choose from SS 202, SS 210, SS 221, or SS 231 for basic requirement.
**Choose from history, literature, or philosophy, but not both from the same field.

Civil Engineering Evening Program (odd year start)

FIRST YEAR
1st Semester
EG 101 Engr Graphics 1-2-2
Eng 111 English Composition 3-0-3
Math 109 Introductory Math IE 2-1-2
2nd Semester
CIS 101 Computer Programming 2-1-2
Hum 112 Man & Culture in Hist Perspective I 3-0-3
Math 110 Calculus IE 2-1-2

SECOND YEAR
1st Semester
Chem 115 Chemistry & Matls 4-2-5
Math 219 Calculus IIE 3-0-3
Hum 231 Man & Culture in Hist Perspective II 3-0-3
2nd Semester
Chem 116 Chemistry & Matls 11 3-2-4
Math 220 Calculus IIIE 3-0-3

THIRD YEAR
1st Semester
CE 200 Surveying 3-3-4
Math 329 Calculus IV E 3-0-3
Phys 111 Physics 1 3-2-4
2nd Semester
CE 210 Constr Matls & Proc 3-0-3
Math 330 Diff Equations 3-0-3
Phys 121 Physics II 3-2-4

FOURTH YEAR
1st Semester
Mech 230 Statics & Dynamics 4-0-4
SS Basic Soc Sci Reqt* 3-0-3
2nd Semester
EG 204 Civil Engr Graphics 1-2-2
SS 201 Economics 3-0-3
CE 231 Strengths of Matls 4-3-5

FIFTH YEAR
1st Semester
CE 350 Transportation Engr 3-0-3
ME 463 Appl Thermo 3-0-3 *or*
EE 405 Elec Engr Princ 3-0-3
2nd Semester
CE 332 Structures I 3-2-4
Hum Elective** 3-0-3

SIXTH YEAR
1st Semester
CE 342 Geology 3-0-3
CE 321 Water & Wastewater Engr 3-0-3
Hum Elective** 3-0-3
2nd Semester
CE 320 Fluid Mechanics 4-0-4
IE 497 Enterprise Mgmt 3-0-3
Phys 231 Physics III 4-2-5

SEVENTH YEAR
1st Semester
CE 430 Structures II 3-0-3
OS 471 Mgmt Practices 3-0-3
Technical Elective 3-0-3
2nd Semester
CE 432 Structural Design 3-0-3
Eng 342 Tech Report Writing 3-0-3
Technical Elective 3-0-3

EIGHTH YEAR
1st Semester
CE 495 CE Design II 3-0-3
CE 341 Soil Mechanics 3-3-4
Technical Elective 3-0-3
2nd Semester
CE 494 CE Design I 3-0-3
Hum/SS/OSS Elective 3-0-3

*Choose from SS 202, SS 210, SS 221, or SS 231 for basic requirement.
**Choose from history, literature, or philosophy only. Humanities electives must not all be chosen from the same field.

Electrical Engineering

Electrical Engineering is a diversified and challenging profession concerned with the design, development, fabrication, and control of the electrical devices upon which our technological society so largely depends. Electrical engineers utilize their knowledge of devices and systems design in a multitude of areas. These include: integrated circuits, computers, environmental and biomedical instrumentation, energy conversion and distribution, space vehicle control, microprocessors, and satellite communications. 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 sequence in communications, control, computers, power, or medical instrumentation. 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 as the basis for further study in a different field such as law or medicine.

Electrical Engineering Day Program

FIRST YEAR (see page 20)

SECOND YEAR
1st Semester
EE 210 Electrical Engr I 3-3-4
EG 205 Engr Communications 1-2-2
Math 221 Calculus III 4-0-4
Phys 231 Physics III 4-2-5
Hum 231 Man & Culture II 3-0-3
2nd Semester
EE 212 Electrical Engr II 3-0-3
Math 222 Differential Equations 4-0-4
ME 361 Thermodynamics 3-0-3
Mech 230 Statics & Dynamics 4-0-4
SS 201 Economics 3-0-3

THIRD YEAR
1st Semester
EE 323 Passive Networks 4-0-4
EE 326 Electromag Fields I 4-0-4
EE 331 Electromag & Energy Conv 3-0-3
EE 342 Active Circuits I 3-3-4
Elective (Lit/Hist/Phil) 3-0-3
2nd Semester
EE 324 Computer-Aided Circuit Analysis & Design 3-0-1.5
EE 343 Semiconductor Devices+ 3-0-1.5
EE 327 Electromag Fields II 3-0-3
EE 332 Magnetics & Electromech Energy Conv Lab 1-2-2
EE 344 Active Circuits II 3-0-3
EE 365 Digital Logic & Circuit Design 3-0-3
SS Basic Soc Sc Req't* 3-0-3

FOURTH YEAR
1st Semester
EE 410 Active Circuits II Lab 1-2-2
OS 471 Management Practice 3-0-3
Elective (E.E.) 3-0-3
Elective (E.E. Syst. I) 3-0-3
Elective (Lit/Hist/Phil) 3-0-3
Elective (Technical) 3-0-3
2nd Semester
EE 415 Elective Engr Project 3-0-3
Elective (E.E.) 3-0-3
Elective (E.E. Syst. II) 3-0-3
E.E. Systems Lab 0-4-2
Elective (Hum/SS/OS)** 3-0-3
Elective (Approved) 3-0-3

+Eighth Week Mini-Courses
*Choose from SS 202, SS 210, SS 221 or SS 231 for Basic SS reqt.
**Excluding OS 471.

Electrical Engineering Evening Program

FIRST YEAR
1st Semester
Chem 115 Chemistry & Materials I 4-2-5
Eng 111 English Composition 3-0-3
Math 109 Introductory Math IE 2-1-2
2nd Semester
Chem 116 Chemistry & Materials II 3-2-4
Hum 112 Man & Culture I 3-0-3
Math 110 Calculus IE 2-1-2

SECOND YEAR
1st Semester
Math 219 Calculus II E 3-0-3
Phys 111 Physics I 3-2-4
EG 101 Engr Graphics 1-2-2
2nd Semester
Math 220 Calculus III E 3-0-3
Phys 121 Physics II 3-2-4
CIS 101 Computer Programming & Problem Solving 2-1-2

THIRD YEAR
1st Semester
EE 210 Electrical Engrg I 3-3-4
Math 329 Calculus IV E 3-0-3
SS 201 Economics 3-0-3
2nd Semester
EE 212 Electrical Engrg II 3-0-3
Math 330 Differential Equations E 3-0-3
Hum 231 Man & Culture II 3-0-3

FOURTH YEAR
1st Semester
EG 205 Engr Communications 1-2-2
Mech 230 Statics & Dynamics 4-0-4
EE 323 Passive Networks 4-0-4
2nd Semester
Phys 231 Physics III 4-2-5
EE 342 Active Circuits 3-3-4

FIFTH YEAR
1st Semester
EE 326 Electromagnetic Fields I 4-0-4
EE 324 Computer Aided Circuit Analysis & Design+ 3-0-1.5
EE 343 Semiconductor Devices+ 3-0-1.5
Basic SS Reqt* 3-0-3
2nd Semester
EE 327 Electromagnetic Fields II 3-0-3
ME 361 Thermodynamics 3-0-3
EE 331 Electromagnetics & Energy Conversion 3-0-3

SIXTH YEAR
1st Semester
EE 344 Active Circuits II 3-0-3
EE 332 Magnetics & Electromech Conv Lab 1-2-2
Elective (Lit/Hist/Phil) 3-0-3
2nd Semester
EE 410 Active Circuits II Lab 1-2-2
EE 365 Digital Logic & Circuit Design 3-0-3
Elective (Hum/SS/OS) 3-0-3

SEVENTH YEAR
1st Semester
Elective (EE Syst I) 3-0-3
OS 471 Management Practices 3-0-3
Elective (Lit/Hist/Phil) 3-0-3
2nd Semester
Elective (EE Syst II) 3-0-3
E.E. Systems Lab 0-4-2

EIGHTH YEAR
1st Semester
Elective (E.E.) 3-0-3
EE 415 Electrical Engrg Proj 3-0-3
Elective (Tech) 3-0-3
2nd Semester
Elective (E.E.) 3-0-3
Elective (Approved) 3-0-3

+Eight week mini-courses
*Choose from SS 202, 210, 221, 231 for Basic SS reqt.
**For the year 1984-85, all the courses offered in seventh year will be offered in eighth year and eighth year's courses offered in seventh year.

Industrial Engineering

The industrial engineering curriculum prepares engineers to design, improve, install, and operate integrated systems of people, materials, and facilities needed by industry, commerce, and society. Industrial engineers solve problems which arise in the management of enterprises by applying the principles of engineering science, product and process design, work analysis, human factors research, and management science. Industrial engineering leads to a wide variety of professional opportunities in industrial, commercial, and public service enterprises, and to graduate study in industrial engineering, business administration, law, and other fields.

The industrial engineering curriculum combines three professional areas of practice: product and production process design, work analysis, and management science. Students are also offered exposure to the more specialized areas of research, design, and development; manufacturing; distribution; and personnel management. Initially 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. Early courses stress fundamental principles and concepts which develop gradually and eventually culminate in a system design dealing with real engineering and management situation in an industrial commercial, or public service enterprise.

Industrial Engineering Day Program

FIRST YEAR (see page 20)

SECOND YEAR
1st Semester
IE 221 Intro to Industrial Engr 3-0-3
Math 221 Calculus III 4-0-4
Phys 231 Physics III 4-2-5
SS Basic Soc Sci Reqt* 3-0-3
SS 201 Economics 3-0-3
2nd Semester
EG 203 Indust Engr Graphics 1-2-2
IE 224 Production Proc Design 3-0-3
Math 222 Differential Equations 4-0-4
Mech 230 Statics & Dynamics 4-0-4
Hum 231 Man & Culture II 3-0-3

THIRD YEAR
1st Semester
IE 335 Cost Analysis 3-0-3
IE 337 Methods Engr 2-2-3
IE 335 Human Factors 3-0-3
Math 333 Probability & Statics 3-0-3
Mech 232 Mechanics of Materials 3-1-3
Elective (Lit/Hist/Phil) 3-0-3
2nd Semester
EE 405 Electrical Engr 3-0-3
IE 331 Applied Statics 3-0-3
IE 334 Engineering Economy 3-0-3
IE 338 Work Measurement 2-2-3
Elective (Technical) 3-0-3
Elective (Lit/Hist/Phil) 3-0-3

FOURTH YEAR
1st Semester
IE 439 Management Science 3-0-3
IE 443 Systems Analysis 2-2-3
IE Elective (Tech) 3-0-3
ME 339 Fund of Mech Design 3-0-3
ME 463 Appl Thermodynamics 3-0-3
OS 474 Human Resources Mgmt 3-0-3
2nd Semester
IE 440 Mgmt Science Practice 3-0-3
IE 444 Systems Design 2-2-3
IE Elective (Technical) 3-0-3
OS Elective 3-0-3
Elective (Humanities) 3-0-3

*Choose from SS 202, SS 210, SS 221, or SS 231 for basic requirement.

Industrial Engineering Evening Program (even year start)

FIRST YEAR
1st Semester
Chem 115 Chemistry & Materials I 4-2-5
Eng 111 English Composition 3-0-3
Math 109 Introductory Math IE 2-1-3
2nd Semester
Chem 116 Chemistry & Materials II 3-2-4
Hum 112 Man & Culture I 3-0-3
Math 110 Calculus IE 2-1-2

SECOND YEAR
1st Semester
Math 219 Calculus IIE 3-0-3
EG 101 Engr Graphics 1-2-2
SS 201 Economics 3-0-3
2nd Semester
Math 220 Calculus IIIE 3-0-3
CIS 101 Computer Programming 2-1-2
Hum 231 Man & Culture II 3-0-3

THIRD YEAR
1st Semester
IE 224 Production Processes 3-0-3
Phys 111 Physics I 3-2-4
Math 329 Calculus IVE 3-0-3
2nd Semester
IE 221 Intro to Ind Engr 3-0-3
Phys 121 Physics II 3-2-4
Math 330 Differential Equations E 3-0-3

FOURTH YEAR
1st Semester
IE 334 Engineering Economy 3-0-3
Math 333 Probability & Statics 3-0-3
Mech 230 Statics & Dynamics 4-0-4
2nd Semester
IE 335 Cost Analysis 3-0-3
IE 337 Methods Engineering 2-2-3
SS Basic Soc Sci Reqt* 3-0-3

FIFTH YEAR
1st Semester
IE 331 Applied Statistics 3-0-3
IE 338 Work Measurement 2-2-3
EG 203 I.E. Graphics 1-2-2
2nd Semester
IE 355 Human Factors 3-0-3
Phys 231 Physics III 4-2-5

SIXTH YEAR
1st Semester
Mech 232 Mechanics of Mat'ls 3-1-3
IE 439 Management Science 3-0-3
IE Technical Elective 3-0-3
2nd Semester
ME 339 Fund of Mach Design 3-0-3
IE 440 Mgmt Science Practice 3-0-3

SEVENTH YEAR
1st Semester
ME 463 Appl Thermodynamics 3-0-3
OS 474 Human Resources Mgmt 3-0-3
Hum Elect (Lit/Hist/Phil) 3-0-3
2nd Semester
OS Elective 3-0-3
Hum Elective 3-0-3
IE Technical Elective 3-0-3

*Choose from SS 202, SS 210, SS 221, or SS 231 for basic requirement.

EIGHTH YEAR
1st Semester
IE 443 Systems Analysis 2-2-3
IE Technical Elective 3-0-3
EE 405 Electrical Engineering 3-0-3
2nd Semester
IE 444 Systems Design 2-2-3
Hum Elective (Lit/Hist/Phil) 3-0-3

Evening Program (odd year start)

FIRST YEAR
1st Semester
Chem 115 Chemistry & Materials I 4-2-5
Eng 111 English Composition 3-0-3
Math 109 Introductory Math IE 2-1-2
2nd Semester
Chem 116 Chemistry & Materials II 3-2-4
Hum 112 Man & Culture I 3-0-3
Math 110 Calculus IE 2-1-2

SECOND YEAR
1st Semester
Math 219 Calculus IIE 3-0-3
EG 101 Engr Graphics 1-2-2
SS 201 Economics 3-0-3
2nd Semester
Math 220 Calculus IIIE 3-0-3
CIS 101 Computer Graphics 2-1-2
Hum 231 Man & Culture II 3-0-3

THIRD YEAR
1st Semester
IE 224 Production Processes 3-0-3
Math 333 Probability & Statistics 3-0-3
Phys 111 Physics I 3-2-4
2nd Semester
IE 2 Intro to Ind Engr 3-0-3
Phys 121 Physics II 3-2-4

FOURTH YEAR
1st Semester
Math 329 Calculus IVE 3-0-3
Mech 230 Statics & Dynamics 4-0-4
2nd Semester
Math 330 Differential Equations E 3-0-3
Mech 232 Mechanics of Mat'ls 3-1-3
SS Basic Soc Sci Reqt* 3-0-3

FIFTH YEAR
1st Semester
IE 334 Engineering Economy 3-0-3
EG 203 I.E. Graphics 1-2-2
EE 405 Electrical Engineering 3-0-3
2nd Semester
IE 335 Cost Analysis 3-0-3
IE 337 Methods Engineering 2-2-3
ME 339 Fund of Mach Design 3-0-3

SIXTH YEAR
1st Semester
IE 331 Applied Statistics 3-0-3
IE 338 Work Measurement 2-2-3
IE Technical Elective 3-0-3
2nd Semester
IE 335 Human Factors 3-0-3
Phys 231 Physics III 4-2-5

SEVENTH YEAR
1st Semester
IE 439 Management Science 3-0-3
IE Technical Elective 3-0-3
IE 443 Systems Analysis 2-2-3

*Choose from SS 202, SS 210, SS 221, or SS 231 for basic requirement.

2nd Semester
IE 440 Mgmt Science Practice 3-0-3
Hum Elective (Lit/Hist/Phil) 3-0-3
IE 444 Systems Design 2-2-3

EIGHTH YEAR
1st Semester
ME 463 Appl Thermodynamics 3-0-3
OS 474 Human Resources Mgmt 3-0-3
Hum Elective (Lit/Hist/Phil) 3-0-3
2nd Semester
OS Elective 3-0-3
Hum Elective 3-0-3
IE Technical Elective 3-0-3

Mechanical Engineering

Mechanical engineering is concerned with the design, development, manufacture, and operation of a wide variety of energy conversion and machine systems. Mechanical engineers employ their knowledge of materials, systems design and control, and production methods to design complex systems (such as aircraft, power plants, and combustion engines) to meet design constraints as well as safety and environmental protection requirements. Mechanical engineers are also involved in developing conventional and alternate energy sources, including fossil fuel, geothermal, wind, tide, solar, hydroelectric, and nuclear power generation systems, in response to our national energy needs.

The first two years of the curriculum provide a foundation 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. Laboratory and project work supplement courses offered in the fourth year.

The mechanical engineering curriculum prepares the student for professional work as well as for graduate study. This broad basis, combined with a wide variety of technical electives in such areas as air, thermal, and noise pollution control, energy conversion, computer-aided design, and bioengineering, enables the mechanical engineering graduate to work in engineering or pursue graduate studies in such non-technical areas as medicine or law.

Mechanical Engineering Day Program

FIRST YEAR (see page 20)

SECOND YEAR
1st Semester
Math 221 Calculus II 4-0-4
Mech 230 Statics & Dynamics 4-0-4
ME 215 Engr Mat & Proc* 2-2-3
EG 202 Elements of M.E 1-2-2
Phys 231 Physics III 4-2-5
2nd Semester
ME 231 Kinematics & Dynamics of Machinery 3-1-3
Math 222 Differential Equations 4-0-4
Mech 232 Mechanics of Mat'ls 3-1-3
Hum 231 Man & Culture II 3-0-3
SS 201 Economics* 3-0-3

THIRD YEAR
1st Semester
EE 305 Elect Engr Princ 3-2-4

ME 311	Thermodynamics I	3-0-3
SS	Basic Soc Sci Req't**	3-0-3
ME 303	Des of Mach Elem	3-2-4
ME 305	Intro to Sys Dynamics	3-0-3

2nd Semester

OS 471	Mgmt Practices	3-0-3
ME 304	Fluid Dynamics	3-1-3
ME 308	Analysis & Synthesis of Mech Systems	2-1-2
ME 312	Thermodynamics II	3-0-3
ME 343	Mechanical Lab I	2-2-3
Hum	Elective (Lit/Hist/Phil)	3-0-3

FOURTH YEAR

1st Semester

ME 403	Mechanical Systems	2-2-3
ME 405	Mechanical Lab II	1-2-2
	Elective (Lit/Hist/Phil)	3-0-3
	Elective (Mech Engr)	3-0-3
IE 494	Enterprise Mgmt	3-0-3
ME 407	Heat Transfer	3-0-3

2nd Semester

ME 404	Mechanical Systems II	2-2-3
ME 406	Mechanical Lab III	1-2-2
	Elective (Technical)	3-0-3
	Elective (Hum/SS/OS)	3-0-3
	Elective (Mech Engr)	3-0-3
	Elective (Free)***	3-0-3

*Paired courses. Half of the students will take these in reverse order.
**Choose from SS 202, SS 210, SS 221, or SS 231 for basic requirement.
***Students may select course from those approved as M.E., Technical, Humanities, or OS or SS electives.

Evening Program

FIRST YEAR

1st Semester

Chem 115	Chemistry & Materials I	4-2-5
Eng 111	English Composition	3-0-3
Math 109	Introductory Math IE	2-1-2

2nd Semester

Chem 116	Chemistry & Materials 11	3-2-4
Hum 112	Man & Culture I	3-0-3
Math 110	Calculus IE	2-1-2

SECOND YEAR

1st Semester

Math 219	Calculus II E	3-0-3
Phys 111	Physics I	3-2-4
EG 101	Engr Graphics	1-2-2

2nd Semester

Math 220	Calculus III E	3-0-3
Phys 121	Physics II	3-2-4
CIS 101	Computer Programming & Problem Solving	2-1-2

THIRD YEAR

1st Semester

EG 202	Elements of M.E	1-2-2
Math 329	Calculus IV E	3-0-3
SS 201	Economics	3-0-3

2nd Semester

Phys 231	Physics III	4-2-5
Math 330	Differential Equations E	3-0-3

FOURTH YEAR

1st Semester

SS	Basic SS Requirement**	3-0-3

**Choose from SS 202, SS 210, SS 221, or SS 231 for basic requirement.

Mech 230	Statics & Dynamics	4-0-4
ME 215	Engr Mat & Proc	2-2-3

2nd Semester

Hum 231	Man & Culture II	3-0-3
Mech 232	Mech of Mat'ls	3-1-3
ME 231	Kinematics & Dynamics of Machinery	3-0-3

FIFTH YEAR

1st Semester

EE 305	Elec Engr Principles	3-2-4
ME 311	Thermo 1	3-0-3
ME 305	Intro Sys Dynamics	3-0-3

2nd Semester

IE 494	Enterprise Mgmt	3-0-3
ME 304	Fluid Dynamics	3-1-3
OS 471	Mgmt Practices	3-0-3

SIXTH YEAR

1st Semester

ME 303	Design of Mach Elements	3-2-4
ME 312	Thermo II	3-0-3

2nd Semester

ME 308	Analysis & Synthesis of Mech Sys	2-1-2
ME 343	M.E. Lab I	2-2-3
ME 407	Heat Transfer	3-0-3

SEVENTH YEAR

1st Semester

ME 403	Mechanical Systems I	2-2-3
ME 405	Mechanical Lab II	1-2-2
	Lit/Hist/Phil Elective	3-0-3

2nd Semester

ME 404	Mechanical Systems II	2-2-3
ME 406	Mechanical Lab III	1-2-2
	Lit/His/Phil Elective	3-0-3

EIGHTH YEAR

1st Semester

	M.E. Elective	3-0-3
	Tech Elective	3-0-3
	Hum/SS/OS Elective	3-0-3

2nd Semester

	M.E. Elective	3-0-3
	Free Elective	3-0-3

Engineering Technology

Both day and evening programs are accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET)

B.S. in Engineering Technology

During the last decade there has been a strong trend toward further education in engineering technology and this has led to the establishment of the bachelor's programs in technology. A new occupational identity, the Engineering Technologist, has come into being.

The Engineering Technologist has a practical approach to the solution of everyday problems and works closely with the technician and the engineer or scientist as an important member of the engineering-scientific team.

The Engineering Technology program offers an opportunity for further education to persons who have completed an appropriate associate degree program at a community college, technical institute, or similar institution or who have an equivalent education. The program can be completed in two years of full-time day study or four years of part-time evening study (normally three evenings per week), and hence is available to those employed full-time in industry. Students may transfer between day and evening programs during normal semester registration periods.

The program provides advanced education in technical and management skills, together with selected humanities and social science electives. A core curriculum is required of all students, and specialization in Construction and Contracting, Electrical, Environmental, Manufacturing or Mechanical Engineering Technologies is provided by inclusion of option courses.

The Engineering Technology program is administered by the Dean of Newark College of Engineering with assistance in overall management and evaluation of the program by the Associate Dean of Engineering for Engineering Technology. Responsibilities for the Technological content of the options with this program lie with the chair of the particular department and the faculty committee of that department offering the courses pertaining to that option. Each department has an assistant chair who is specifically charged with evaluating the completeness of the record of incoming students and to denote the appropriate curriculum describing all deficiencies or advanced credit where given.

It is the responsibility of each student to meet the appropriate assistant chair for advice and approval of his course selections. The Associate Dean will be available to all students for consultation and assistance.

To provide real world feedback for the validity of each option within the Engineering Technology program, each option receives the benefit of an advisory committee comprised of persons whose professional practice is within that program area. Each area advisory committee is a subcommittee of a larger Advisory Committee to the Board of Trustees of New Jersey Institute of Technology.

Further faculty overview of the Engineering Technology program is provided by an advisory faculty committee chaired by the Associate Dean of Engineering for Engineering Technology.

Students electing to transfer into an option of the B.S.E.T. curriculum will find marticulation into the New Jersey Institute of Technology program facilitated if their academic background is similar to other students entering that curriculum from different institutions and programs. Entering students lacking the expected minimum background will be assigned to a "bridge program" to make up the necessary prerequisites before taking progressively advanced work.

All entering B.S.E.T. students will find that their programs are shorter and fit more easily into their fields of interest if their preparation (within the guidelines of their home institution) includes the following work in their first two years:

Mathematics and Basic Sciences—a minimum of 17 semester credits, including if possible, one semester of elementary calculus and two semesters of physics.

Humanities and Social Science—a minimum of 11 semester credits with one semester of freshman English required.

Technical Courses—a minimum of 30 semester credits, including one semester,

each, of the courses as suggested by the options below:

CONSTRUCTION & CONTRACTING
Engineering Graphics
Statics
Strength of Materials
Elementary Surveying

ELECTRICAL
Elementary Electrical Theory
Electrical Measurements with Laboratory
Electronic Theory and Laboratory

ENVIRONMENTAL
Chemistry with Laboratory and/or Biology

MANUFACTURING
Engineering Graphics
Statics
Dynamics
Strength of Materials
Machine Laboratory

MECHANICAL
Engineering Graphics
Statics
Dynamics
Strength of Materials
Kinematics
Machine Design

Other courses—as needed to satisfy the curriculum for the associate degree as specified by the institution, but one semester of computer science is highly recommended.

Those students who are accepted as transfers into the B.S.E.T. program without the associate degree must have 65 credits of transferrable grade to be accorded junior status by the Registrar.

Degree Requirements

All candidates for graduation in the Bachelor of Science in Engineering Technology program must meet the following minimum criteria before a degree will be awarded:

23 credits in mathematics and basic sciences*.
21 credits in humanities and social science.
45 credits in technical specialities.
Complete all the courses in the option.

The above credit requirements include courses taken at other schools either in fulfillment of associate degree requirements or as transfer credits to be used as equivalents for entrance with junior standing.

Credits earned at other schools plus those credits earned at New Jersey Institute of Technology must meet the above minimal requirements.

Students taking the Aerospace Studies option will take Aerospace courses in addition to regular courses in the junior year. AS 333 may be used in lieu of OS 472 and AS 334 may be used in lieu of a Hum/SS or OS elective.

The numbers following the course title represent, in order, lecture-recitation hours per week, laboratory hours per week, and credits for the semester; X indicates that hours and credits may vary depending on the elective.

The Institute reserves the right to make changes in course requirements, although few changes are contemplated.

AREA OPTION LOC/BLDG.	RESPONSIBLE ASS'T CHAIR—TELEPHONE
Const & Cont Civil & Env. Eng. Dept. 206C	Prof. Walter Konon 596-2476
Electrical Elec. Eng. Dept. 250T	Dr. Henry Ayoub 596-3541
Environmental Civil & Env. Dept. 311C	Prof. Paul Cheremisinoff 596-2462
Manufacturing Industrial & Mgmt. Eng. Dept. 502W	Prof. Joseph Kopf 596-3656
Mechanical Eng. Dept. 204B	Dr. Benedict Sun 596-3328

For further information or assistance, please contact Dr. S. S. Thomas, Associate Dean (Acting) for Engineering Technology. Phone (201) 596-3222.

B.S.E.T. DAY PROGRAMS

Construction and Contracting Option

The construction and contracting option is a program with specializations in general construction, heavy construction, building construction, mechanical and electrical contracting, and supervision of construction. It prepares the holder of an associate degree in any of the construction related fields for a higher level of employment in the construction industry.

JUNIOR YEAR

1st Semester

CIS 202	Computer Programming & Business Problems	2-2-3
Eng 342	Tech. Report Writing	3-0-3
Math 305	Statistics for Technology	3-0-3
CET 301	Constr Surveying	2-3-3
CET 313	Constr Procedures I	4-0-4

2nd Semester

CET 322	Hydraulic and Hydrologic Problems in Constr	3-0-3
OS 371	Superv & Empl Rel	3-0-3
CET 331	Structural Systems	3-3-4
CET 314	Constr Procedures II	4-0-4
	Elective (SS or Hum)	3-0-3

SENIOR YEAR

1st Semester

IET 414	Ind Cost Analysis	3-0-3
MET 450	Mech & Elec Syst I	3-3-4
CET 411	Cost Est & Scheduling	3-0-3
CET 431	Construction Testing	2-2-3
	Elective (Lit. Hist, Philo)	3-0-3
	OS or Tech Elective	3-0-3

2nd Semester

OS 472	Mgmt & Org Behavior	3-0-3
IET 421	Contracts & Specifications	3-0-3
CET 435	Design of Temp Struct for Construction	3-3-4
	OS or Tech Elective	3-0-3
	Elective (SS or Hum)	3-0-3

TECHNICAL ELECTIVES

Chem 202	Chem for Today's Society	2-2-3
CET 415	Building Constr	3-0-3
CET 416	Heavy Construction	3-0-3
CET 441	Soils & Earthwork	3-0-3
CET 490	Senior Project	3-0-3
EET 309	Electric Circuits & Mach	3-0-3
IET 315	Industrial Statistics	3-0-3
IET 416	Production Scheduling	3-0-3
IET 419	Work Meas Tech	3-0-3
MatSc 311	Properties of Matls	3-0-3
MET 303	Appl Thermodynamics	3-0-3
MET 417	Solar Energy Appl	3-0-3
MET 451	Mech & Elec Syst II	3-0-3
CE 412	Construction Codes & Specifications	3-0-3

Electrical Systems Option

The electrical systems option is designed as a continuation of an associate degree program in electrical or electronics technology, with emphasis on the theory and application of electrical circuits. Electives provide specialization in communications, computers, controls, power generation and distribution, and electrical machinery. Minor elective areas may be developed to satisfy student needs.

JUNIOR YEAR

1st Semester

CIS 202	Computer Programming & Business Problems	2-2-3
EE 301	Circuit Analysis I	3-0-3
EET 303	Circuit Measurements I	1-3-2
Eng 342	Technical Report Writing	3-0-3
Math 108	Mathematical Analysis 1+	3-0-3
MET 303	Appl Thermodynamics*	3-0-3

2nd Semester

EET 302	Circuit Analysis II	3-0-3
EET 304	Circuit Measurements II	1-3-2
Math 209	Mathematical Analysis II	3-0-3
OS 371	Supervision & Empl Rel	3-0-3
MatSc 311	Prop of Materials*	3-0-3
	Elective (SS or Hum)	3-0-3

SENIOR YEAR

1st Semester

EET 405	Discrete & Integ Cir	3-3-4
IET 414	Industrial Cost Analysis	3-0-3
	Elective (OS or Tech)	
	Elective (Humanities)	3-0-3
	Elective (Lit/Hist/Phil)	

2nd Semester

EET 406	Control Syst & Transd	3-3-4
EET 408	Electrical Syst Project	1-3-3
OS 472	Mgmt & Org Behavior	3-0-3
	Elective (OS or Tech)	
	Elective (SS or Hum)	3-0-3

TECHNICAL ELECTIVES

CIS 215	Intro to Comp Science	3-0-3
CIS 331	Machines & Ass'y Lang Prog	2-2-3
CIS 330	Minicomputer Systems	2-2-3
Chem 202	Chem for Today's Society	2-2-3
EET 410	Microprocessors	2-2-3
EET 411	Energy Conversion Devices	3-0-3
EET 412	Power Generation & Distribution	3-0-3
EET 413	Pulse & Digital Circuits	3-0-3
EET 414	Communication Systems	3-0-3

*Basic Sciences include physics, chemistry and the life sciences.

IET 315	Industrial Statistics	3-0-3
IET 405	N.C. for Machine Tools	2-2-3
IET 416	Production Scheduling	3-0-3
IET 419	Work Meas Techniques	3-0-3
IET 420	Quality Control	3-0-3
IET 421	Contract & Specifications	3-0-3
MET 307	Plastics Technology	3-0-3
MET 409	Air Cond & Refrig	3-0-3
MET 410	Electro-Mech Equip	3-0-3
MET 416	Mechanical Instru Lab	3-0-3
MET 417	Solar Energy Appl	3-0-3

*May be waived for incoming students who have had sufficient preparation. A Technical elective will be substituted.
+Math 108 will be waived for incoming students who have sufficient preparation in mathematics. An elective will be substituted in an area which will satisfy degree requirements.

Environmental Technology Option

The environmental option is of interest to students who wish to specialize in the broad areas of air, water, and waste water analysis and treatment. Graduates of this program are able to assume a variety of positions involving management, design, or analysis of environmental related processes and activities in industry and governmental agencies. This option is designed for those who hold associate degrees in the physical or life sciences as well as engineering oriented technologies.

JUNIOR YEAR

1st Semester

Math 106	Basic College Math*	4-0-4
Eng 342	Tech Report Writing	3-0-3
CIS 202	Computer Programming & Business Problems	3-3-4
ENT 311	Chemistry of Contaminated Atmospheres Emissions	3-3-4
	Elective (Technical)	3-0-3

2nd Semester

Math 108	Mathematical Analysis	3-0-3
ENT 312	Chem & Biology of Water & Wastewater Treatment	2-2-3
OS 371	Supervision & Employee Relations	3-0-3
	Elective (Technical)	3-0-3
	Elective (SS or Hum)	3-0-3

SENIOR YEAR

1st Semester

ENT 415	Wastewater Analysis	3-3-4
MET 304	Fluid Machinery	3-0-3
IET 414	Indust Cost Analysis	3-0-3
	Elective (OS or Tech)	
	Elective (Lit/Hist/Phil)	3-0-3

2nd Semester

ENT 416	Unit Operations of Water & Wastewater Treatment	3-0-3
OS 472	Mgmt & Org Behavior	3-0-3
	Elective (OS or Tech)	3-0-3
	Elective (SS or Hum)	3-0-3
	Elective (Technical)	

*Waived if the student has sufficient preparation. An elective will be substituted in an area which will satisfy degree requirements.

TECHNICAL ELECTIVES

Chem 303	Applied Chem Principles	3-0-3
Chem 483	Bioorganic Chemistry	3-0-3
Chem 486	Intro Physical Chem	3-0-3
CET 422	Hydraulic Prob in Construc	3-0-3
EET 309	Elec Circuits & Mach	3-0-3
ENT 313	Public Health Tech	3-0-3
ENT 414	Industrial Toxicology	3-0-3
ENT 417	Industrial Safety & Health	3-0-3
ENT 418	Air Pollution Control	3-0-3
ENT 419	Envir Quality & the Law	3-0-3
IET 315	Industrial Statistics	3-0-3
IET 419	Work Meas Tech	3-0-3
IET 421	Contracts & Spec	3-0-3
MatSc 311	Properties of Matls	3-0-3
MET 303	Appl Thermo	3-0-3
MET 415	Auto Control Systems	3-0-3
MET 416	Mech Instr Laboratory	3-0-3
MET 417	Solar Energy Applications	3-0-3

Manufacturing Technology Option

The manufacturing option is a broad program emphasizing the quantitative methods of manufacturing and production management. It prepares the holder of an associate degree in any field of technology for work in quality control, work measurement, reliability, cost analysis, plant layout, materials handling, and supervision.

JUNIOR YEAR

1st Semester

CIS 202	Computer Programming and Business Problems	3-0-3
Eng 342	Tech Report Writ'g	3-0-3
Math 108	Math Analysis I	3-0-3
IET 315	Ind. Statistics	3-0-3
IET 317	Manufacturing Oper. Analysis	2-2-3
IET 414	Ind. Cost Analysis	3-0-3

2nd Semester

MatSc 311	Prop. of Mat'l	3-0-3
OS 371	Supervision and Employee Rel	3-0-3
Math 209	Math. Analysis II	3-0-3
	Elective (SS or Hum.)	3-0-3
IET 318	Mfg. Proc. Design	2-2-3
IET 420	Quality Control	3-0-3

SENIOR YEAR

1st Semester

IET 416	Prod. Scheduling	3-0-3
IET 405	NC for Mach. Tools	3-0-3
IET 423	Motion and Time Study Tech	2-2-3
	Elective (OS or Tech.)	
	Elective (Hum.)	3-0-3

2nd Semester

IET 422	Tool Design	2-2-3
IET 424	Facilities Planning	2-0-2
IET 426	Facilities Planning Lab	1-3-2
OS 472	Mgt. and Org. Behavior	3-0-3
	Elective (SS or Hum.)	3-0-3
	Elective (OS or Tech.)	

TECHNICAL ELECTIVES

Chem 202	Chem for Today's Society	2-2-3
CET 301	Constr. Surveying	2-3-3
IE 465	Patent Law	3-0-3
EET 309	Elec. Circuits & Mach	3-0-3
IET 313	Quant Mgt Methods	3-0-3
IET 421	Contracts and Specif	3-0-3
MET 303	Appl Thermodynamics	3-0-3
MET 304	Fluid Machinery	3-0-3
MET 307	Plastics Technology	3-0-3
MET 407	Structural Design	3-0-3
MET 410	Electro-Mechn Equip	3-0-3
MET 413	Environmental Tech	3-0-3
MET 417	Solar Energy Appl	3-0-3
MET 439	Appl. Mech. Vibrations	3-0-3

Mechanical Systems Option

The mechanical systems option is a continuation of an associate degree program in mechanical technology, with an emphasis on design. Electives permit specialization in electromechanical equipment, air conditioning and refrigeration, manufacturing equipment, and other fields.

JUNIOR YEAR

1st Semester

CIS 202	Computer Programming & Business Problems	2-2-3
Eng 342	Tech Report Writing	3-0-3
Math 108	Mathematical Analysis I	3-0-3
MET 301	Machine Design I	3-0-3
MET 314	Dynamics of Mach	3-0-3
EET 309	Elec Circ & Mach	3-0-3

2nd Semester

Math 209	Mathematical Analysis II	3-0-3
MET 302	Machine Design II	3-0-3
MET 303	Appl Thermo	3-0-3
MET 304	Fluid Machinery	3-0-3
OS 371	Superv and Empl Rel	3-0-3
	Elective (SS or Hum.)	3-0-3

SENIOR YEAR

1st Semester

IET 414	Industrial Cost Analysis	3-0-3
MET 415	Automatic Control Sys	3-0-3
MET 416	Mech Instr Lab	2-2-3
	Elective (OS or Tech)	
	Elective (Lit/Hist/Phil)	3-0-3
	Elective (Technical)	

2nd Semester

MET 408	Mech Design Proj	1-3-3
OS 472	Mgmt & Org Behavior	3-0-3
	Elective (OS or Tech)	
	Elective (SS or Hum)	3-0-3
	Elective (Technical)	

TECHNICAL ELECTIVES

Chem 202	Chem for Today's Society	2-2-3
ENT 417	Indust. Safety & Health	3-0-3
IET 315	Industrial Statistics	3-0-3
IET 405	Numerical Control for Machine Tools	2-2-3
IET 416	Production Sched	3-0-3
IET 419	Work Meas. Tech	3-0-3
IET 420	Quality Control	3-0-3
IE 465	Patent Law	3-0-3
MatSc 311	Properties of Mat'ls	3-0-3
MET 307	Plastics Technology	3-0-3
MET 308	Plastics Processing Technology	3-0-3
MET 407	Structural Design	3-0-3
MET 409	Air Cond. & Refrig	3-0-3
MET 410	Electro-Mech. Equip	3-0-3
MET 411	Manufacturing Equip	3-0-3
MET 413	Environmental Tech	3-0-3
MET 417	Solar Energy Appl	3-0-3
MET 439	Appl Mech Vibrations	3-0-3

B.S.E.T. EVENING PROGRAMS

Construction and Contracting Option (even year start)

FIRST YEAR
1st Semester
CET 301 Constr Surveying 2-3-3
Math 305 Prob and Statistics for Tech 3-0-3
Eng 342 Tech Report Writing 3-0-3
2nd Semester
CET 331 Structural Systems 3-3-4
CIS 202 Comp Prog & Bus Prob 2-0-3

SECOND YEAR
1st Semester
CET 313 Constr Procedures I 4-0-4
Elective (SS or Hum) 3-0-3
2nd Semester
CET 314 Constr Procedures 11 4-0-4
OS 371 Suprv & Empl Rel 3-0-3
CET 322 Hydraulic & Hydrologic Prob. in Constr 3-0-3

THIRD YEAR
1st Semester
MET 450 Mech & Elec Syst I 3-3-4
CET 431 Construction Testing 3-0-3
Elective (SS or Hum) 3-0-3
2nd Semester
IET 421 Contr & Spec 3-0-3
OS 472 Mgmt & Org Behavior 3-0-3
Elective (OS or Technical)

FOURTH YEAR
1st Semester
CET 411 Cost Est & Sch 3-0-3
IET 414 Ind Cost Analysis 3-0-3
Elective (Hum) 3-0-3
2nd Semester
CET 435 Design of Temp Struct for Const 3-3-4
Elective (OS or Technical)

B.S.E.T. Construction and Contracting Option (odd year start)

FIRST YEAR
1st Semester
CET 313 Constr Procedures 1 4-0-4
Math 305 Statistics for Tech 3-0-3
Eng 342 Tech Report Writing 3-0-3
2nd Semester
CET 314 Constr Procedures II 4-0-4
CIS 202 Comp Prog & Bus Prob 2-2-3
IET 421 Contr & Spec 3-0-3

SECOND YEAR
1st Semester
CET 301 Constr Surveying 2-3-3
Elective (SS or Hum) 3-0-3
2nd Semester
CET 331 Structural Systems 3-3-4
OS 371 Super & Empl Rel 3-0-3

THIRD YEAR
1st Semester
CET 411 Cost Est & Sch 3-0-3
Elective (Lit/Hist/Phil) 3-0-3
Elective (SS or Hum) 3-0-3
2nd Semester
CET 435 Design of Temp Struct for Construction 3-3-4
Elective (OS or Technical)

FOURTH YEAR
1st Semester
MET 450 Mech & Elec Syst 1 3-3-4
IET 414 Ind Cost Analysis 3-0-3
CET 431 Constr Testing 3-0-3
2nd Semester
CET 322 Hydraulic & Hydrologic Prob in Construction 3-0-3
OS 472 Mgmt & Org Behavior 3-0-3
Elective (OS or Technical)

B.S.E.T. Electrical Systems Option (even year start)

FIRST YEAR
1st Semester
EET 301 Circuit Analysis I 3-0-3
MET 303 Appl Thermodynamics 3-0-3
Math 108 Math Analysis I 3-0-3
2nd Semester
EET 302 Circuit Analysis II 3-0-3
Eng 342 Tech Report Writing 3-0-3
Math 209 Math Analysis II 3-0-3

SECOND YEAR
1st Semester
EET 303 Circuit Measurements I 1-3-2
CIS 202 Comp Prog & Bus Prob 2-2-3
OS 371 Superv & Empl Rel 3-0-3
2nd Semester
EET 304 Circuit Measurements II 1-3-2
Elective (Hum or SS) 3-0-3
MatSc 311 Prop of Matls 3-0-3

THIRD YEAR
1st Semester
EET 405 Discrete & Integ Cir 3-3-4
IET 414 Ind Cost Analysis 3-0-3
2nd Semester
EET 406 Control Syst & Transd 3-3-4
Elective (Technical)

FOURTH YEAR
1st Semester
Elective (OS or Tech)
OS 472 Mgmt & Org Behavior 3-0-3
Elective (Lit/Hist/Phil) 3-0-3
2nd Semester
EET 408 Elec Syst Proj 1-3-3
Elective (OS or Tech)
Elective (SS or Hum) 3-0-3

B.S.E.T. Electrical Systems Option (odd year start)

FIRST YEAR
1st Semester
EET 301 Circuit Analysis I 3-0-3
Math 108 Math Analysis I 3-0-3
MatSc 311 Prop of Matls* 3-0-3
2nd Semester
EET 302 Circuit Analysis II 3-0-3
Math 209 Math Analysis II 3-0-3
Eng 342 Tech Report Writing 3-0-3

SECOND YEAR
1st Semester
EET 303 Circuit Measurements I 1-3-2
MET 303 Appl Thermodynamics* 3-0-3
CIS 202 Comp Prog & Bus Prob 2-2-3
2nd Semester
EET 304 Circuit Measurements II 1-3-2
OS 371 Superv & Empl Rel 3-0-3
Elective (SS or Hum) 3-0-3

THIRD YEAR
1st Semester
EET 405 Discrete & Integ Cir 3-3-4
IET 414 Ind Cost Analysis 3-0-3
2nd Semester
EET 406 Control Syst & Transd 3-3-4
Elective (Technical)

FOURTH YEAR
1st Semester
Elective (OS or Tech)
OS 472 Mgmt & Org Behavior 3-0-3
Elective (Lit/Hist/Phil) 3-0-3
2nd Semester
EET 408 Elec Syst Proj 1-3-3
Elective (OS or Tech)
Elective (Hum or SS) 3-0-3

*Waived if student has sufficient preparation. An elective will be substituted in an area which will satisfy graduation requirements.

B.S.E.T. Mechanical Systems Option (even year start)

FIRST YEAR
1st Semester
MET 301 Machine Design I 3-0-3
Math 108 Math Analysis I 3-0-3
CIS 202 Comp Prog & Bus Prob 2-2-3
2nd Semester
MET 302 Machine Design II 3-0-3
Math 209 Math Analysis II 3-0-3
Eng 342 Tech Report Writing 3-0-3

SECOND YEAR
1st Semester
MET 303 Applied Thermodynamics 3-0-3
MET 304 Fluid Machinery 3-0-3
0S 371 Superv. & Empl. Rel 3-0-3
2nd Semester
MET 314 Dynamic of Mach 3-0-3
EET 309 Electric Cir. and Mach 3-0-3
Elective (SS or Hum) 3-0-3

THIRD YEAR
1st Semester
MET 415 Automatic Control Syst 3-0-3
OS 472 Mgmt & Org Behavior 3-0-3
Elective (OS or Tech)
2nd Semester
MET 416 Mech Instr Lab 2-2-3
IET 414 Ind Cost Analysis 3-0-3
Elective (Lit/Hist/Phil) 3-0-3

FOURTH YEAR
1st Semester
IET 414 Ind Cost Analysis 3-0-3
Elective (OS or Tech)
OS 472 Mgmt & Org Behavior 3-0-3
2nd Semester
MET 408 Mech Design Proj 1-3-3
Elective (Lit/Hist/Phil) 3-0-3

Surveying

Surveying is the art and science of measuring the physical features of any portion of the surface of the earth, moon, or planets and delineating them accurately on a map or storing the information in a computer data bank. Surveying techniques are applied in such non-traditional areas as medicine, satellite navigation, and criminology. These varied applications coupled with rapidly changing technology have resulted in the development of areas of specialization. Some of these areas include: geodesy, photogrammetry, remote sensing, hydrographic surveys, topography, property surveys, cartography, engineering, and construction.

The undergraduate curriculum addresses many of the specialties which comprise surveying, a strong foundation of mathematics, science, and computer programming forms the basis for the advanced surveying courses. Professional surveyors must be able to communicate effectively with other design professionals and the public in general. A strong background is thus also provided in the humanities and social sciences with emphasis on communication skills.

Surveying

FIRST YEAR (see page 20)

SECOND YEAR

1st Semester

CE 200	Surveying	3-3-4
CIS 213	Intro to Computer Science	3-0-3
Math 221	Calculus III	4-0-4
Mech 230	Statics & Dynamics	3-0-3
SS 201	Economics	3-0-3

2nd Semester

CE 300	Advanced Surveying Lab	0-3-2
CE 301	Advanced Surveying	3-0-3
CE 342	Geology	3-0-3
Hum 231	Man & Culture I	3-0-3
Math 223	Elem of Diff Eq & Stat	4-0-4
Phys 231	Physics III	4-2-5

THIRD YEAR

1st Semester

CE 320	Fluid Mechanics	4-0-4
CIS 438	Prog for Interactive Comp Graphics	3-0-3
Eng 342	Tech Report Writing	3-0-3
CE 305	Aerial Photo Interp	3-0-3
CE 405	Geodetic Surveying	3-0-4

2nd Semester

CE 321	Water & Wastewater Engr	3-0-3
IE 497	Enterprise Mgt	3-0-3
SS	Basic Soc Sci Reqt+	3-0-3
Hum	Elective (Lit/Hist/Phil)++	3-0-3
CE 303	Photogrammetry I	3-0-3
CE 304	Adjust Computation I	3-0-3

FOURTH YEAR

1st Semester

OS 471	Management Practice	3-0-3
Hum	Elective (Humanities)++	3-0-3
CE 401	Photogrammetry II	3-3-4
CE 402	Adjust Computation II	3-0-3
CE 409	Geodetic Astronomy	3-0-3
	Elective (Technical)	3-0-3

2nd Semester

CE 231	Strength of Materials	4-3-5
	Elective (Hum/SS/OS)	3-0-3
CE 307	Geometric Design for Highways	3-0-3
CE 403	Hydrographic Surv'g	3-0-3
	Elective (Technical)	3-0-3

+Choose from SS 202, SS 210, SS 221 or SS 231 for basic requirement.

++Student may choose from history, literature, or philosophy, but not both from the same field.

Third College

Aerospace Studies

A commission as a second lieutenant in the United States Air Force is available to any student who completes the Aerospace Studies option through the Air Force Reserve Officer Training Corps program on campus. Students in any undergraduate program may pursue this optional program in conjunction with their normal academic studies. In a typical program, a student takes AS111 and AS112 in the first year; AS221 and AS222 in the second; AS333 and AS334 in the third; and AS443 and AS444 in the fourth year. A compressed option for students with three remaining years is available with the approval of the Professor of Aerospace Studies. A special program for junior students is also available beginning the summer prior to their junior year. It is possible to complete any of the options without delaying graduation. All students on an Air Force ROTC scholarship who are enrolled in the ASIII, 112 and AS221, 222 courses (normally freshman and sophomores) are required to complete successfully a course in English composition within the first two years. All students in the last two years of the Air Force ROTC program must successfully complete a course in mathematical reasoning approved by the Professor of Aerospace Studies prior to receiving a commission.

Aerospace Studies Option

Students taking the Aerospace Studies Option will take Aerospace Studies courses in addition to their regular courses in three of the four years of their campus academic program. AS333 may be used in lieu of OS471; for CE, ChE, ME, EE, and CIS Students OS472; for BSET and engineering science students OS474; for IE students AS334 may be used by all engineering science students in lieu of the Hum/SS/OS elective.

Computer Science

Computer science is the study of information: its structure, its representation, and its utilization. This includes the analysis, design, implementation, and application of computer programs (software) and computer equipment (hardware) for developing computerized information processing systems in response to user's needs.

The use of computers can be characterized as augmenting a person's mental skills and intelligence. The dramatic use of computers in problem solving and in support of human cognitive processes has resulted in a change in the thinking of professionals in every discipline. Modern enterprises are also dependent on computers for automating their industrial and office procedures and practices. In order to keep pace with these sophisticated technological uses of computers, professionals in the computer field must understand and employ advanced scientific concepts in their work.

NJIT students may choose between degree programs as follows: B.S. in Computer Science, if oriented towards engineering, mathematics, or science; B.A. in Computer Science; or B.A. in Information Processing Systems. (Both B.A. programs are given jointly with Rutgers University—NCAS.)

The B.A. in Computer Science requires a substantial mathematics and computer science base, leading to an understanding of the full potential of applications in management, social science and science.

For the business applications of computers, students should consider Information Systems Management. The program is shown in this catalog as an option in the B.S. in Industrial Administration (which see).

In addition to the career possibilities suggested above, students in either the B.S. or B.A. programs may continue their studies with graduate work toward an advanced degree.

B.S. in Computer Science

FIRST YEAR

1st Semester

Math 111	Calculus I	4-0-4
Phys 111	Physics I	3-2-4
Eng 111	English Composition	3-0-3
CIS 111	Computer Programming	2-1-2
	Elective (Soc. Sci)**	3-0-3

2nd Semester

Math 112	Calculus	4-0-4
Phys 121	Physics II	3-2-4
Hum 112	Man & Culture I	3-0-3
SS 201	Economics	3-0-3
CIS 213	Intro. to Computer Sci	3-0-3

SECOND YEAR

1st Semester

Math 221	Calculus III	4-0-4
Phys 231	Physics III	4-0-4
CIS 331	Machine & Assembly Pro	2-2-3
	Elective	
	Elective	

2nd Semester

Math 226	Discrete Mathematics	4-0-4
Hum 231	Man & Culture II	3-0-3

CIS 332 Prin. of Operating Syst 2-2-3
CIS 351 Computer Organization 3-0-3
Elective

THIRD YEAR
1st Semester
Math 333 Probability/Statistics 4-0-4
CIS 335 Data Structures & Algorithm Design I 3-0-3
Elective+ (CIS)
Elective (Humanities)** 3-0-3
Elective (Interdisciplinary)†

2nd Semester
CIS 435 Data Structures & Algorithm Design II 3-0-3
Elective (CIS) 3-0-3
Elective (Humanities)** 3-0-3
Elective (Interdisciplinary)†
Elective

FOURTH YEAR
1st Semester
OS 471 Management Practices 3-0-3
CIS 490 Guided Design in Software Eng 3-0-3
Elective (CIS)+
Elective (Interdisciplinary)†
Elective

2nd Semester
CIS 491 Computer Science Project 3-0-3
Elective (CIS)+
Elective (Math)*
Elective (Hum. or OSS)**
Elective

**Mathematics:* One 300 or 400 level course in mathematics with prerequisites including Math 222.

***Humanities and OSS:* One basic social science course chosen from SS 202, 210, 221, 231. Two upper division (300-400 level) courses from Philosophy, History, or Literature; not both from the same field. One Hum/OSS elective. Students taking the Aerospace Studies option may substitute AS 333 for OS 471, and AS 334 for the Hum/OSS elective.

+CIS: Four 300-400 level elective courses as offered by the CIS Department.

†Interdisciplinary studies: A sequence of three 300-400 level courses focusing on quantitative aspects of a discipline relevant to Computer Science. A list of approved course sequences in a variety of disciplines offered at NJIT or NCAS-Rutgers is available from the advisor.

Elective studies: A minimum of 18 credits. Courses should be chosen to meet prerequisite requirements of other courses. Four elective courses must be in mathematics, science, computer science, engineering, student's interdisciplinary area, or studies required for graduate professional schools (e.g., business, pre-med or pre-law).

Note: Except as noted above:

Courses developed for BSIA or Engineering Technology programs may not be included in this program.

Each course must carry at least 3 credits. Programming training courses may not satisfy any elective course in this program.

B.A. in Computer Science

COMPUTER SCIENCE
CIS 101 Computer Programming & Problem Solving 2-2-3
CIS 213 Intro. to Computer Science 3-0-3
CIS 331 Machine & Assembly Language Programming 2-2-3
CIS 332 Principles of Operating Systems 2-2-3
CIS 335 Data Structures & Algorithm Design I 3-0-3
CIS 351 Computer Organization 3-0-3
CIS 435 Data Structures & Algorithm Design II 3-0-3
CIS 490 Guided Design in Software Engineering 3-0-3
CIS 491 Computer Science Project 3-0-3

Three CIS courses (9 credits) from the following:

CIS 330 Min Computer Systems CIS 341 Introduction to Logic and Automata CIS 365 Computer Applications to Commercial Problems CIS 438 Programming for Interactive Computer Graphics CIS 453 Microcomputers and Applications CIS 461 Systems Simulation CIS 455 Computer Center Organization CIS 465 Computer Techniques for Management Information

MATHEMATICS
Math 111 Calculus I 4-0-4
Math 112 Calculus II 4-0-4
Math 221 Calculus III 4-0-4
Math 226 Discrete Analysis 3-0-3
Math 333 Probabilities & Statistics 3-0-3
Math 340 Applied Numerical Methods & Organization 3-0-3

SCIENCE
A 2-course sequence (8 credits) of laboratory science in physics, chemistry or biology

HUMANITIES/ORGANIZATIONAL AND SOCIAL SCIENCES
Eng 111 English Composition 3-0-3
Hum 112 Man & Culture in Historical Perspective I 3-0-3
Hum 231 Man & Culture in Historical Perspective II 3-0-3
2 courses in literature, history or philosophy (but not both from the same field)
SS 201 Economics 3-0-3
1 course selected from SS 202, 210, 221, 231 3-0-3
OS 471 Management Practices 3-0-3
1 elective chosen from any 300-400 level course in Hum/SS/OS 3-0-3

**Aerospace Studies Option:* Students in the option should take AS 333334 Leadership Managment for the Professional Officer I and II, instead of OS 471 and the Hum/OSS elective.

Humanities and OSS—One basic social science course chosen from SS 202, SS 210, SS 221 or SS 231. Two upper division courses from Philosophy, History, or Literature; not both from same field. One Hum/OSS elective. Students taking Aerospace Studies option may substitute AS 333 for OS 471, and AS 334 for the Hum/OSS elective.

CIS—Four upper division elective courses as offered by the CIS department.

Interdisciplinary Studies—A sequence of three upper division courses focusing on the quantitative aspects of a discipline which is relevant to Computer Sciences. A list of approved course sequences in a variety of disciplines offered at NJIT or NCAS-Rutgers is attached.

Elective studies—Courses chosen to complement student's program with studies of individual interest and/or complete prerequisite to other courses as needed. Four courses must be elected from mathematics, science, computer science, engineering, student's interdisciplinary area, or studies required for graduate professional schools (e.g., business, pre-med or pre-law).

Note: *Except as noted above*—
Upper division courses must have a 300 or 400 number. Courses developed for BSIA or Engineering Technology programs may not be included in this program. Each course must carry at least 3 credits. Programming training courses may not satisfy any elective course in this program.

FREE ELECTIVES
The student chooses 21 credits of electives which represent a coherent and logical sequence as approved by the student's adviser.
Total Credits: 126

Engineering Science

The engineering science program is intended for students who wish to pursue an individual course of study in an interdisciplinary area of engineering and science. An appropriate selection of courses may serve as a preparation for graduate studies or professional work in one of the interdisciplinary engineering fields, such as nuclear engineering, biomedical engineering, materials science, systems engineering or urban planning.

The curriculum is also intended for students whose interests fall between science and engineering. The complexity of modern engineering problems often requires a team effort involving both scientists and engineers. As a result, the boundary between science and engineering has become indistinct. Many scientists do engineering work, and many engineers are deeply involved in scientific endeavors. The engineering science program provides an education for work at the boundary between science and engineering. The program is designed to give all engineering science students a strong background in both science and engineering.

Qualified students may specialize, for example, in chemistry, environmental science, mathematics, or physics, while at the same time gaining an understanding of the engineering disciplines in which these sciences are applied.

Engineering science is offered as a part-time evening program. However, limited enrollment necessitates offering many of the junior and senior level engineering courses every other year. It is important that the student carefully plan an approved program to insure progress at the normal rate.

Engineering Science Evening Program

FIRST YEAR (see page 20)

SECOND YEAR
1st Semester
Math 221 Calculus III 4-0-4
Mech 230 Statics & Dynamics 4-0-4
SS 201 Economics 3-0-3
Elective 3-0-3
Elective (Technical) 3-0-3

2nd Semester
Math 222 Differential Equations 4-0-4
Phys 231 Physics III 4-2-5
Elective (Soc Sci) 3-0-3
Hum 231 Man & Culture II 3-0-3
Elective 3-0-3

THIRD AND FOURTH YEARS
The following courses are required of all students in engineering science. In addition, students will elect courses to complete the requirements for graduation with approval of their advisor.

OS 471 or OS 472 and an OS contemporary issues elective (Fourth Year)

Four courses in humanities (Third and Fourth Years)

One course in thermodynamics (Minimum of 3 Credits)

Four courses in engineering (Totaling at least 12 Credits)

Two courses in mathematics (Totaling at least 6 Credits)

Two courses in physics, chemistry, or computer science (one area) (Totaling at least 6 Credits)

Degree Requirements

Students must complete at least 24 credits in a field of specialization. The field may include courses in more than one department, but it must represent a coherent and logical occupational objective. The field of specialization should consist of advanced undergraduate courses that show a progression in depth of knowledge in the field. The fourth year must include a course that unifies the background obtained in the field of specialization. The 24 credits may include any of the third and fourth year general requirements.

A minimum of 135 credits is required for the degree of Bachelor of Science in Engineering Science. Individual programs of study must be approved by the Committee on the Undergraduate Engineering Science Program before the student can be officially admitted to the program. No student may register as an engineering science major after the freshman year unless they have been admitted to the program.

Courses in biology, anatomy, physiology and zoology are available at the adjacent Newark campus of Rutgers University. Students who have demonstrated exceptional ability may choose from offerings at the graduate level (see Catalog of Graduate Programs).

Applied Mathematics

Students selecting the option in applied mathematics are required to complete a minimum of 24 credits numbered at the 300-level or higher. Math 332, 337, 491, 545, and 546 should be taken. Math 333 is recommended.

Nuclear Science and Engineering Physics

Two areas of specialization are available: an option in engineering physics and one in nuclear science. The program in the engineering physics option offers a great deal of flexibility. The nuclear option involves studies in modern physics, nuclear physics, nuclear engineering, and applications of theory to design problems in a nuclear reactor laboratory.

Industrial Administration (Management and Business)

The Bachelor of Science in Industrial Administration program applies modern management principles to the administrative operations in both the private and public sectors. Students may specialize in areas such as human resource management, financial administration, information systems management, marketing, and operations management. The program can serve as an entry to a broad range of management positions in business and government. The BSIA Program can also be used as the foundation for graduate study in business administration, management or public administration.

The BSIA curriculum is designed to articulate closely with business transfer programs at county colleges. Students may enter the program as freshmen or as juniors after completing an associate degree at a county college or similar institution.

A minimum of 127 credits is required for the degree of Bachelor of Science in Industrial Administration.

Industrial Administration

FIRST YEAR

1st Semester

Eng 111	English Composition	3-0-3
IM 110	Ind Acct & Budg I	3-0-3
Math 102	Mathematical Concepts***	3-0-3
OS 171	Ind Org & Mgmt	3-0-3
	Elective (Soc Sci)	3-0-3
	Physical Education	0-1-0
	Orientation	1-0-0

2nd Semester

Hum 112	Man & Culture I	3-0-3
IM 111	Ind Acct & Budg II	3-0-3
IM 112	Admin Systems	3-0-3
Math 105	Prob & Statistics	3-0-3
OS 261	Behavioral Science	3-0-3
	Physical Education	0-1-1

SECOND YEAR

1st Semester

Hum 231	Man & Culture II	3-0-3
SS 201	Economics	3-0-3
CIS 202	Comp Prog for Bus Appl	3-0-3
IM 305	Business Statistics	3-0-3
	Elective (Science)	3-0-3

2nd Semester

SS 301	Economic Analysis	3-0-3
OS 381	Pers Mgmt & Ind Rel	3-0-3
	Elective (Humanities)	3-0-3
	Elective (Science)	3-0-3
	Elective (Comp Inf Sci)*	3-0-3

THIRD YEAR

1st Semester

Math 106	Basic Coll Math***	4-0-4
IM 230	Cost Analysis	3-0-3
	Elective (Major)	3-0-3
	Elective (Humanities)	3-0-3
	Elective (Hum or Soc Sci)	3-0-3

2nd Semester

IM 442	Fin of Bus Enterprise	3-0-3
Math 138	General Calculus I***	3-0-3
	Elective (Soc Sci)**	3-0-3
	Elective (Org Sci)	3-0-3
	Elective (Major)	3-0-3
	Elective (Humanities)	3-0-3

FOURTH YEAR

1st Semester

IM 441	Industrial Marketing	3-0-3
OS 457	Tech & Society I	3-0-3
	Elective (Major)	3-0-3
	Elective (Free)	3-0-3
	Elective (Humanities)	3-0-3
	Elective (Major)	3-0-3

2nd Semester

IE 446	Law	3-0-3
OS 458	Tech & Society II	3-0-3
	Elective (Major)	3-0-3
	Elective (Major)	3-0-3
	Elective (Org Sci)**	3-0-3

*Students with a major concentration in human resources management or marketing may substitute an OS course.

Students with a major concentration in financial administration or operations management may substitute IM 339.

**Students with a major concentration in information systems management or operations management may substitute a CIS course.

***Students begin their math sequence with Math 102, 106, or 138. Placement is dependent on previous math background, SAT scores, and Basic Skills test scores.

Field of Specialization

A field of specialization totaling at least 18 credits in a "major elective" must be completed. The area of concentration, planned in consultation with the student's advisor, may include courses in more than one department, but it should be selected with a career objective in mind. Students whose career objective lies in financial administration, human resources management, information systems management, marketing, or operations management, may find the following selection of courses the most appropriate to their needs.

FINANCIAL ADMINISTRATION

IM 333	Public Finance	3-0-3
IM 339	Computerized Mgmt Control	3-0-3
IM 351	Purch & Matls Mgmt	3-0-3
IM 352	Risk Management	3-0-3
IM 445	Managerial Economics	3-0-3
IM 449	Financial Simulation Sem	3-0-3
IM 483	Controllership, Budgeting & Control	3-0-3
IM 484	Investment Management	3-0-3
SS 411	Money & Banking	3-0-3
SS 412	The Financial System	3-0-3
SS 420	International Economics	3-0-3
SS 421	International Business Operations	3-0-3

HUMAN RESOURCE MANAGEMENT

IM 336	Indust Safety Admin	3-0-3
OS 371	Supervision & Emp Rel	3-0-3
OS 391	Labor-Mgmt. Relations	3-0-3
OS 461	Group Development & Dynamics	3-0-3
OS 473	Employee Mgmt Commun	3-0-3
OS 475	0rg Strategies for Productivity Improvement	3-0-3
OS 481	Job & Wage Analysis	3-0-3
OS 482	Training & Development	3-0-3
OS 484	Admin of Equal Employment Opportunity Programs	3-0-3
	Industrial Psychology	3-0-3
SS 402	Labor Market Analysis	3-0-3
SS 403	Social Insurance & Employee Benefits	3-0-3

INFORMATION SYSTEMS MANAGEMENT

CIS 213	Introduction to Computer Science	3-0-3
CIS 330	Mini-Computer Systems	3-0-3
CIS 331	Mach & Assem Lang Prog	3-0-3

CIS 335	Data Structures & Algorithms I	3-0-3
CIS 337	Programming Syst Libraries	3-0-3
CIS 351	Computer Organization	3-0-3
CIS 365	Computer Applications to Commercial Problems	3-0-3
CIS 435	Data Structures & Algorithms II	3-0-3
CIS 455	Computer Center Organization	3-0-3
CIS 461	System Simulation	3-0-3
CIS 465	Computer Techniques for Mgmt Info Systems	3-0-3
MARKETING		
SS 311	Industrial Psychology	3-0-3
SS 314	Consumer Behavior	3-0-3
SS 316	Promotion, Persuasion & Marketing	3-0-3
SS 401	Economics of Consumption	3-0-3
OS 281	Advertising	3-0-3
OS 461	Group Development & Dynamics	3-0-3
IE 457	Marketing Distribution Systems	3-0-3
IM 351	Purchasing & Materials Management	3-0-3
IM 445	Managerial Economics	3-0-3
OPERATIONS MANAGEMENT		
IM 329	Management Science in Business	3-0-3
IM 351	Purchasing & Materials Management	3-0-3
IM 448	Production Simulation Seminar	3-0-3
IM 483	Budgeting & Control	3-0-3
IET 419	Work Measurement Techniques	3-0-3
IET 420	Quality Control	3-0-3
OS 371	Supervision & Employee Relations.	3-0-3
OS 391	Labor-Management Relations	3-0-3
OS 475	Org Strategies for Productivity Improvement	3-0-3
OS 482	Training & Development	3-0-3
CIS 365	Computer Applications to Commercial Problems	3-0-3
SS 402	Labor Market Analysis	3-0-3

Man and Technology

The Man and Technology program provides a liberal education for a technological age. It resembles a liberal arts program in the flexibility of its requirements. It differs from such programs by virtue of its strong technical component. The program is designed for those who seek an analytical understanding of the role of science and technology in society but who do not necessarily plan to pursue a technical career.

The degree requirements are stated broadly rather than in terms of specific courses. Students can therefore design a program of study that meets their own interests and goals. The full range of courses offered at NJIT is available to students in the Man and Technology program. Through established cross-registration procedures, all courses at Rutgers-Newark College of Arts and Sciences are also available. With this great diversity of building blocks, a wide variety of specific programs is possible.

Here are a few possibilities for interdisciplinary concentrations:

- Students seeking a career in patent law or environmental law can combine courses in the social sciences and the communications arts with courses in engineering as preparation for law school.
- Students planning a career in science writing—as a science reporter for popular media or as an editor for a technical journal—can develop a technical background while learning writing skills.
- Students interested in understanding the impact of technology on the environment can choose from an array of courses in biology, ecology, and environmental engineering.
- Students concerned about the problems of cities can select courses in urban history, urban economics, urban sociology, planning, architecture, and urban housing.
- Students focusing on the growing field of technology assessment can structure their program around courses in history of technology, economics, sociology, and political science while also learning the methodology of engineering.

After an initial orientation meeting, entering students will submit a tentative program of study, developed in consultation with a faculty advisor knowledgeable in the area of the student's interest. This program will be tailored to the interests of the individual student while satisfying general degree requirements. During the first semester of the junior year, students will be assisted by their advisor in developing a final course of studies as well as a brief outline of their proposed senior project. Later changes can be made, with advisor approval.

The Man and Technology program is supervised by a faculty committee chaired by Dr. John Pattinson, Chair of the Humanities Department. The program coordinator is Dr. John E. O'Connor.

Degree Requirements

In completing the requirements for a Bachelor of Science degree in the Man and Technology program, each student must meet the following general requirements:

Total Credits: a minimum of 124 credits is required for the degree; of this total, 60 credits must be in junior-senior level courses (courses numbered 300 or above).

Fundamental Areas: a minimum of 15 credits must be completed in each of the four fundamental areas listed below. It is expected that students will concentrate on these requirements in their first two years. However, completion may be extended into the junior and senior years.

Natural Science: at least two courses in mathematics and two courses in a laboratory science (biology, chemistry, geology, physics).

Social Sciences: economics, geography, political science, psychology, sociology.

Humanities: English, history, philosophy, the arts.

Engineering and Engineering Science: chemical, civil, electrical, industrial, mechanical engineering, computer science, and mechanics OR architecture: a combination of courses in architecture, engineering, engineering science, and computer science.

Interdisciplinary Concentration: At least 24 credits in junior-senior level courses, which must be a coherent, related combination of an engineering or engineering field with one of the other three major fields.

Man and Technology core curriculum: 12 credits in final two years.

Junior Year

MT 308: Alternative Technologies (3 credits)
ME 310: Technology and Human Values (3 credits)

Senior Year

MT 490 and MT 491: Project and Seminar (6 credits). This project must be proposed and approved in the junior year and initiated in the first semester of the senior year. The project will require a definition of aims, a search of the literature, and the application of skills and knowledge acquired in formal course work. It may also require consultation with persons in academic, governmental, and industrial fields. Students will work closely with one or more faculty advisors as they define and execute their projects. A weekly seminar will be an important component of the senior projects course. The seminar will be devoted to a critical examination of the interactions of science, technology, and society. Presentations will be made by students and faculty from a wide range of disciplines.

Statistics and Actuarial Science

Actuarial science concerns itself with the application of mathematical probability to the design of financially sound insurance and pension programs which satisfy the public's needs. Actuaries forecast probable development in areas such as life expectancy and pension plans.

Career advancement is heavily dependent upon passing a series of examinations sponsored by the professional actuarial societies. The Society of Actuaries gives 10 examinations for the life and health insurance and pension fields. The Casualty Actuarial Society gives 10 examinations for the property and liability field. The curriculum leading to the B.S. in Statistics and Actuarial Science prepares the graduate for the first four of these examinations which are common to both fields.

Statistics is the collection and analysis of numerical data for the purpose of solving problems. The statistician might help a scientist design an experiment so that the data obtained lend themselves to clear and meaningful analysis. The statistician might design a sampling and polling technique for an automobile company to determine which design features are popular with consumers. A statistician might compile data on weather patterns to help predict future climate. Statisticians become adept in the technique of sampling—the careful analysis of a small number of data to predict how a much larger number will behave.

The curriculum at NJIT is designed to give the graduate a strong foundation in mathematics, training in communication skills, and a broad liberal arts education which enables the individual to better understand the world

in which actuaries and statisticians practice their profession.

Curriculum—Actuarial Science

FIRST YEAR
1st Semester

Math 111	Calculus I	4-0-4
Math 141	Intro Act Sci	3-0-3
CIS 202	Computer Prog	3-0-3
	Elective (Sci)	3-0-3
Eng 111	Composition	3-0-3
	Phys Ed	0-1-0

2nd Semester

Math 112	Calculus	4-0-4
Math 142	Data Analysis	3-0-3
Hum 112	Man & Culture I	3-0-3
CIS 213	Computer Sci	3-0-3
	Elective (Sci)	3-0-3
	Phys Ed	3-0-3

SECOND YEAR
1st Semester

Math 221	Calculus III	4-0-4
Math 337	Linear Algebra	3-0-3
SS 201	Economics	3-0-3
	Elective (Free)	3-0-3
	Elective (SS)	3-0-3

2nd Semester

Math 226	Discrete Anal	4-0-4
Math 242	Intro to Stat	3-0-3
Math 244	Intro to Probability	3-0-3
SS 301	Economic Anal	3-0-3
Hum 231	Man & Culture II	3-0-3

THIRD YEAR
1st Semester

Math 341	Prob & Stat I	3-0-3
CIS 421	Numerical Calc	3-0-3
IM 352	Risk Mgt	3-0-3
	Elective (Hum)	3-0-3
	Elective (Free)	3-0-3

2nd Semester

Math 342	Prob & Stat II	3-0-3
Math 334	Math for Mgt Sci	3-0-3
	Elective (Free)	3-0-3
	Elective (IM)	3-0-3

FOURTH YEAR
1st Semester

	Elective (IM)	3-0-3
	Elective (OSS/SS)	3-0-3
	Elective (Free)	x-x-6

2nd Semester

SS 403	Social Ins	3-0-3
	Elective (Hum)	3-0-3
	Elective (Free)	3-0-3

Notes:
Total Program Credits—125
Total Required Credits—83
Total Free Elective Credits—18
Total Mathematics Credits—53

Curriculum—Statistics

FIRST YEAR
1st Semester

Math 111	Calculus I	4-0-4
Eng 111	Composition	3-0-3
CIS 202	Computer Prog	3-0-3
	Elective (Free)	3-0-3
	Elective (Sci)	3-0-3
	Phys Ed	0-1-0

2nd Semester

Math 112	Calculus II	4-0-4
Math 142	Data Analysis	3-0-3
Hum 112	Man & Culture I	3-0-3
CIS 213	Computer Sci	3-0-3
	Elective (Sci)	3-0-3
	Phys Ed	0-1-0

SECOND YEAR
1st Semester

Math 221	Calculus III	3-0-3
Math 337	Linear Algebra	3-0-3
	Elective (Free)	3-0-3
SS 201	Economics	3-0-3
	Elective (SS)	3-0-3

2nd Semester

Math 226	Discrete Anal	4-0-4
Math 242	Intro to Stat	3-0-3
Math 244	Intro to Probability	3-0-3
SS 301	Economic Anal	3-0-3
Hum 231	Man & Culture II	3-0-3

THIRD YEAR
1st Semester

Math 341	Prob & Stat I	3-0-3
CIS 421	Numerical Calc	3-0-3
	Elective (Hum)	3-0-3
	Elective (Free)	6-0-6

2nd Semester

Math 342	Prob & Stat II	3-0-3
Math 334	Math for Mgt Sci	3-0-3
	Elective (Free)	6-0-6

FOURTH YEAR
1st Semester

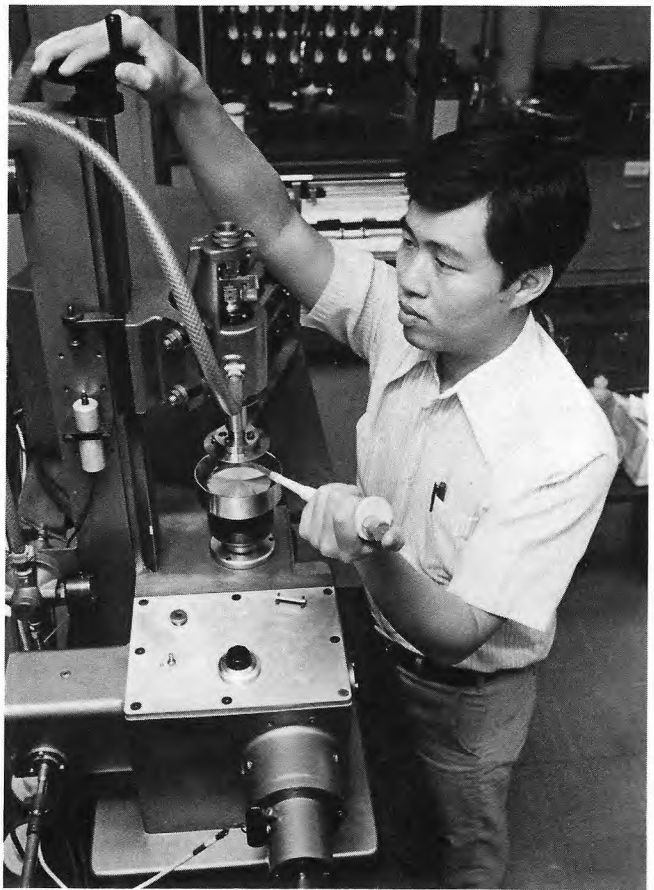
	Elective (OSS/SS)	3-0-3
	Elective (Free)	6-0-6

2nd Semester

	Elective (Hum)	3-0-3
	Elective (Free)	9-0-9

Notes:
Total program credits—125
Total required credits—74
Total free elective credits—33
Total mathematics credits—50

Elective Course Requirements for both programs:
All electives are to be selected in consultation with an advisor.
The first year science electives must be laboratory courses.
The social science elective in the second year must be one of the these courses: SS202—Labor Relations, SS210—General Psychology, SS221—Sociology, SS231—Political Science.
The IM electives in the third and fourth year must be at 300- or 400- level.
The OSS/SS elective in the fourth year must be a 400 level course.




PERIODIC TABLE OF THE ELEMENTS

Courses of Instruction

GUIDE TO COURSE DESCRIPTIONS

Courses numbered between 100 and 199 are normally taken by freshmen.
Courses numbered 200-299 are normally taken by sophomores.
Courses numbered 300-399 are normally taken by juniors.
Courses numbered 400-499 are normally taken by seniors.
Courses numbered 500-599 are graduate courses open to undergraduates with adviser's approval, except in the School of Architecture where such courses are taken by fifth-year undergraduate students.

The numbers after each course (e.g., 3-3-4) represent the recitation hours, laboratory hours, and credits, respectively.

Listed prerequisites must be completed before registering for a course. A prerequisite may be waived only with written permission of the department offering the course.

Aerospace Studies

Chair: Gary E. Brown
Professor: Brown
Assistant Professors: Arocho, Kaufhold, Russell

AS111
United States Military Forces in the Contemporary World I 1-1-1
This introductory course explores the doctrine, mission, and organization of the United States Air Force. It examines the mission and weaponry of the U.S. strategic offensive and defensive forces—including the Army-Navy and the function and employment of nuclear weapons. There is also a study of the technological and political significance of a missile defense system. One hour of class and one hour of Leadership Laboratory per week.

AS112
United States Military Forces in the Contemporary World II 1-1-1
Prerequisite: AS 111 or approval of the Professor of Aerospace Studies. This course is a study of U.S. general purpose forces and aerospace support forces. It explores the mission, resources, and operation of tactical air forces and their role in limited warfare. The support functions of research, logistics, and education are also introduced. One hour of class and one hour of Leadership Laboratory per week.

AS221
Development and Growth of Air Power I 1-1-1
Prerequisite: AS 112 or approval of the Professor of Aerospace Studies. This course examines the development of air power over the past 60 years. It traces the development of various concepts of employment of air power and focuses on factors which have prompted research and technological change. One hour of class and one hour of Leadership Laboratory per week.

AS 222
Development and Growth of Air Power II 1-1-1
Prerequisite: AS 221 or approval of the professor of Aerospace Studies. This course stresses the variety of events and elements in the history of air power especially where these provide significant examples of the impact of air power on strategic thought. One hour of class and one hour of Leadership Laboratory per week.

AS333
Leadership and Management for the Professional Officer I 3-1-3
Prerequisite: AS 222 or approval of the professor of Aerospace Studies. This seminar course explores the theory, function, and practice of leadership as applied to specific situations. A broad introduction to general management principles and philosophy is also highlighted. Emphasis is placed on the analysis, practice, and refinement of communicative skills. Three hours of class and one hour of Leadership Laboratory per week.

AS334
Leadership and Management for the Professional Officer II 3-1-3
Prerequisite: AS 333 or approval of the professor of Aerospace Studies. This seminar course details management principles, tools, practices, and controls used by the junior military officer. Emphasis is placed on management philosophy and ethics, as well as further refinement of communicative skills in a managerial environment. Both the decision-making process and the execution of decisions are discussed. Three hours of class and one hour of Leadership Laboratory per week.

AS443
National Security Forces in Contemporary American Society I 3-1-3
Prerequisite: AS 334 or approval of the professor of Aerospace Studies. Focusing on the American Armed Forces as an integral element of American society, this course examines a broad range of topics related to American civil and military relations and the environmental context in which U.S. defense policy is formulated. Specific topics include the role of the professional soldier in a democratic society; socialization processes within the American military forces; and the requisites for maintaining adequate national security forces. A special emphasis will be placed on the communicative skills in the context of the course material. Three hours of class and one hour of Leadership Laboratory per week.

AS444
National Security Forces in Contemporary American Society II 3-1-3
Prerequisite: AS 443 or approval of the professor of Aerospace Studies. Focusing on the Armed Services as an integral part of the world society, this course examines the broader range of American civil-military relations and the environmental context formulating defense policy. Special themes emphasized are: political, economic, and social constraints upon the national defense structure; impact of technological and international developments upon strategic preparations and the policy-making process; and a futuristic look into the world diplomatic-military scene. A special topic is the Laws of War and American military law highlighted by a study of military justice and its effect on the citizenship. Three hours of class and one hour of Leadership Laboratory per week.

Architecture

Dean: Sanford Greenfield
Associate Dean: Leslie Weisman
Professors: Sanford Greenfield, Richard Hatch
Associate Professors: David Elwell, Karen Franck, David Hawk, Barry Jackson, Karl Linn, Sandra Moore, Michael Mostoller, Anatole Senkevitch Jr., Don Wall, Michael Webb, Leslie Weisman, Troy West, Stephen Zdepski
Assistant Professors: Glenn Goldman, Jeffrey Hannigan, Susan Henderson, Anthony Schuman
Research Professor: Ervin Bales

Arch 103
Introduction to People and their Environment I 3-0-3
This introduction to design presents an overview of the relationship between people and their environment, both natural and manmade. The emphasis is on seeing and comprehending what is around us, identifying and discussing the forces of change at work in the environment, and clarifying the role of the environmental designer. Supplementing the faculty lectures will be guest lecturers and field trips to significant environments and professional design offices.

Arch 104
Introduction to People and their Environment II 3-0-3
Prerequisite: Arch 103. This course is a continuation of Arch 103.

Arch 154
Architectural Graphics 1-3-2
Techniques of graphic presentation constitute the basic language of architecture. This course familiarizes students with a broad range of graphic expression and develops skills in technical drawing. The course progresses through fundamental architectural delineation to perspective drawing, rendering techniques, layout format, presentation graphics, and reproduction media.

Arch 161
Introduction to Design I 0-9-3
This course is an introduction to the basic principles and elements of design with emphasis on design methodology, sensitivity to context function, and communications skills. The course draws upon many areas of design, particularly architectural and industrial design, and constructs a systematic introduction to these fields.

Arch 162
Introduction to Design II 0-9-3
Prerequisite: Arch 103 and 161. This course continues the design fundamentals introduced in Arch 161.

Arch 251
History of Architecture I 3-0-3
(formerly Arch 111)
Prerequisite: Hum 112. This course is a survey of the social, political, technological, functional, and aesthetic concerns of Western architecture from its earliest beginnings.

Arch 252
History of Architecture II 3-0-3
(formerly Arch 112)
Prerequisite: Hum 231. This course is a continuation of Arch 251, bringing the survey of the continuing evolution of Western architectural works and ideas up to the present day.

Arch 254
Structures I 2-0-2
Prerequisite: Physics 102. This course covers the details and methods of timber construction and the functions and responsibilities of the architect during the structural design phase of buildings. Structural design is taught in the context of architectural design and cost estimating. The emphasis is on practicality and economy, with an exploration also of the implications of non-standard structures.

Arch 255
Architectural Construction I 2-0-2
Prerequisite: Arch 154. This course is an introduction to the construction process and its relationship to architectural design. The study of materials and methods of construction is concerned primarily with wood and masonry construction and is presented through lectures, exercises, case studies, and site visits.

Arch 256
Architectural Construction II 2-0-2
This course is a continuation of Arch 255, relating construction process to architectural design. The study of materials and methods of construction is concerned primarily with heavy timber and steel construction and is presented through lectures, exercises, case studies, and site visits.

Arch 261
Architecture Studio I 1-12-5
Prerequisite: Arch 162. This studio course continues to build upon the concepts introduced in Arch 161 and 162. The lecture hour explores in depth the nature of technology, environment, and social order as they relate to studio work.

Arch 262
Architecture Studio II 1-12-5
Prerequisite: Arch 261. This studio course continues to build upon the design concepts introduced in Arch 261. The lecture hour explores in depth the nature of technology, environment, and social order as they relate to studio work.

Arch 283
Special Topics 3 credits
Group investigation of problems of special interest in Architecture.

Arch 312
Environmental Education I 2-3-3
Prerequisite: Arch 262. This course involves architecture students in working with grade school or high school students in the solution of a joint environmental design project. Participants will first work towards developing their own understanding and sensitivity of the manmade environment. Emphasis will be on learner-directed and discovery-guided inquiry and educational methods to increase awareness of the physical settings created for human activities. Projects will be 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 213. This course introduces both philosophical and technical approaches to the use of the computer in architectural design and analysis. It explores the use of existing computer programs for spatial allocation, energy analysis, life cycle costing, problem analysis, and computer simulation. Projects will include development of computer programs applicable to architecture.

Arch 317
Advanced Architectural Graphics 2-3-3
Prerequisite: Arch 262. This course will give students advanced techniques for architectural expression, including Chinese ink wash and air brush techniques. It will emphasize 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 (formerly Arch 218)
Prerequisite: Arch 359. This course 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 will encompass a section and/or representative aspect of the city's evolution.

Arch 321
Radical Architecture 3-0-3
(formerly Arch 212)
Prerequisites: Arch 252, Arch 359, Arch 363. This course offers a broad-based exploration of art and architecture as a form of individual, social, or cultural expression, stressing the relationship between ideas and craft.

Arch 328
Urban Values 2-3-3 (formerly Arch 216)
Prerequisite: Arch 359. This course is a survey of urban planning practice and historical contemporary, and theoretical urban design approaches. It considers the physical environment as a response to human values and explores how nature, the city, and the human user influence the form and content. Case studies will include cities, towns, and specialized recreation and retirement communities. Laboratory work will include field trips, demonstration exercises and analysis of case studies.

Arch 351
Landscape I 2-0-2
This course is an overview of the opportunities and constraints of landscape manipulation. The emphasis is on developing a basic practical understanding of the place-shaping power of earth, water, and plants. Lectures consist of illustrated presentations of information and ideas and discussions of completed coursework projects. Assignments are exploratory and/or manipulative exercises based on class sessions and printed materials.

Arch 352
Landscape II 2-0-2
This course is an overview of landscape design and site planning methods. The emphasis is on building an understanding of social and ecological determinants and applying them to problem solving. Case studies are used for demonstration and practice. Lectures consist of illustrated presentations of information and ideas and discussions of student work. Assignments are varied and include a cumulative mapping exercise based on individual and team research.

Arch 353
Building Performance 1 2-0-2
Prerequisite: Physics 102, 103. Building Performance I develops the physical concepts of heat, air movement, and thermal mass into the context of building construction and design. The course explores the use of thermal qualities as expressive and analytical elements of building design in response to the subtle characteristics of the natural environment.

Arch 354
Building Performance II 2-0-2
Prerequisite: Arch 353. This course continues with the subject matter introduced in Architecture 353. It develops concepts of dynamic thermal analysis and passive solar design and emphasizes energy conservation. This course also focuses upon qualitative and quantitative methods of daylighting design, building systems detailing, and architectural economics.

Arch 355
Structures II 2-0-2
Prerequisites: Arch 254. This course covers details and methods of steel construction and the functions and responsibilities of the architect during the structural design phase of buildings. Structural design is taught in the context of architectural design and cost estimating. The emphasis is on practicality and economy, with an exploration also of the implications of non-standard structures.

Arch 356
Structures III 2-0-2
Prerequisite: Arch 355. This course covers details and methods of concrete construction and functions and responsibilities of the architect during the structural design phase of buildings. Structural design is taught in the context of architectural design and cost esti-

mating. The emphasis is on practicality and economy, but with exploration also of the implication also of the implications of non-standard structures.

Arch 359
Architecture in Society 2-0-2
Corequisite: Arch 363. This course views architectural design from a sociological perspective to examine the impact of social concerns on design. Relevant methods are introduced to gather information in social science modes for use in design programming and development.

Arch 362
Environmental Product Design 2-3-3
(formerly Arch 219)
Prerequisite: Arch 353. This lecture/seminar/workshop encompasses the design, workshop fabrication, and testing of environmental products such as small-scale shelters, exhibit systems, and furniture. Particular emphasis will be placed on understanding the nature of materials and mass production processes and on acquiring workshop skills.

Arch 363
Architecture Studio III 1-12-5
Prerequisite: Arch 262. Corequisite: Arch 359. This studio course continues to build upon the design concepts introduced in Arch 262. The lecture hour explores in depth the nature of technology, environment, and social order as they relate to studio work.

Arch 364
Architecture Studio IV 1-12-5
Prerequisites: Arch 363 and Arch 359. This studio course continues to build upon the design concepts introduced in Arch 363. The lecture hour explores in depth the nature of technology, environments, and social order as they relate to studio work.

Arch 370
Architectural Programming 2-0-2
This course establishes the relationship between people's activity and architectural intention through systemmatic development of goals, performance requirement, and concepts. Programming is approached as information management in terms of gathering, analyzing, and presenting data useful to design. Students participate in assignments requiring activity analysis, casual and systematic observation, photo documentation, and the reading of relevant literature. Students develop a complete schematic design program as a final project. Students choosing to do a thesis may use the final project as an opportunity to develop a program for their thesis design.

Arch 383
Special Topics 3 credits
Group investigation of problem of special interest in Architecture.

Arch 403
The American Home and Household I 3-0-3
This course is a cultural, and psychological analysis of various 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 will 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: SS 221. This course analyzes the architecture of the 20th century American homes and households—hotels, apartment houses, war housing, suburban homes, public projects, communes, self-help housing, and housing concepts for the future. Psychological, sociological, and cultural perspectives will also be considered insofar as they affect the architecture of the home.

Arch 408
Advanced Landscape Architecture 2-3-3
Prerequisite: Arch 352. This course introduces students to the design, construction and management of significant contemporary landscape project through case studies, field trips, and personal contact with prominent practicing landscape architects. An historical perspective of landscape architecture since World War II will be used as a context for discussion.

Arch 412
Construction Codes and Specifications
3-0-3
Prerequisite: CE 210 or CET 313, and senior standing in the BSCE or BSET program or fourth/fifth year standing in Architecture. This course deals with the code and specification aspects of engineered construction. Topics to be covered are: professional ethics, contracts, specifications, bidding procedures, building codes such as BOCA and New Jersey Uniform Construction Code, Energy Code Provisions, construction safety, and the impact of the OSHA and EPA on construction. (This course is the same as CE 412.)

Arch 419
Architectural Photography 2-3-3
Prerequisite: Arch 364. This course is designed to give the student a wide range of photographic solutions for presentations and portfolios. Lectures will consist of orientation on general topics, including light and space, using relevant text selections, and slide presentations for reinforcement. There will be basic demonstrations of darkroom techniques and unorthodox methods to encourage experimentation.

Arch 422
Mythical House 3-0-3 (formerly Arch 213)
Prerequisites: Arch 252, 359, and 363. This course will show 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 451
History of Architecture III 3-0-3
Prerequisite: Arch 252. From Vitruvius to the present, thoughtful architectural practice has been guided by theory. Architectural theory deals with these questions: What is the relationship between architecture and the society that produces it? What meanings can architecture convey and how are they encoded in the built environment? What is the role of history in design? What is the proper relationship between the architect and the public? Students will read the major figures in the history of architectural theory, including Vitruvius, Alberti, Palladio, Perrault, Boulee, Ruskin, Frank Lloyd Wright, Le Corbusier, and Robert Venturi. The course will relate the theoretical precepts to the historical moment in which they arise and the body of work they generate.

Arch 452
History of Architecture IV 3-0-3
Prerequisite: Arch 451. This course examines the evolution of urban forms in terms of the social, economic, and technological forces which shape our cities. The focus is on the conscious intervention of the design professional architect, planner, urban designer seeking to humanize the city. The course traces major movements in planning and urban design from the 18th century to the present day.

Arch 453
Environmental Control Systems I 2-0-2
Prerequisite: Arch 354. This course provides students with the necessary background to discuss the advantages and disadvantages of alternative system designs with consulting engineers and to carry out lifecycle cost analyses of building systems. The course will focus on the major components of the mechanical, electrical, plumbing, and transportation systems of buildings.

Arch 454
Environmental Control Systems II 2-0-2
Prerequisite: Arch 453. A continuation of Arch 453. This course provides a framework for making intelligent selections of building systems and equipment.

Arch 455
Architectural Construction III 2-0-2
Prerequisite: Arch 256. This course continues Architecture 256. It presents the study of steel construction and introduces precast and poured-in-place concrete construction. Through lectures, exercises, case studies, and site visits the construction of buildings is investigated from the ground up.

Arch 456
Structures IV 2-0-2
Prerequisite: Arch 356. This course is a synthesis of structural systems derived from wood, steel, and concrete construction. The behavior and application of structures are investigated in terms of skeletal, surface, and solid systems. Emphasis is on evaluating alternative structural solutions as considerations in architectural design.

Arch 463
Architecture Studio V 1-12-5
Prerequisite: Arch 364. This studio course continues to build upon the design concepts introduced in Arch 364.The lecture hour explores in depth the nature of technology, environment, and social order as they relate to studio work.

Arch 464
Architecture Studio VI 1-12-5
Prerequisite: Arch 463. This studio course continues to build upon the design concepts introduced in Arch 463.The lecture hour explores in depth the nature of technology, environment, and social order as they relate to studio work.

Arch 483
Special Topics 3 credits
Group investigation of problems of special interest in Architecture.

Arch 491
Independent Study 1 credit

Arch 492
Independent Study 2 credits

Arch 493
Independent Study 3 credits

Arch 532
Contemporary Architectural Theory Seminar 3-0-3
Prerequisites: Arch 452 or equivalent. The seminar will concentrate on major contemporary architectural theories and methods. Discussion will include a range of design approaches from the corporate to the populist, from post-modern and semiotics to the Italian rationalists, from neo-vernacular to high-tech. Other topics of study will include the use of energy efficiency, social psychology, advocacy and typology as design strategies. The seminar will focus on both the specific relationship between built projects and stated theoretical format and the more general development of theory as an outgrowth of contemporary history.

Arch 533
Case Studies in Architectural Creativity 3-0-3
Prerequisite: Arch 364. This course considers creativity in architecture from psychological, philosophical, and autobiographical perspectives. The buildings, writings, and lives of contemporary architects will be discussed in the context of general theories of creativity. Each student will choose an individual architect noted for creative accomplishments and prepare a case study of his/her life.

Arch 541
Experiments in Structural Form 2-2-3
Prerequisites: Arch 456 or equivalent. Study of structural form through model design, construction and testing of minimum structures. Inquiry into the relationship between elements of soap film study, orthogonal and diagonal grids, design of tension grids through deflection loading, photoelastic models and calculation. Studies the relationship between structural form, geometric systems, patterning and proportion, symmetry, asymmetry, relative scale, nesting, linearity and spiral orders, rectilinear patterns, randomness resulting in architectural structure and form.

Arch 542
Regulatory Codes and Standards for Architectural Construction 3-0-3
Prerequisites: Arch 554. The course explores the varity of standards and regulations which affect the evolution of a building from preliminary design through occupancy. Topics include building codes, life safety and comfort, structural performance, environmental protection, construction products and systems standards, materials testing, zoning, land use, and esthetic restrictions, etc. Regulations are analyzed for their impact upon various building types such as residential development, or specialized uses such as hospital and research laboratories.

Arch 546
Designing and Optimizing the Building Enclosure 3-0-3
Prerequisite: Arch 354, 362, CIS 101. This course considers the "building envelope", the boundary dividing the inside of a structure from the outside environment. Students will study and design optimal enclosures considering energy exchange, the relationship between energy and light, and life cycle costs.

Arch 551
Problems in Modern Housing 2-0-2
Prerequisite: Arch 452. There is an evident crisis in the ability of our country to provide decent, well-designed housing at affordable prices. The crisis extends not only to well-known examples of urban decay like New York's South Bronx but to the rise in construction and financing costs which puts the American dream home beyond the reach of 85% of our people. This course is designed to explore the economic and political roots of current housing policy and practice and to review the history of urban/suburban housing models which have developed since the mid-19th century.

Arch 554
Professional Architecture Practice 2-0-2
Prerequisite: fourth year standing. This course is a forum for examination of the nature of the profession and the formal and informal relationship among architects, clients, and other persons in organizations involved in design and construction.

Arch 563
Architecture Studio VII 1-12-5
Prerequisite: Arch 464. This course continues to build upon the concepts introduced in Arch 464. The lecture hour explores in depth the nature of technology, environment, and social order as they relate to studio work.

Arch 564
Architecture Studio VIII 1-12-5
Prerequisite: Arch 563. This studio course continues to build upon the design concepts introduced in Arch 563.

Arch 566
Senior Thesis 0-15-5
Prerequisite: Arch 563. This is an independent study option which may be chosen by the student, with the approval of the school, in place of Arch 564.

Arch 583
Special Topics 3 credits
Group investigation of problems of special interest in Architecture.

Arch 591
Independent Study 1 credit
Prerequisite: 3.0 G.P.A.

Arch 592
Independent Study 2 credits
Prerequisite: 3.0 G.P.A.

Arch 593
Independent Study 3 credits
Prerequisite: 3.0 G.P.A.

Chemical Engineering and Chemistry

Chair: Deran Hanesian
Associate Chair: John E. McCormick (Chemical Engineering)
Associate Chair: Howard Kimmel (Chemistry)
Assistant Chair: Donald Getzin (Freshman Chemistry Program, Ching R. Huang (Graduate Program)

Chemical Engineering Staff:
Professor: Hanesian, Huang, McCormick, Perna, Roche, Tassios
Associate Professor: Greenstein, Lewandowski
Assistant Professors: Aba-El-Bary, Armenante, Baltzis, Bart, Knox, Petroulas, Wong
Visiting Professors: Hundert, Lichtman, Wang
Chemistry Staff:
Professors: Bozzelli, Greenberg, Greenstein, Kimmel, Kristol, Parker, Shilman, Suchow, Trattner
Associate Professors: Dauerman, Getzin, Grow, Kebbekus, Lambert, Lei, Perlmutter, Tomkins
Assistant Professors: Cagnati, Gund, Venanzi
Special Lecturers: Conley, Kononeko, Levine

CHEMICAL ENGINEERING

ChE 227
Chemical Process Principles I 3-0-3
Prerequisites: Chem 116, CIS 101, Math 112. An introduction to the analysis of chemical processes, with special emphasis on mass balances.

ChE 228
Chemical Process Principles II 3-0-3
Prerequisite: ChE 227. A continuation of ChE 227 with special emphasis on energy balances.

ChE 310
Work Experience I
Prerequisites: completion of the sophomore year, approval of the department, and permission of the director of cooperative education. Cooperative education work experience of six months for the first working period. Only CO-OP students can register for this course.

ChE 311
Work Experience II
Only CO-OP students can register for this course for the second-six-month work experience. See ChE 310 above.

ChE 345
Chemical Engineering Thermodynamics I 3-0-3
Prerequisites: ChE 228, Chem 232. The thermal properties of matter are studied and interpreted in terms of the fundamental concepts and laws of thermodynamics. Generalized methods for handling P-V-T relations and thermodynamic properties of fluids are considered. Batch and flow processes are studied.

ChE 346
Chemical Engineering Thermodynamics II 3-0-3
Prerequisite: ChE 345. The concepts and methods developed in ChE 345 are applied to the treatment of compressors, heat engines, refrigeration, phase equilibria, and chemical reactors. The student is introduced to the thermodynamic analysis of practical processes as a method for the evaluation of energy utilization.

ChE 349
Reaction Kinetics 3-0-3
Prerequisities: Chem 335, ChE 228. A study of the mechanisms and kinetics of homogenous chemical reactions in batch and flow reactors, and the applications of kinetics to both isothermal and nonisothermal reactor design. An introduction to the kinetics of heterogenous catalytic reactions and reactor design is included.

ChE 363
Transport Operations I 3-0-3
Prerequisites: ChE 228. The principles of the molecular and turbulent transport of momentum, heat, and mass with applications to the design of chemical process equipment are considered. This first semester of a three-course sequence emphasizes momentum transport, with applications.

ChE 364
Transport Operations II 3-0-3
Prerequisites: ChE 363, Math 222. A continuation of ChE 363, emphasizing heat transport, with applications.

ChE 444
Introduction to Polymer Engineering 3-0-3
Prerequisites: ChE 349, Math 221. An introductory course in basic concepts of polymer engineering. Topics covered include nature of high polymers, rheology, polymerization kinetics, and stability and control of polymerizations.

ChE 455
Process Synthesis and Evaluation 3-0-3
Prerequisite: ChE 364. This course provides chemical engineers with a working knowledge of the technical fundamentals and current practices in process synthesis and process evaluation. The concepts covered are essential for implementing the decisions made by engineers working in research, development, design, operations, and management.

ChE 466
Pollution Control in Chemical Processes 3-0-3
Prerequisite: ChE 467 or 551. This course applies chemical engineering principles to problems of pollution. The emphasis will be on the treatment of various side and discharge streams that are environmentally undesirable. A case study approach is used to evaluate processes and pinpoint pollution sources. Quantitative designs and calculations will be required.

ChE 467
Transport Operations III 4-0-4
Prerequisites: ChE 346, ChE 364. This course completes the transport operations sequence. It covers mass transfer operations, simultaneous heat and mass transfer, and simultaneous mass and momentum transfer operations. The course relates these basic operations to design equipment specification.

ChE 468
Air Pollution Control Principles 3-0-3
Prerequisite: Chem 335 or undergraduate thermodynamics. Introduction to the problems of air pollution control. Pollutant identification, inventory, monitoring, and sampling are included. Aerochemistry and methods for minimizing air pollution are also covered.

ChE 472
Process and Plant Design 4-0-4
Prerequisites: ChE 349, and ChE 467. The process and equipment design of process units is covered, focusing on process design, equipment selection, and process-equipment parameter studies. The emphasis of the process design segment is to cover, for a process, the flow sheet and equipment sequence as related to raw materials and location factors, establishment of process operating conditions, and preparation of necessary material and energy balances. The second segment concentrates on the preparation of preliminary investment and operating cost estimates, incorporating the size and/or selection of equipment, and the utility and instrumentation requirements. The third segment is an exposure to the interrelationships of process and design variables via the utilization of process simulation programs available on the Institute's computing facilities.

ChE 473
Mathematical Methods in Chemical Engineering 3-0-3
Prerequisite: ChE 364. Matrix operations, Fourier series, and numerical methods are developed and applied to the solution of problems in chemical engineering. Numerical results and use of computers are required.

ChE 475
Process Dynamics and Control 4-2-5
Prerequisites: ChE 364, ChE 349. Integrated theory and laboratory course. An introduction to the principles of process dynamics and control with applications to the automatic control of chemical processes. Mathematical description and analysis of chemical process systems.

ChE 476
Introduction to Biochemical Engineering 3-0-3
Prerequisites: Chem 344 or 483 and either Chem 334 or 335 or 486. The application of chemical engineering to biological processes. Biochemical reaction systems and their technological employment. The material basis of living systems, enzyme reactions, cellular organization and function, metabolism and transport, effect of the physical and chemical environment in cell behavior, modeling and kinetic behavior of biological populations.

ChE 477
Unit Operations in Food Engineering 3-0-3
Prerequisite: ChE 364. The application of unit operations to foodstuffs, their production, and processing (rheology, fluid flow, heat transfer, and mass transfer).

ChE 481
Chemical Engineering Laboratory 2-4-4
Prerequisite: ChE 364. A communication experimentation course which introduces the student to concepts of experimentation and analysis, both oral and written technical communication, and laboratory investigations in the areas of fluid dynamics and energy transport. Experimental investigations are undertaken utilizing both bench and pilot plant sized apparatus. Special emphasis is placed on the relationships between theoretical and experimental analysis of results obtained, design and synthesis application, and their representation.

ChE 482
Chemical Engineering Laboratory 2-4-4
Prerequisites: ChE 481, ChE 349, ChE 467. Laboratory investigations of topics in mass transport, kinetic phenomena, and selected special topics. Experiments are undertaken on both pilot plant and bench scale sized equipment to illustrate relationships between predictive theory and actual experimental results. Emphasis is placed on the design and synthesis application of the results and their representation.

ChE 484
Special Topics in Mass Transfer 3-0-3
Prerequisites: ChE 467, ChE 364. This course is concerned with the application and design of equipment in special mass transfer operations. The four major topics will be humidification, adsorption and ion exchange, drying, and leaching. Optional, less conventional topics will also be covered at the discretion of, and with consensus of, the class and the instructor.

ChE 486
Alternative and Synthetic Fuels 3-0-3
Prerequisites: ChE 228, Chem 335, and Chem 343. A survey of the chemical processes involved in converting available fossil fuels to more useable forms to supplement or replace existing energy sources. Consideration is given to the technical, economic, and environmental problems that must be solved to produce synthetic fuels.

ChE 491
Research and Independent Study 0-6-0
An honors course open to a limited number of qualified students. This course provides the student with an opportunity to work in research or on projects of special interest under the individual guidance of a member of the department staff. Department approval is required for admission to this course. Students taking ChE 491 must take ChE 492. The grade for this course is Satisfactory or Unsatisfactory. Credit for graduation will be given upon completion of ChE 492 at which time a grade for six credits will be submitted covering both courses.

ChE 492
Research and Independent Study 0-6-6
A required continuation of ChE 491 at the honors level.

ChE 551
Principles of Mass Transfer 3-0-3
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. Not available for credit to chemical engineering students.

ChE 575
Statistical Thermodynamics 3-0-3
Prerequisite: undergraduate course in thermodynamics. Application of statistical methods to the evaluation of thermodynamic properties. Among the topics considered are the ideal gas, monatomic crystals, chemical equilibrium, the transition state theory of reaction, inter-molecular forces, and virial coefficients.

ChE 583
Petroleum Refining 3-0-3
Prerequisite: ChE 349 and ChE 467 (co-requisite). An introduction to the chemical processing of petroleum to produce fuels, lubricants, and petrochemical feedstocks. Lectures and readings from the current literature emphasize modern refining practice in an era of uncertain petroleum supplies and changing product demands.

CHEMISTRY

Chem 101
Introductory Chemistry 3-0-3
The course presents the elementary chemical principles and their application to the understanding of descriptive chemistry. Not available to BSIA students.

Chem 111
Fundamentals of Chemistry and Materials I 3-0-3
Prerequisites: high school math including algebra and trigonometry; chemistry placement examination required. An introductory course in chemistry and the chemistry of engineering materials suitable for students who have not had high school chemistry or for those who wish to pace their studies. Not open to students who have taken Chem 115 or 117.

Chem 112
Fundamentals of Chemistry and Materials II 4-3-5
Prerequisite: Chem 111. This course is a continuation of Chem 111. Suitable laboratory experiments illustrate the course material.

Chem 113
Fundamentals of Chemistry and Materials III 3-3-4
Prerequisite: Chem 112. This is a continuation of Chem 112.

Chem 115
Chemistry and Materials I 4-2-5
Prerequisite: high school math including algebra and trigonometry, chemistry placement examination required. This course introduces the student to the basic concepts of chemistry and presents their immediate application to the understanding of the structure, properties, and uses of engineering materials. Suitable laboratory experiments illustrate the course material. Not open to students who have taken Chem 111 or 117.

Chem 116
Chemistry and Materials II 3-2-4
Prerequisite: Chem 115 or equivalent. A continuation of Chem 115.

Chem 117
Honors Chemistry and Materials I 4-2-5
Admission is by invitation only. An honor chemistry course which parallels Chem 115 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.

Chem 118
Honors Chemistry and Materials II 3-2-4
Prerequisite: Chem 117. This is a continuation of Chem 117, which parallels the course content of Chem 116.

Chem 202
Chemistry for Today's Society 2-2-3
Not open to students who have taken Chem 113, 116, or 117. The relationship of chemistry to life and to living in today's society is considered. The course examines the application of chemistry to this modern world of drugs, biocides, fertilizers, detergents, plastics, pollutants, and covers other contemporary topics.

Chem 231
Physical Chemistry I 3-0-3
Prerequisites: Chem 116 or equivalent, Math 221, Phys 111. Not open to students who have taken or are taking Chem 232 or Chem 486. This course is intended for non-chemical engineering students. The topics covered include the properties of ideal and non-ideal gases, liquids, solutions, thermochemistry, thermodynamics, the phase rule, and phase equilibria.

Chem 232
Physical Chemistry I 3-2-4
Prerequisites: Chem 116 or equivalent, Math 221, Phys 111. Not open to students who have taken or are taking Chem 486. The topics covered in lecture include the properties of ideal and non-ideal gases, liquids, solutions, thermochemistry, thermodynamics, the phase rule, and phase equilibria. The laboratory is concerned with basic analytical principles and techniques.

Chem 303
Applied Chemical Principles 3-0-3
Prerequisite: one semester of a college chemistry course which included a laboratory. This course is not open to students who have taken Chem 113, 116, or 118. An elementary treatment of the physical and chemical processes occurring in water solutions is presented and applications to environmental and other contemporary problems are considered. A brief introduction to the properties of organic materials is included.

Chem 334
Physical Chemistry II 3-0-3
This course is intended for non-chemical engineering students. A continuation of Chem 231, the topics covered include homogeneous and heterogeneous chemical equilibria, electrochemistry, kinetic theory of gases, transport phenomena, kinetics, and irreversible processes.

Chem 335
Physical Chemistry II 4-3-5
Prerequisite: Chem 232. The lecture presents a continuation of Chem 232. The topics include homogeneous and heterogeneous chemical equilibria, ionic equilibria, electrochemistry, kinetic theory of gases, transport phenomena, kinetics, and irreversible processes. The laboratory consists of experiments in which the student applied and extends the basic knowledge of physical chemistry acquired in the lecture and is introduced to the various physical chemical instrumentation methods.

Chem 343
Organic Chemistry I 3-0-3
Prerequisite: Chem 116 or equivalent. Not open to students who have taken or are taking Chem 483. The preparation and properties of the various classes of organic compounds are discussed, with attention given to industrial sources such as coal and petroleum and the commercial utilization of these materials in the synthesis of useful products used in areas such as foods, cosmetics, textiles, plastics and pharmaceuticals.

Chem 344
Organic Chemistry II 4-3-5
Prerequisite: Chem 343. The lecture presents a continuation of Chem 343. The principles discussed in lecture are carried out in the laboratory.

Chem 412
Organic Reactions and Processes 2-3-3
Prerequisites: undegraduate organic chemistry and physical chemistry. Organic molecules are treated from a structural, rather than a mechanistic viewpoint. Topics covered include atomic and molecular structure, sterochemistry, reactive intermediate (cations, anions, radicals and carbenes), and spectroscopy.

Chem 552
Laser Chemistry and Technology 3-0-3
Prerequisites: Chem 116 or equivalent, Physics 231 or equivalent, Math 221. An introduction to the underlying chemistry and physical principles of lasers, theri operation, uses, and the related optoelectronic technology. The course will include analysis of each class of laser; pumping mechanisms for creating the atomic and molecular excited states; detection of light; absorption and emission of radiation; current industrial and state of the art uses; and associated optoelectronic processes.

Civil and Environmental Engineering

Chair: Eugene Golub
Associate Chair: Edward G. Dauenheimer
Assistant Chairs: Harold Deutschman (Graduate), Mathew Cisela (Undergraduate), Paul Cheremisinoff (Environmental Engineering), Walter Konon (Construction Technology)
Distinguished Professors: G. Lee, J. Liskowitz
Professors: Cheng, H. Deutschman, Dresnack, Golub, Khera, Peck, Salek
Associate Professors: Chan, Cheremisinoff, Ciesla, Craig, Dauenheimer, Hicks, Hsu, Jones, Konon, Olenik, Raghu
Assistant Professors: Ansari, Bagheri, Hsieh, Hussein, Kuperstein, Leptourgos, Schuring, Shrestha, Wecharatana

(A full listing of surveying courses may be found on page 68.)

CE 200
Surveying 3-3-4
Prerequisite: Math 111. Angle and distance measurement; leveling; tachometry; topographic mapping; traverse and area computations.

CE 210
Construction Materials and Procedures 3-0-3
Prerequsite or corequisite: EG 204. A study is made of current practices in construction, including earth moving, soil and rock excavation, framing materials and procedures, masonry, carpentry, fenestration, roofing, electrical systems, and mechanical systems. Field trips to construction sites give the student the opportunity to view directly many of the practices.

CE 231
Strength of Materials 4-3-5
Prerequisites: Mech 230, Math 221, or equivalents. This course, designed for civil engineering students, is more intensive than Mech 232. The student must have a working knowledge of statics with emphasis on force equilibrium and free body diagrams. Primary objectives include 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. Classroom studies are supplemented by laboratory experiments.

CE 232
Strength of Materials 1-2-2
This course is intended only for students who have taken Mech 232, Mechanics of Materials, or the equivalent, and who subsequently have decided to transfer into the Civil Engineering Program. The student is required to complete additional laboratory and class work needed to bring him/her to the level required in CE 231, Strength of Materials. Registration is by departmental permission only and the student must consult with his/her advisor before registering to plan a program of work in this course.

CE 301*
Advanced Surveying 3-0-3
Prerequisite: CE 200. Plane table; barometric and precise leveling, aximuth from sun and polaris observations.

CE 305*
Aerial Photographic Interpretation 3-0-3
Prerequisite: CE 200 and CE 342. Analysis and study of photographic techniques and procedures, land forms, surficial soils, and rock formations by the use of aerial photos and stereograms with special emphasis on the engineering significance of the results. The applications of other remote sensing devices and of aerial photography to land surveying, transportation engineering, environmental and sanitary engineering, construction engineering, soil mechanics, and geological engineering are discussed.

CE 307*
Geometric Design for Highways 3-0-3
Prerequisite: CE 200. A course in highway design based on a study of traffic distribution, volume, and speed with consideration for the predictable future. The elements of at-grade intersections and interchanges are analyzed. Studies are made of the geometrics of highway design and intersection layout with advanced curve work including compound and transition curves.

CE 310*
Construction Methods 3-0-3
Prerequisites: CE 210, CE 231 (CE 231 may be taken concurrently). A continuation of CE 210 with emphasis on concrete construction, formwork design, steel erection, temporary retaining walls, and geometric control. Modern materials and their adaptation to construction are discussed.

CE 311
Work Experience I
Prerequisites: junior standing, department approval, and admission to the CO/OP program. Work experience of six months that is assigned, supervised, and approved by the department and the director of cooperative education.

CE 320
Fluid Mechanics 4-0-4
Prerequisites: Math 221, Mech 230. 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 321
Water and Wastewater Engineering 3-0-3
Prerequisite: junior standing. The objective of this course is to train the student in methods or developing water supplies and the means to treat said supplies for consumptive use. In addition, the nature of wastewaters and related treatment is examined. Hydrologic techniques such as surface and ground water yield, hydrograph and routing analyses, probabilistic methods related to hydrologic studies are treated in the course.

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. Various hydrologic and hydraulic techniques related to the above will be examined.

CE 332
Structures I 3-2-4
Prerequisite: CE 231 or equivalent. The students must have 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 336
Experimental Structures 1-4-3
Prerequisite: Arch 355 or CE 231. This course deals with lightweight, longspan structures. In the structures laboratory, students will experiment with space frames, grids, tension structures, and so forth. Large scale models will be designed, built, and tested for performance. The underlying principles of structural behavior and architectural application will be presented in lecture. (This course is the same as Arch 336.)

CE 341
Spoil Mechanics 3-3-4
Prerequisites: CE 231 or equivalent. Corequisite: CE 342. A study of soil types and properties is made with the objective of developing a basic understanding of soil behavior on the part of the student. Theory and methods of compaction as well as properties of compacted soil are emphasized. Fundamentals pertaining to frost action, seepage, consolidation, stress distribution, and shear strength are introduced. Bearing capacity and settlement analysis are also presented. Studies in the classroom are supplemented by experimental work in the laboratory.

CE 342
Geology 3-0-3
Prerequisite: Satisfactory sophomore engineering standing or special permission. The science of geology is studied with emphasis on physical geological processes. The principle of uniformity of process is stressed in the context of rock and soil formation, transformation, deformation, and mass movement. Aspect of historical geology and geomorphology are included.

CE 350
Transportation Engineering 3-0-3
Prerequisite: junior engineering standing. A study of the principal modes of transportation, with emphasis on the planning, design and construction of facilities for modern transportation systems.

CE 351*
Municipal Government in Contemporary Society: Theory and Practice 3-0-3
Prerequisite: junior engineering standing. This course is designed to provide the municipal engineer or planner with a foundation for planning and operational efficiency based upon the concepts and problems of local government. Attention is focused on such topics as fiscal management, intergovernmental relations, and planning and operation of public works.

**A technical elective.*

CE 410*
Construction Scheduling and Estimating I 3-0-3
Prerequisite: CE 210. Quantity take off, cost estimate and CPM computer analysis of typical building or highway projects. A study is made of construction project organization, contract requirements, management control techniques with an introduction to computer applications.
**A technical elective.*

CE 411*
Construction Scheduling and Estimating II 3-0-3
Prerequisite: CE 210. The course is a study of building construction. Case studies are used to illustrate current practices. Organization of construction companies and field accounting practices are introduced.

CE 412*
Construction Codes and Specifications 3-0-3
Prerequisites: CE 210 or CET 313 and senior standing in the BSCE or BSET program, or Arch 256 and 4th/5th year standing in architecture. This course deals with the code and specification aspects of engineered construction. Topics to be covered are: 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 E.P.A. on construction. (This course is the same as Arch 412.)

CE 413*
Work Experience II
Prerequisite: CE 311. Work experience of six months that is assigned, supervised, and approved by the department and the director of cooperative education.

CE 416*
Construction Processes 2-3-3
Prerequisite: CE 210 or CET 313 or Arch 256. This course will give students practical experience in transforming design and technical theory into buildings. Lectures will present broad exposure to construction processes which comprise the construction project; studios will involve application of theory and skills to actual projects. Lectures and discussions will be supplemented by field trips to manufacturers, fabricators, architects, offices, and construction sites. (This course is the same as Arch 416.)

CE 430
Structures II 3-0-3
Prerequisites: CE 332 and CIS 101. 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 432
Structural Design 3-0-3
Prerequisites: CE 332 and CIS 101. A working knowledge of structural analysis including determinate and indeterminate beams and frames is essential. The course objective is the development of current design procedures for structural steel elements and their use in multistory buildings, bridges, and industrial buildings.

CE 440*
Geotechnical Engineering 3-0-3
Prerequisite: CE 341. The objective of the course is to expose the student interested in geotechnical engineering as a specialty to the practical aspects of the field. Case histories and field trips are a major part of the course, and the practitioner's methodologies are emphasized, including studies of existing data sources and field reconnaissance, site and sub-surface exploration, the testing program, analysis, and design.

CE 443
Foundation Design 3-0-3
Prerequisites: CE 341, CE 430. Selection of foundation types and basis for design, allowable loads, and permissible settlements of shallow and deep foundations. Structural design of footings and pile caps. Computations of earth pressure and design of retaining walls.

CE 450*
Urban Planning 3-0-3
Prerequisites: 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 451*
Urban Systems 3-0-3
Prerequisites: CIS 101 and senior standing. Development of urban problem solving strategies and techniques. Management of urban problems by dealing with them as systems. Concepts, philosophy, and techniques of systems analysis are developed and applied to urban problems.

CE 490*
Civil Engineering Projects 3-0-3
Prerequisite: senior standing in civil engineering and approval of the department. The student works on one or more individually selected projects, guided by the Civil Engineering Department staff. These projects 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 branch out on his own. The project(s) of each student must be completed and professionally presented by assigned due dates for appropriate review and recording of accomplishment. Critiques will be held and students will present their work to other students having similar interests.

CE 494
Civil Engineering Design I 3-0-3
Prerequisite: senior standing in civil engineering. This design course will simulate the submission and acceptance process normally associated with the initial design phases for a civil engineering project. The course is intended to familiarize the students with the preparation of sketch plats, preliminary engineering design, and a related environmental assessment. Requirements will include written submittals and oral presentations in defense of same.

CE 495
Civil Engineering Design II 3-0-3
Prerequisite: senior standing in civil engineering. The purpose of this course is to provide the students with the type of design experience they would receive if they were currently engaged in civil and environmental engineering design practice. The design areas that the students can select from include the following: structures, geotechnical engineering, transportation and planning, sanitary and environmental engineering, and construction.

ENVIRONMENTAL ENGINEERING

EnE 360*
Environmental Engineering 3-0-3
Prerequisites: Chem 115 and junior standing. The object of this course is to train students in the methods used for water pollution control. Topics include the chemical, physical, and biological processes which occur in waste treatment design and in receiving waters; modeling schemes are assigned to determine allowable loadings in various bodies of water, and waste treatment processes used for water pollution control are examined.

EnE 361*
Environmental Problems 3-0-3
Prerequisite: Chem 115. The object of this course is to expose students to the area of air pollution control, solid waste disposal, and radioactive waste disposal. Topics include the chemistry of contaminated atmospheres: the influence of meteorological conditions on 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 560*
Environmental Chemistry 3-0-3
Prerequisite: Chem 116 or equivalent. Basic physical and chemical principles applicable to environmental and sanitary engineering are presented. The laboratory is used to complement the lectures and illustrate the aforementioned principles. Laboratory fee.

MECHANICS

Mech 230
Statics and Dynamics 4-0-4
Prerequisites: Phys 111, Math 112. The student must have a working knowledge of college level algebra, trigonometry, and elements of calculus in addition to mechanics (physics). Primary objectives include the following: an understanding of equilibrium of particles and rigid bodies subject to concentrated and distributed forces, the mathematics of the motion of particles and rigid bodies, and of the relation of forces and motion of particles.

**A technical elective.*

Mech 231
Statics and Dynamics 4-0-4
Prerequisite: An honors course for the student with adequate preparation in freshman physics and math courses. Primary objectives include an understanding of statics and dynamics as given in the regular Mech 230 course, virtual work, LaGranges equations, and moments of inertia. Ability to solve gyroscopic and other three-dimensional problems that require an understanding of vector analysis.

Mech 232
Mechanics of Materials 3-1-0
Prerequisites: Mech 230, Mech 221, or equivalents. The entering student must have a working knowledge of statics with emphasis on force equilibrium and free body diagrams. Primary objectives include: an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple practical mechanical problems, and of the mechanical behavior of materials under various load conditions. Classroom studies are supplemented by laboratory experiments.

Mech 233
Mechanics of Materials 3-0-3
Prerequisites: Mech 230, Math 221, or equivalents. The entering student must have a working knowledge of statics with emphasis on force equilibrium and free body diagrams. Primary objectives include: an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple practical mechanical problems, and of the mechanical behavior of materials under various load conditions. Students enroll in Mech 232 but do not participate in the laboratory.

Computer and Information Science

Chair: Julian Scher
Associate Chairs: Featheringham, McHugh
Professors: Moshos, Turoff
Associate Professors: Baltrush, Featheringham, Iliogolous, LaSalle, McHugh, Medsker, Ryon, Sarian, Scher
Assistant Professors: Chiang, Chen
Special Lecturers: Babinski, Irwin, Lubliner, Wohlgemuth

CIS 101
Computer Programming and Problem Solving 2-1-2
An introductory course in FORTRAN programming 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.

CIS 102
Honors Computer Programming and Problem Solving 2-1-2
Admission to the course is by invitation. This course covers the same material as CIS 101 at an accelerated rate. The time thus gained (at least one half on the semester) is devoted to other programming languages such as PASCAL, SNOROL, and LISP, as well as in-depth study of some applications, such as information storage and retrieval, sorting techniques and cryptography.

CIS 202
Computer Programming and Business Problems 3-1-3
An introductory course in programming which develops the same level of FORTRAN knowledge as CIS 101. Problems used in this course will reflect business applications. In addition, an introduction to the concepts of COBOL programming is provided. This is a required course for the industrial administration, engineering technology, and architecture programs. CIS 202 may be used as the CIS 101 prerequisite for other CIS courses.

CIS 203
Business Programming 1-1-1
Prerequisite: CIS 101. This eight-week minicourse provides, at an introductory level, the elements of commercial data processing utilizing the COBOL programming language. It is intended for students who have completed CIS 101 and have subsequently transferred into a curriculum for which CIS 202 is a required course (BSIA, achitecture, or engineering technology.)

CIS 213
Introduction to Computer Science 3-0-3
Prerequisite: CIS 101 or CIS 202. Fundamentals of computer science are introduced for understanding the structures and uses of computing systems. The course covers a study of the representation of data and instructions, a survey of programming languages, operating systems, methods for accessing computing systems, and software design. Programming topics in FORTRAN and assembly language are included. Computer problems using both batch and interactive computing are assigned.

CIS 310
Work Experience I 3 credits
Prerequisite: junior standing and permission of director of cooperative education. Industrial work experience of six months providing industrial reinforcement of academic program. Direct exposure to industrial situations. Work assignments are provided by and approved by the director of cooperative education.

CIS 330
Mini-Computer Systems 2-2-3
Prerequisite: CIS 101 or CIS 202. This course deals with the software and hardware characteristics of mini-computers. Included is the programming and application of mini-computer systems. A variety of application areas is surveyed and practical solutions to problems in these applications are offered using functions available on the mini-computer. Areas of application include text handling, data entry, computerized communications, continuous simulation, process control, and multi-mini computer configurations. Individual assignments will be made requiring hands on operation of the minicomputer in the Computer and Information Science Laboratory.

CIS 331
Machine and Assembly Language Programming 2-2-3
Prerequisite: CIS 213. Fundamentals of machine organization and machine language programming. Representation of computer instructions and data in assembly language, together with intensive practice in formulating, programming, running, and debugging programs for both numerical and logical problems.

CIS 332
Principles of Operating Systems 2-2-3
Prerequisite: CIS 331. Organization of operating systems covering batch, multiprogramming, and virtual memory systems. Systems functions are considered both from the user's and designer's point of view. Included are introductions to data management, system communications, job control, scheduling, and memory management. Laboratory work is assigned using the facilities of the Computer Center.

CIS 335
Data Structures and Algorithm Design I 3-0-3
Prerequisite: CIS 213. Corequisite: Math 222. A study of advanced programming topics dealing with logical structures of data, their hardware representation, and the design and analysis of computer algorithms operating on the structures. This course, the first of a two course sequence, concentrates on data structures; primitive types, stacks, queues, arrays, sets, linked lists, trees and graphs, and some basic operations using these data structures including sorting, searching and memory management. Problems and individual computer exercises are assigned. Not open to students who have had CIS 436.

CIS 337
Programming Systems Libraries 3-0-3
Prerequisite: CIS 213. Programming systems are discussed from the perspective of making available programming libraries. Various libraries will be described. Includes structuring of programming libraries, forms of documentation, methods of evaluation, portability, convertibility, and compatibility. Particular emphasis is given to programming and hardware standards.

CIS 341
Introduction to Logic and Automata 3-0-3
Prerequisite: CIS 101 or CIS 202. This course includes an introduction to logic and formal grammars. Theoretical models such as finite state machines, push-down stack machines, and Turing machines are developed and related to issues in programming language theory.

CIS 351
Computer Organization 3-0-3
Prerequisite: CIS 213. A study of the components that make up a computer system. In particular, the hardware components are analyzed for those characteristics which are important in the design of software products. Topics covered include representation of information, basic processor organization, memory systems, file devices, peripheral devices, and data transmission.

CIS 365
Computer Applications to Commercial Problems 2-2-3
Prerequisite: CIS 213. 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 andutilized in developing the programming techniques for the solution of these problems.

CIS 407
Computer Augmented Design 3-0-3
(This course is not to be taken by CIS majors.) Prerequisites: CIS 101 or CIS 202 and calculus. The topics covered are those needed by engineers for using the computer in engineering design. Included are: data structures for handling information, time-sharing facilities, interactive languages, problem-oriented languages, special application programs, numerical and non-numerical algorithms, and automated bibliographic searching.

CIS 408
Computer Configurations 3-0-3
(This course is not to be taken by CIS majors.) Prerequisite: CIS 101 or CIS 202. This course covers computer hardware and architectures as they relate to engineering applications. The emphasis of this course is on modern hardware which engineers integrate into either the control of their processes or the management of their processes. Topics covered are: signal processing, differences between main-frame, mini, and microarchitectures, and applications of these architectures in special-purpose computers, computer graphics equipment, and information retrieval systems.

CIS 410
Work Experience II 3 credits
Prerequisites: CIS 310 and permision of director of cooperative education. Industrial work experience for a six month assignment, normally with same industry as CIS 310. Work assignments provided by and approved by director of cooperative education.

CIS 421
Numerical Calculus 3-0-3
Prerequisite: CIS 101 or CIS 202. 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.

CIS 435
Data Structures and Algorithm Design II 3-0-3
Prerequisite: CIS 335. This course is a continuation of CIS 335 covering a study of table and directory design, file design, searching, external sorting, and further studies of some exemplary algorithms; e.g., used in such problem areas as critical path, compiler design, game theory, string matching, data compression, scheduling and garbage collection. Some research topics in the current literature are introduced. Problems and individual computer exercises are assigned. Not open to students who have had CIS.

CIS 436
Principles of Algorithms 3-0-3
Prerequisite: CIS 331. Corequisite: CIS 332. A study of advanced topics in programming including recursive programming, data structures, storage mapping functions, linked lists, trees, arrays, symbol tables; sorting techniques, parsing algorithms, decision tables, case studies of some exemplary algorithms, and an introduction to some research topics in the current literature. Not open to students who have had CIS 335 or 435.

CIS 438
Programming for Interactive Computer Graphics 3-0-3
Prerequisite: CIS 101 or CIS 202. This course introduces fundamental concepts of interactive graphics oriented towards 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 graphs. Exercises will be given using the Institute's Interactive Graphics Laboratory.

CIS 453
Microcomputers and Applications 3-1-3
Prerequisite: CIS 331. A study of the basic principles of microprocessors and their support modules; memory, serial and parallel interfaces. The course focuses on software system design for control by microcomputers and other applications such as speech recognition and generation, music, and graphics. Individual exercises as well as one large project will be assigned for solution in the laboratory portion of the course.

CIS 455
Computer Center Organization 3-0-3
Prerequisite: CIS 213. An overview of computing centers and their organization for accomplishing specific objectives. Includes a classification of systems, analysis of cost and size, layout of equipment, methods of accessing computer facilities, equipment selection, and facilities evaluation.

CIS 461
Systems Simulation 3-0-3
Prerequisites: Math 333; CIS 101 or CIS 202. This course introduces computer simulation as a problem solving technique. Includes discrete simulation models, elementary theory, stochastic processes, use of simulation languages, random number generators, simulation methodology, design of simulation experiments, validation of models, and applications.

CIS 465
Computer Techniques for Management Information Systems 3-0-3
Prerequisite: CIS 365. 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.

CIS 490
Guided Design in Software Engineering 3-0-3
Corequisite: CIS 436. This course focuses on the issues of developing large computer programs (i.e., computer programs that take over one man-year effort to produce). It covers theory and methodology for the design and implementation of professional programs and considers all major aspects of production programming such as functional requirements and analysis, design, coding, testing, and proving, integration, and maintenance. Tools and techniques for all areas of a program's life cycle will be covered. Students will participate in various phases of several large projects using a guided design approach.

CIS 491
Computer Science Project 3-0-3
Prerequisites: CIS 332, CIS 490, and project approval. An opportunity for the student to integrate the knowledge and skills gained in previous computer science work into an individual research 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. The topic should be consonant with the emphasis of direction chosen by the students in their computer science studies. To register for this course, a student must have a written project proposal approved by the department. Students attend a weekly seminar at which progress reports are presented and discussed.

CIS 500
Introduction to Systems Analysis 3-0-3
Prerequisite: Math 222. Provides the background information and techniques for the study of systems concepts at the graduate level. Covers the solution of a wide variety of system engineering problems chosen from different disciplines and introduces mathematical tools only as needed to find practical solutions to the se problems. Includes topics from network analysis, morphological analysis, dynamic analysis of systems, transport processes, control theory, and probability theory. Also an overview of specialized languages for implementing various systems approaches will be presented.

CIS 510
Computer Programming 3-1-3
Prerequisite: knowledge of at least one procedure-oriented language such as FORTRAN. Machine organization and structure, machine language programming, multi-programming executive, batch processing monitor, program linkage, and segmentation are studied as a means for program preparation. Various organizations used in computers are described.

CIS 515
Advanced Computer Programming for Engineers 2-2-3
Prerequisite: CIS 101, Math 222. This course is designed for engineering students who require an extensive knowledge of programming for their project or thesis work. Topics covered include a review of basic programming techniques, extensive treatment of algorithm design, error analysis and debugging using advanced features of FORTRAN IV, and programming facilities available on the operating system. As time permits, problem-oriented languages such as CSMP are examined. Students specializing in computer science may not take this course for credit.

CIS 540
Fundamentals of Logic and Automata 3-0-3
Prerequisite: Math 222. This course is an introduction to mathematical logic, formal languages, and computability theory. Some of the topics covered are: finite state machines, Turing machines, predicate calculus, mechanical theorem proving, recursively unsolvable problems, and the application of logical calculus to proving the correctness of programs. Emphasis is placed on intuitive understanding and applicability rather than mathematical rigor.

Electrical Engineering

Chair: Joseph J. Strano
Associate Chair: Robert R. Meola
Assistant Chair: Warren H. Ball (Graduate), Chung-Wei Chow (Undergraduate)
Distinguished Professor: M. Zambuto
Professors: Ball, Cohen, Cornely, Denno, Klapper, Kuo, Meyer, Misra, Padalino, Strano, G.Thomas, Whitman
Associate Professors: Ayoub, Carluccio, Chow, Clements, Engler, Frank, Reisman, Rose, Rosenstark, Singh, Sohn, Troop
Assistant Professors: Niver, Wason
Special Lecturers: Cirelli, Gulcur, Yankielun

EE 210
Electrical Engineering I 3-3-4
Prerequisites: CIS 101. Phys 121, Math 112. A class and laboratory course dealing with the basic concepts of dc and ac circuit analysis. The class work includes loop and node analysis, network theorems, resonance, mutual inductance, and polyphase circuits. The laboratory work emphasizes basic measurement techniques.

EE 212
Electrical Engineering II 3-0-3
Prerequisite: EE 210. This course is an introduction to electronic circuits and devices, particularly junction diodes, bipolar transistors, and field-effect transistors. The elementary concepts of electronic device physics, transistor circuit biasing, and equivalent circuits are covered. Basic circuits for performing the electronic functions of amplification and rectification are studied.

EE 305
Electrical Engineering Principles 3-2-4
Prerequisites: Phys 121. (This course is not for EE students.) Course for mechanical engineering students with content similar to EE 405 with the addition of a laboratory which includes measurement techniques, passive circuits characteristics, electronic circuits, and motor performance.

EE 310
Work Experience I
Prerequisite: completion of sophomore year, approval of department, and permission of director of cooperative education. Cooperative education work experience of six months providing industrial reinforcement of academic program. Direct exposure to industrial situation work assignments provided by and approved by director of cooperative education.

EE 323
Passive Networks 4-0-4
Prerequisites: EE 210, Math 222. A course in the analysis of passive lumped-parameter electrical networks with emphasis on the linear systems approach. Topics covered include network theorems, signal representation, convolution, Fourier and Laplace transform methods, and two-port network parameters, covering their interrelations with interconnection in parallel, series, and cascade.

EE 324
Computer-Aided Circuit Analysis and Design 3-0-1 1/2
Prerequisite: EE 323. The digital computer will be employed as a tool in the analysis and design of simple linear passive and active circuits using frequency-response, s-plane, and time domain methods. Included will be computer projects involving models of an audio amplifier, a control system, a transducer measurement circuit, and analog filters. Fortran IV will be the computer language used. (*8-week mini-course.)

EE 326
Electromagnetic Fields I 4-0-4
Prerequisite: Math 221 or 329 and Phys 121. This is an introductory engineering course in electromagnetic theory. Topics covered include vector analysis, static fields, time-dependent fields, Maxwell's equations, and plane waves.

EE 327
Electromagnetic Fields II 3-0-3
Prerequisite: EE 326. This course covers the circuit aspects of distributed parameter transmission lines and applications of Maxwell's equations to guided waves. Topics include transient and steady-state conditions in lossless and lossy transmission lines, reflection and refraction of plane waves in isotropic media, transmission modes in waveguides.

EE 328
Electromagnetic Fields II for Honors Students 3-0-3
Prerequisites: EE 326 and department admission to its Honors Program. Honors students cover the material of EE 327 at an accelerated rate and then proceed to consider advanced topics in microwaves.

EE 331
Electromagnetics and Energy Conversion 3-0-3
Prerequisite: EE 210. Magnetic materials and their applications are discussed in this course. Included are the graphical and analytical solution and design of singly- and multiply-excited magnetic circuits, as well as the steady-state performance of electromechanical energy converters. The course is reinforced by the laboratory work of EE 332.

EE 332
Magnetics and Electromechanical Energy Conversion Laboratory 1-2-2
Prerequisite: EE 331. Basic properties of magnetic materials are studied through the permeameter, Epstein core loss and Rowland ring tests. The effects of superimposed ac and dc magnetization in an iron core are studied and applied in a saturable reactor motor speed control system. Transformers and rotating machines are studied under transient and steady state conditions using special equipment with built-in information windings and passive computing circuits. Extensive use is made of the X-Y plotter, strip-chart recorder, and cathode ray oscilloscope.

EE 342
Active Circuits I 3-3-4
Prerequisite: EE 212. This class and laboratory course is an extension of previous work in engineering electronics. Basic equivalent circuits for electronic devices are reviewed. Singlestage and multistage small-signal amplifiers as well as tuned amplifiers are studied. Frequency response of amplifiers is included in considerable detail. Other subjects include single-ended power amplifiers, push-pull amplifiers, thyristors, and transistor switching.

EE 343
Semiconductor Devices 3-0-1 1/2
Prerequisite: EE 212. Concepts of solid state and physical devices are explained from the point of view of a design engineer for utilization and design of electronic solid state devices. (*8-week mini-course.)

EE 344
Active Circuits II 3-0-3
Prerequisites: EE 323, 342. Extending the circuit design begun in EE 342, this course includes operational amplifiers, feedback, Nyquist criteria for stability, oscillators, and AM and FM systems of transmission.

EE 365
Digital Logic and Circuit Design 3-0-3
Prerequisite: EE 210. This course develops the mathematical minimization techniques for designing digital sub-systems utilizing standard logic symbolism considering both cost and time units. Arithmetic units, coders, translators, comparitors, control units, indicator units and other sample circuits are designed. Flip-flops and registers are introduced as memory devices.

EE 405
Electrical Engineering Principles 3-0-3
Prerequisite: Phys 121. (This course is not for EE students.) This course is designed primarily for civil engineers and industrial engineers. It covers working familiarity with basic circuits, both dc and ac, understanding of tubes and transistors as amplifiers, feedback and application to automatic controls, transducers, simple problems in transmission, single and three phase systems, motors and generators, and transformers. Also, some coverage is given to wiring, switching, and protection.

EE 410
Active Circuits II Laboratory 1-2-2
Prerequisite or corequisite: EE 344. This course includes laboratory work in the areas covered in EE 344. Students design, build, and test circuits to meet given specifications utilizing their own components.

EE 411
Work Experience II
Prerequisite: EE 310 and permission of director of cooperative education. Cooperative

education work experience of six months, normally with same employer as EE 310.

EE 415
Electrical Engineering Project 3-0-3
Prerequisites: EE 344, 410. A synthesis and focusing of the student's previous experience, in and out of college, upon one or more electrical engineering projects selected by the student. Library research, design, cost analysis, construction, and testing are involved. Class members become aware of other projects by means of seminar discussions. A preliminary report is to be submitted by midterm of the immediately preceding semester to the student's EE systems instructor.

EE 416
Electrical Engineering Project for Honors Students 3-0-3
Prerequisites: senior standing and department approval. This course, similar to EE 415, allows honors students to select projects of a research nature and work in close liaison with a research staff member of the department. Informal seminar meetings are to be held by the respective research staff members during the semester preceding registration for this course, and the students are expected to have their research well under way before being permitted to register for the course. Requirements are the same as for EE 415.

EE 420
Communications Systems I 3-0-3
Prerequisite: EE 344. An introduction to communications systems and modulation theory, including the calculation of spectra correlation, effects of filtering, linear and angle modulation systems, and an introduction to stochastic processes.

EE 421
Communications Systems II 3-0-3
Prerequisite: EE 420. The study of communications theory is extended to the fundamentals of sampled-data communications, information theory, and noise. Modulation systems are compared from the communication point of view. General communication theory is used to analyze the performance of hardware designs.

EE 422
Communications Systems II Laboratory 0-4-2
Prerequisite: EE 420. Laboratory work in the design and synthesis of communications systems, closely coordinated with the communications systems course.

EE 425
Control Systems I 3-0-3
Prerequisite: EE 323. This course is an introduction to the field of automatic control engineering, a subject which deals with the analysis and design of automated and self-regulated systems. Topics covered include multiple-input, multiple-output systems, systems state-space representation, signal flow graphs, and various techniques of stability study. Analysis of linear control systems is covered. While main emphasis is placed on industrial systems, examples are presented to show the general applicability of the theory to various disciplines. Laboratory demonstrations are included.

EE 426
Control Systems II 3-0-3
Prerequisite: EE 425. The study of automatic control theory is continued with a number of important aspects of control systems and practical problems. A limited number of topics from different areas of control theory are selected and treated in reasonable depth, thereby relying largely on the application of fundamental principles to consideration of practical control problems. Among the areas discussed are discrete systems, nonlinear systems analysis and design, with emphasis on state plane and describing-function methods.

EE 427
Control Systems II Laboratory 0-4-2
Prerequisite: EE 425. Corequisite: EE 426. Laboratory work in the design and synthesis of control systems, closely coordinated with the control systems courses.

EE 430
Computer Systems I 3-0-3
Prerequisites: Math 222, EE 365 or CIS 351. This is a foundation course for engineering and computer science students to develop an understanding of analog, digital, and hybrid systems. Topics covered include linear and nonlinear analog computer elements, analog programming, scaling, and problem preparation procedures. The digital portion builds on the student's background of combinational logic to cover the design and application of sequential systems.

EE 431
Computer Systems II 3-0-3
Prerequisite: EE 430. This course is a continuation and extension of EE 430. Sequential digital systems are studied including counters, shift registers, and sequence generators. Additional topics are analog-digital and digital-analog conversion, memories, controllers, digital computer organization, and microprocessors.

EE 432
Computer Systems II Laboratory 0-4-2
Prerequisite: EE 430. Corequisite: EE 431. Laboratory work in the design of digital and analog circuits and systems closely coordinated with the material of EE 430 and 431.

EE 435
Power Systems I 3-0-3
Prerequisites: CIS 101, EE 331. The main objectives of this course are to represent the electrical system with mathematical models, and to show how to use the models for both steady-state and dynamic systems analysis. A clear demonstration is given of the interplay among the frequency, voltage, and real and reactive power flow varibles which characterize the steady state operation of the system.

EE 436
Power Systems II 3-0-3
Prerequisite: EE 435. This course deals with the analysis and discussion of the electrical energy system control problem. Fault analysis and problems involved with system-unbalanced operation will be analyzed in detail.

EE 437
Power Systems Laboratory 0-4-2
Prerequisite: EE 435. Laboratory study of rotating electric machinery and transformer from the point of view of the power systems engineer. Some of the topics studied experimentally are magnetizing current in rush transients in transformers, torque angle characteristics of synchronous machines, parallel operation of alternators, ac and dc motor speed control systems, exciter response and ferroresonance phenomena in electric power systems.

EE 440
Medical Instrumentation Systems I 3-0-3
Prerequisites: EE 342 and 323. This is an introductory course which undertakes the study of some of the interfaces between the medical sciences and engineering. The emphasis is on clinical instrumentation applied to the measurement of physiological signals. The theoretical and practical aspects of transducers, amplifiers, and signal processing devices for use with biological systems are covered.

EE 441
Medical Instrumentation Systems II 3-0-3
Prerequisite: EE 440. This is an extension of EE 440 which investigates tissue visualization techniques, clinical instrumentation systems, and engineering applications in the medical sciences. The problem of detecting, extracting, and processing physiological data is studied from the general point of view, and the technical problems of medical care units are discussed.

EE 442
Medical Instrumentation Systems II Laboratory 0-4-2
Prerequisite: EE 440. The laboratory work covers transducers, amplifiers, active filters, recording systems, and the response of a physiological system to exercise and other stimuli. Simulation experiments of the pupillary light reflex, muscle twitch, and other physiological responses are performed to indicate how engineering contributes to biological research.

EE 450
Electromechanical Energy Conversion 3-0-3
Prerequisite: EE 331 and 332. Equivalent circuits of induction and synchronous machines are derived and applied to steady-state and transient problems. The theoretical work of the course is supplemented by demonstrations using machines having specially designed information windings.

EE 451
Direct Power Generation 3-0-3
Prerequisite: EE 210 or 405 or 305 and a course in thermodynamics. Principles of direct modes of electrical power generation and their environmental impacts. These methods include electrochemical, nuclear, thermionic, and magnetohydrodyamic systems. Emphasis is on performance, system behavior, and characteristics of such methods of generation.

EE 452
Computer Application to Power Networks 3-0-3
Prerequisites: CIS 101, EE 323. This is a basic

course to develop the techniques of computer applications in solving problems encountered most frequently in power system analysis. It is assumed that the student has a general understanding of elementary power system analysis.

EE 457
Microwaves and Integrated Optics 3-0-3
Prerequisite: EE 327. After a brief review of basic field theory and transmission line analysis, the study of rectangular, circular and surface waveguides will be undertaken. A circuit theory for waveguiding systems will be developed and utilized in the study of resonators, filters, and passive microwave devices such as alternators, phase changers, and directional couplers. Techniques used in the study of microwave systems will then be applied to the technology of integrated optics. The field of integrated optics is devoted to the development of microscopic optical circuits. Waveguides of integrated optics and optical fibers, the transmission media of optical communication systems are discussed.

EE 462
Semiconductor Circuits 3-0-3
Prerequisites: EE 343 and EE 344. Topics include characteristics of FET and bipolar transistors, low and high frequency analysis of FET and bipolar transistors, feedback in semiconductor circuits, linear integrated circuit (IC) building blocks, the IC operational amplifier, linear IC's for communications, transistor logic gates, and digital IC building blocks.

EE 463
Microelectronic Devices and Circuits 3-0-3
Prerequisites: EE 326 and EE 343. The basic principles of semiconductor electrical behavior (particularly as applied to the PN junction, the MOS field effect, and optoelectronic phenomena) are studied thoroughly to provide the background for understanding the operation and characteristics of devices and circuits. Among the devices whose characteristics are studied are Schottky barrier and PN junction diodes, solar cells, photoconductive and photovoltaic infrared detectors, bipolar and FET transistors, semiconductor lasers and LED's, and 12L memory cells. Device characteristics important for circuit design, e.g., dynamic switching, behavior, are emphasized. The fabrication technologies used in the production of microelectronic circuits are briefly discussed.

EE 465
Digital Computer Circuits 3-0-3
Prerequisite: EE 365. The techniques for the design of sequential digital logic synchronous and nonsynchronous systems are developed. Counters, timers, controllers, serial arithmetic and coding units, and other sample systems are designed.

EE 468
Computer Interface Design 3-0-3
Prerequisites: EE 365 or CIS 351. (This course is not to be taken by those who take EE 431.) This course introduces the principles involved when implementing a microcomputer or minicomputer into a system for measurement and control. Topics covered: computer organization and instructions, modes of input-output addressing, interrupt systems, data acquisition, peripheral devices, and interface components.

EE 470
Network Synthesis 3-0-3
Prerequisite: EE 323. An introduction to passive and active network synthesis. Topics from passive synthesis include testing for physical reliability and the synthesis of LC and RC one-port and two-port networks. Topics from active synthesis include the effect of controlled sources on the poles and zeros of transfer functions, and use of the operational amplifier in designing active RC filters, oscillators, and phase equalizers.

EE 471
Pulse Techniques 3-0-3
Prerequisite: EE 344. This course deals with analysis of circuitry for the generation and shaping of waveforms. Fundamental applications are covered, including linear and diode waveshaping, compensated amplifiers, clipping and clamping circuits, switching circuits, multivibrators, and other selected topics.

EE 472
Digital Signal Processing and Data Transmission 3-0-3
Prerequisites: EE 323 and EE 324. The course starts with the sampling theorem. It covers z transforms and the frequency response of digital signal processing systems. The design of both recursive and non-recursive digital filters is considered in some detail. The second part of the course deals with problems in data transmission such as intersymbol interference and the calculation of error rates.

EE 476
Control Engineering 3-0-3
Prerequisite: EE 323 or Math 222. This is an introductory course in the analysis and design of feedback control systems. The material covered includes such items as: system characterization, block diagram manipulation, stability, sensitivity, error response, state variable methods, root locus, performance indices, compensation methods, and the consideration of a variety of applications of control engineering to various engineering disciplines.

EE 480
Simulation of Physiological Systems 3-0-3
Prerequisite: Math 222. A course introducing the student to applications of engineering techniques to solutions of biological problems. Basic concepts of physiology are presented, followed by a discussion of various modeling techniques applied to specific biological systems. Examples of feedback control systems in biology are presented.

EE 530
Electromagnetic Field Analysis 3-0-3
Prerequisite: undergraduate vector analysis or equivalent. The course covers electrostatic fields, magnetostatic fields, Maxwell's equations, the Poynting vector, relationship between circuit theory and Maxwell's equations, some low-frequency and high-frequency applications of the equations, retarded potential type of solutions, wave equations, the plane waves.

EE 540
Electronic Circuits 3-0-3
Prerequisite: EE 342. The material treated in this course includes the analysis and design of various types of amplifiers, oscillators, and power supplies. Topics also considered are: feedback circuits, comparators, and some simple digital circuits.

EE 550
Circuit Analysis 3-0-3
Prerequisite: EE 323. The course is an introduction to the 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. Pole-zero diagrams are developed as an aid in the study of low-order systems.

EE 563
Introduction to Control Systems 3-0-3
Prerequisite: bachelor's degree in engineering. Linear feedback control systems are treated in both state variable and transfer function representation. Nyquist criterion, root-locus and parameter-plane methods are introduced and applied to both analysis and design of linear time-invariant systems. Principles of controllability and observability are studied. A survey of various topics is given, such as ac carrier control systems and some selected nonlinear and optimization problems.

EE 575
Introduction to Digital Circuits 3-0-3
Prerequisite: undergraduate course in electronic circuits. This course develops the mathematics and minimization techniques together with the circuit implementation for the design of combinational and sequential digital solid state logic circuits. Elementary computer and control circuits are used as examples.

EE 580
The Analog Computer as Used in Electrical Engineering 3-0-3
Prerequisite: undergraduate course in electrocomputer and the types of applicable problems. The topics of amplitude and time scaling, ordinary linear and nonlinear differential equations, simulation of transfer functions in the time domain, problem "set up" and solution checks are studied.

Engineering Technology

Courses listed in this section are not available for engineering students without special permission of their advisors.

CONSTRUCTION AND CONTRACTING ENGINEERING TECHNOLOGY

CET 301
Construction Surveying 2-3-3
Corequisite: Math 106. All aspects of horizontal and vertical control measurements and settings and layouts applied to various construction problems.

CET 313
Construction Procedures I 4-0-4
An introduction to heavy construction practices. Emphasis is on construction equipment,

site preparation, piles, drilling and blasting, concrete construction. Case studies in heavy construction are used.

CET 314
Construction Procedures II 4-0-4
Prerequisite: CET 313. 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.

CET 322
Hydraulic and Hydrologic Problems in Construction 3-0-3
Prerequisite: Applied Mathematics. A study of fluid flow as it applies to construction problems. Pumping, rainfall runoff, stream flow, pipe flow, hydrostatic pressure systems, scour, and seepage are among the subjects covered.

CET 331
Structural Systems 3-3-4
Prerequisite: Strength of Materials. Study of types and behavior of modern structures using both analytical and intuitive techniques. Examples will include beam and column, one and two way slab systems, stressed skin structures.

CET 411
Cost Estimating and Scheduling 3-0-3
Corequisite: Take off of quantities of materials from typical building and highway projects. Pricing for labor, materials, and equipment will come from standard reference guides. A CPM schedule will be developed as part of the estimate.

CET 415
Building Construction 3-0-3
Prerequisite: CET 314. Planning and control of all operations employed in construction of buildings. Typical buildings will be studied in detail. Preparation of building procedures and cost estimates will be made.

CET 416
Heavy Construction 3-0-3
Prerequisite: Surveying and CET 313. Practices unique to heavy construction are studied in detail. Typical structures considered include bridges, tunnels, highways, dams, and utilities.

CET 431
Construction Testing 2-2-3
Prerequisite: CET 331. A course designed for construction and contracting technology students which will expose them to a variety of construction related field tests and field testing equipment. Included will be concrete mix design, concrete forming and testing, soil density and compaction, permeability tests, asphalt tests, load testing of wood and steel shores, construction noise, and vibration control.

CET 435
Design of Temporary Structures for Construction 3-3-4
Prerequisite: CET 331. Analysis of loadings on, and design of temporary structures required in construction. Formwork, shoring and scaffolding systems, temporary bridges and temporary retaining walls are among the subjects covered.

CET 441
Soils and Earthwork 3-0-3
Prerequisite: a course on strength of materials. A study of the significant soil types and tests. Problems are investigated relating to soil mechanics, soil supported foundations for engineering structures. Appropriate field trips are made.

CET 490
Senior Project 3-0-3
Prerequisite: senior standing in construction and contracting 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. Critiques will be held and students will present their work to other students having similar interests.

ELECTRICAL ENGINEERING TECHNOLOGY

EET 301
Circuit Analysis I 3-0-3
Prerequisite: DC and AC Circuit Analysis (AAS level). Corequisite: Math 108. Steady-state analysis of circuits. Topics to be reviewed include mesh analysis, nodal analysis, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer and controlled sources. The description of circuits by means of differential equations is studied.

EET 302
Circuit Analysis II 3-0-3
Prerequisite: EET 301. This course is a continuation of EET 301. The transient analysis of circuits is studied using differential equation methods. Use is also made of Laplace transforms for the steady-state and transient analysis of circuits.

EET 303
Circuit Measurements I 1-3-2
Prerequisite: Electronics laboratory experience (AAS level). Corequisite: Math 108. 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. Computer circuit analysis using PCAP is introduced, and the basics of microprocessors are included.

EET 304
Circuit Measurements II 1-3-2
Prerequisite: EET 303, Math 108. This lecture and laboratory course is a continuation of EET 303. The course is designed to further develop techniques for the measurement of parameters in linear and non-linear circuits. Use is made of spectrum analyzers and analog computers and other instrumentation. Transfer functions and their use in two-port networks will be included. Computer analysis of networks will be used.

EET 309
Electric Circuits and Machines 3-0-3
Prerequisite: Basic Physics. Corequisite: Math 108. This course is for non-electrical technology students who have no circuit and machinery background. The course includes a study of electric and magnetic circuits, motors and motor applications, transformers and power distribution in single phase and balanced polyphase systems. Demonstrations of subject matter are used to emphasize the basic principles for applying electricity to industrial situations.

EET 405
Discrete and Integrated Circuits 3-3-4
Prerequisite: EET 304. Various active circuits are analyzed in both their discrete and integrated forms. Advantages of the different forms are studied and compared. Laboratory measurements of selected circuits are performed to verify their design characteristics.

EET 406
Control Systems and Transducers 3-3-4
Prerequisite: EET 302 and EET 304. This course is a class and laboratory study of analog and digital automatic control. Principles of analysis and design of control systems are introduced. Transducer characteristics and their applications in instrumentation and control are investigated.

EET 408
Electrical Systems Project 1-3-3
Prerequisite: EET 405. Corequisite: EET 406. In this laboratory course, students will construct and analyze a project of their own choice. The project may be of the small equipment design or measurement system type.

EET 410
Microprocessors 2-2-3
Prerequisite: some programming experience. This elective course covers the operations, breadboarding, and interfacing of devices peripheral to microcomputers. Also, emphasis is placed on the applications of these microcomputers in industrial measurement and control.

EET 411
Energy Conversion Devices 3-0-3
Prerequisite: EET 301. A study of various energy conversion devices, including dc and ac equipment which converts mechanical energy to electrical energy and vice versa. Demonstrations will be used to emphasize important aspects of the theory and application of electric machinery.

EET 412
Power Generation and Distribution 3-0-3
Prerequisite: EET 301. Electrical power generation systems, including hydroelectronic, steam, and nuclear plants. Substation and transmission line topics will also be included as part of distribution system.

EET 413
Pulse and Digital Circuits 3-0-3
Corequisite: EET 405. Analysis and design of circuits and digital systems for the generation and shaping of waves. Applications include

multivibrators, switching and counting circuits, and voltage and current sweeps.

EET 414
Communication Systems 3-0-3
Corequisite: EET 405. A study of amplitude modulation, frequency modulation, and pulse modulation systems of transmission and reception. Applications of these systems in radio, television, and telemetry will be included.

ENVIRONMENTAL ENGINEERING TECHNOLOGY

ENT 311
Chemistry of Contaminated Atmospheres and Emissions 3-3-4
Prerequisite: a course in college chemistry with laboratory. This course deals with the chemical and physical processes which lead to the generation of pollutants from sources and the formation of harmful pollutants such as photochemical smog in the atmosphere. Knowledge of these processes is essential for understanding the operation of abatement equipment used for the control of these emissions. Methods for monitoring pollutants in the atmosphere will be demonstrated in the laboratory.

ENT 312
Chemistry and Biology of Water and Wastewater Treatment 3-3-4
Prerequisite: a course in college chemistry with laboratory. This course deals with the physical, chemical, and biological processes utilized in water and wastewater treatment. Factors which influence these processes are considered. Methods and instrumentation utilized in monitoring these processes are demonstrated in the laboratory.

ENT 313
Public Health Technology 3-0-3
Prerequisites: ENT 311, 312. This course involves the examination of tne following topics relating to public health and the environment: milk and food examination, industrial hygiene, vector control, solid waste control, and air and water pollution control.

ENT 414
Industrial Toxicology 3-0-3
Prerequisite: a course in college chemistry. This course is an introduction to the study of the occupational poisons, their threshold limits, and effects on body systems. Particular emphasis is placed on the effects produced by introducing toxic materials in the air and water.

ENT 415
Water and Wastewater Analysis 3-3-4
Prerequisites: ENT 312 and one year of college chemistry. This course deals with actual laboratory and field measurements of parameters such as biochemical oxygen demand, total organic carbon, and dissolved oxygen, that are used to characterize the chemical, physical, and biological processes in water and wastewater treatment. The theory and application of wet chemical techniques and instruments used for these measurements are discussed.

ENT 416
Unit Operations of Water and Wastewater Treatment 3-0-3
Prerequisite: ENT 312. This course deals with the principles which govern the equipment used in water and wastewater treatment. The types of equipment available and their selection for different applications are covered.

ENT 417
Industrial Safety and Health 3-0-3
Prerequisite: a course in college chemistry. This is a study of occupational safety and health hazards. Emphasis on toxic materials hazards, threshold limit values to health, comfort, and work area safety. A review of legislation and its impact in these areas as well as implementation of safety programs to meet legal and safe level working requirements.

ENT 418
Air Pollution Control 3-0-3
Prerequisites: ENT 311 and one year of college chemistry. This course is concerned with understanding the principles which cover the operation of control equipment used in abatement of gaseous and particulate emissions. Such particulate removal equipment as the settling in chamber, cyclones, spray towers, scrubbers, electrostatic precipitators, and fabric filters are discussed. Also, methods primarily used for gaseous emission control from stationary sources as well as automotive emissions will be considered.

ENT 419
Environmental Quality and the Law 3-0-3
The effects of federal, state, local, and international law on environmental quality of life are studied. Student discussions are encouraged.

MANUFACTURING ENGINEERING TECHNOLOGY

IET 313
Quantitative Management Methods 3-0-3
An introduction of mathematical and statistical techniques for use in managerial decision making. Topics will include model building, simulation, and the application of various quantitative techniques to such areas as production, inventory control, quality, budgeting, manpower planning, capital investment, and distribution.

IET 315
Industrial Statistics 3-0-3
Introduction to data collection and analysis and the concepts of probability. Data collection will include the basis of sampling while data analysis will include calculation and interpretation of measures of central tendency and variation, and statistical testing of hypotheses.

IET 317
Manufacturing Operations Analysis (2-2-3)
A course in manufacturing based on the use of the computer to solve manufacturing problems. A variety of topics concerning manufacturing are covered. Hands-on laboratory experience will enable the student to become proficient in computer use.

IET 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 support the lecture. Computer problem solving is incorporated in the course.

IET 405
Numerical Control for Machine Tools 2-2-3
Designed as a first course in numerical control. The course prepares the student in the understanding of the fundamental concepts of numerical control systems and components as well as learning "how to" program. No formal laboratory is indicated. Hands-on experience is gained through assigned projects requiring program preparation, program input via manual, tape, and teletype means. Program verification is accomplished via use of CNC equipment.

IET 414
Industrial Cost Analysis 3-0-3
An introduction to general and cost accounting, and project selection on the basis of minimum cost is treated. Cost control techniques are discussed. Problems involving the time value of money are treated.

IET 416
Production Scheduling 3-0-3
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.

IET 419
Work Measurement Techniques 3-0-3
(Not to be taken by manufacturing technology students.) Work measurement and methods appraisal techniques for industrial and clerical operations. Charting, micro-motion study, stop watch analysis, element analysis, rating and leveling, practice studies of hand and machine operations, work sampling, predetermined times.

IET 420
Quality Control 3-0-3
Prerequisite: IET 315. The management of industrial quality control, development and treatment of the operational and statistical principles of acceptance sampling and process control, and problems in control chart operations.

IET 421
Contracts and Specifications 3-0-3
Legal aspects of construction contracts and specifications; scope, format, and use of various types of specifications such as descriptive, outline, and performance.

IET 422
Tool Design 3-0-3
Introduction to the design of cutting tools with emphasis on speeds, feeds, and power requirements. Design of jigs, fixtures, punch and dies, gaging and inspection tooling are covered with emphasis on current industrial practices.

IET 423
Motion and Time Study Techniques 2-2-3
A study of the basic principles of motion study concerning work place design and related techniques involving process analyses, man-machine charts and micromotion study. Stop watch time study techniques covered as well as predetermined time standards, work sampling and wage incentive system.

IET 424
Facilities Planning 2-0-2
Prerequisites: IET 318, IET 423. Operational principles and techniques of plant design. Topics are: plant organization, plant location, layout, materials handling, production planning and control, inspection, methods and standards.

IET 426
Facilities Planning Laboratory 1-3-2
Corequisite: IET 424. A laboratory and project course reinforcing the lectures in IET 424. Work involves a plant design project.

MECHANICAL ENGINEERING TECHNOLOGY

MET 301
Machine Design I 3-0-3
Prerequisities: Elementary Strength of Materials. Corequisite: Math 108. The application of principles of mechanisms and strength of materials to mechanical design. Topics include theories of failure, fatigue, weldments, fasteners, spring and other machine elements subject to static and dynamic loading.

MET 302
Machine Design II 3-0-3
Prerequisites: Math 108, MET 301. A continuation of MET 301, including the design of power screws, brakes, clutches, belt and chain drives, gears, gear trains, bearings, thick-wall cylinders, and other machine elements.

MET 303
Applied Thermodynamics 3-0-3
Prerequisite: Math 108. The topics discussed in this course are the basic principles of thermodynamics and their applications to internal combustion engines, turbines, compressors, power generating, and refrigerating, and refrigeration systems.

MET 304
Fluid Machinery 3-0-3
Prerequisite: Math 108. The operations, performance, and selection of equipment and machinery for fluid power applications will be studied. Topics will include properties of fluids used in engineering applications, fluid control and protection devices, pipe flow systems and ducting design, applied measuring devices, basic fluid machinery design and selection including basic classification, operation, performance characteristics, and selection of pumps, compressors, fans, and turbines.

MET 307
Plastics Technology 3-0-3
An introduction to the basic concepts of plastics conversion, resin classification, processing techniques, significant engineering properties, and product applications. Laboratory demonstrations are incorporated into the lecture sequence.

MET 308
Plastics Processing Techniques 3-0-3
A study of the various commercial plastics processing techniques for both thermoset and thermoplastic materials. Included are extrusion, injection molding, blow molding, compression molding, and RIM processes.

MET 314
Dynamics of Machinery 3-0-3
Corequisite: Math 108 or equivalent. A course designed to acquaint students with motion and forces in machines. Topics include velocities and acceleration in linkages, gears, cams, and other machine systems; static and inertial forces and torques in machines; and critical speeds.

MET 407
Structural Design 3-0-3
Prerequisites: elementary strength of materials. A course designed to acquaint students with the fundamentals of structural design. Analytical solutions as well as the application of AISC code are discussed. Topics include: design and analysis of axial, bending, torsion, and shear loading on structural member. Deflection of structural member; truss analysis, timber design, and reinforced concrete beam design.

MET 408
Machine Design Project 1-3-3
Prerequisites: MET 302, 303, 314, 415, 416. A project course which applies the principles learned in all mechanical engineering technology courses to more advanced design situations. Typical mechanical engineering systems are designed by individual students or by small groups.

MET 409
Air Conditioning and Refrigeration 3-0-3
Prerequisite: MET 303. Calculation of building cooling and heating loads, psychrometric calculations, air distribution and duct design, compression and absorption refrigeration cycles, automatic control of refrigeration systems.

MET 410
Electro-Mechanical Equipment 3-0-3
Prerequisite: EET 309. Applications of mechanical vibration and electric circuit concepts to the principles of design, selection, and operation of electro-mechanical devices such as gyroscopes, integrators, accelerometers, and other common transducers.

MET 411
Manufacturing Equipment 3-0-3
Prerequisite: IET 312 or MET 302. The objective of the course is intended to cover the fundamental principles for the evolution of a carefully conceived manufacturing scheme and to establish a clear relationship between production engineering and design. Representative topics to be studied are the development of location systems and operational sequences, tool and tooling classifications, tolerance and dimensional analysis and their control and special production techniques.

MET 413
Environmental Technology 3-0-3
Introduction to water, air, noise, thermal, nuclear, and solid waste pollution. Emphasis is placed on the sources of pollutants, their effect upon the ecological environment, and the methods employed to minimize the release of these pollutants into the environment.

MET 415
Automatic Control Systems 3-0-3
Prerequisite: Math 209. An introduction to the basic concepts of automatic control systems will be considered. Process characteristics, transducers dynamics, and frequency response will be among the topics studied.

MET 416
Mechanical Instrumentation Laboratory 2-2-3
Prerequisite: Eng 342 and EET 309 or equivalent. A laboratory and lecture course in instrumentation and measurement. Basic principles and techniques in the measurement of displacement, speed, force, pressure, temperature, fluid flow, will be covered.

MET 417
Solar Energy Applications 3-0-3
Prerequisite: MET 303 or equivalent. This course is an elective course for technologists. It is concerned with the practical application and uses of solar energy. The technology of applications for domestic water heating, space heating, and low temperature water heating for industrial processes will be emphasized as well as instrumentation and controls for solar systems.

MET 439
Applied Mechanical Vibrations 3-0-3
Prerequisite: Math 209 and MET 301, or equivalent. An introduction to the fundamental theory of mechanical vibrations. Discussion includes undamped and damped vibrational systems and vibrations with harmonic forcing functions, magnification factor, transmissibility. and vibration isolation. Laboratory demonstration includes natural frequency measurement, applications of accelerometers and vibrometers, principal mode measurement on two degrees of freedom system.

MET 450
Mechanical & Electrical Systems I 3-3-4
Prerequisite: College physics. 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 will be presented using residential, industrial and commercial applications from industry. Class projects are included in the laboratory. Not for MET students.

MET 451
Mechanical & Electrical Systems II 3-0-3
Prerequisite: MET 450. A continuation of MET 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. Not for MET students.

Industrial and Management Engineering

Chair: James L. Rigassio
Associate Chairman: John Milhalasky
Professors: Mihalasky, Rigassio, Wolf
Associate Professors: Gage, McDermott, Stone, Thomas
Assistant Professors: Ho, Kopf, Mo
Special Lecturers: Howery, Kalley, Percival, Ruffolo, Walsh

IE 221
Introduction to Industrial Engineering 3-0-3
Open to second year students in engineering, engineering science, or computer science. This course gives a broad and fundamental view of the field of industrial engineering in both its traditional and contemporary aspects, and introduces the student to operations research as applied to industrial and managerial problems, stressing the logical methods used. It specifically treats problems in all phases of industry-research, finance, production, and distribution and builds to an analysis of decision theory and model building.

IE 224
Production Process Design 3-0-3
Open to second year students in engineering. Introduction to design and control of manufacturing processes. Study covers theory and practice of manufacturing techniques, measurement and quality control, automated processes and tape controlled machines. Selection of the best and most economical process to meet design specifications is stressed. In addition to lecture and discussion, the student observes equipment in operations in the laboratory and in plants which are visited.

IE 310
Work Experience I
Prerequisite: completion of sophomore year. Approval of department and permission of director of cooperative education. Cooperative education work experience of six months providing industrial reinforcement of academic program. Direct exposure to industrial situations work assignments provided by and approved by director of cooperative education.

IE 331
Applied Statistical Methods 3-0-3
Prerequisite: Math 333. This course presents statistical methods together with their applications. Subjects treated include the selection, classification, treatment and analysis of data, frequency distributions, central tendency, dispersion, skewness, curve fitting, probability distributions, student's "t", significant differences, analysis of variance, regression, and correlation. Special emphasis is placed on the application to industrial fields.

IE 334
Engineering Economy and Capital Investment Analysis 3-0-3
Prerequisites: SS 201. Introduction to the principles of engineering economics for utilization in evaluation and uncertainty, risk, time value of money, depreciation and sensitivity analysis, cost of capital, multiple alternatives, replacement, and value engineering.

IE 335
Engineering Cost Analysis and Control 3-0-3
Prerequisites: IE 221, SS 201. The intent of this course is to provide an understanding of basic accounting methods used in management information systems; emphasis will be on the development of standard costs, effect of cost on services, break even and variance analysis, cost volume relationships, and utilization of financial data for control of operation.

IE 337
Methods Engineering 2-2-3
Prerequisites: IE 221, 224. Included are production planning and control, work simplification, human factors, methods, tool design, the use of motion economy, jig and fixture design, and micromotion analysis techniques.

IE 338
Work Measurement 2-2-3
Prerequisites: IE 221, 224, Math 333. Quantitative analysis of manufacturing activities, man and machine systems, wage payment plans, line balancing problems, and plant design decisions. Involved is the use of standard data, method measurement systems, work sampling, time study, predetermined time systems, value analysis, and simulation of production systems.

IE 355
Human Factors 3-0-3
Prerequisite: junior IE standing or equivalent. Man-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. The control and measurement of work stress; introduction to industrial hygiene; the impact of OSHA. Familiarization with the facilities of the Human Factors Laboratory via demonstrations and supervised experiments; special techniques for experimenting with man.

IE 411
Work Experience II
Prerequisite: IE 310, approval of department, and permission of director of cooperative education. Cooperative education work experience of six months, normally with same employer as IE 310.

IE 439
Management Science 3-0-3
Prerequisites: Math 333, IE 221, SS 201. Introduction to quantitative and analytical techniques useful in managerial decision making, including model formulation, linear programming, network analysis applied to PERT/CPM, queueing theory.

IE 440
Contemporary Practices in Management Science 3-0-3
Prerequisite: IE 439. Extension of the concepts studied in IE 439 to include topics such as simulation, dynamic programming, inventory models, and game theory. An important aspect of this course will be discussed by and with leading managers using management science techniques.

IE 443
Systems Analysis 2-2-3
Prerequisite: IE 337, 338. The concepts of industrial engineering systems and sub-systems design; principles, procedures, and techniques of systems design; management control as an integral system component. Selection of a specific system design for the project of IE 444, establishment of plant contacts, determination of the systems specifications, preliminary collection, classification, and analysis of the system data.

IE 444
Systems Design and Control 2-2-3
Prerequisite: IE 443. A course in which research projects will culminate in a systems design, including the related management controls. The design will draw upon the applicable mathematical, scientific, engineering, and humanistic principles included in the curriculum. Whether theoretically and/or practically oriented, the design will classify within or between the broad curriculum areas of process design, work design, and management science.

IE 446
Law 3-0-3
Open to any fourth-year student in a bachelor's degree program. This course familiarizes the student with basic principle of common and statutory law applicable to business and professional relationships, emphasizing contracts, negotiable instruments, sales of goods, agency and business organization.

IE 450
Product Engineering Standards 3-0-3
Open to any fourth-year engineering student. A course designed to aid the engineer in developing and using standards in the design, manufacturing, and use of products. Topics included in the course are economics of using standard parts, procedures, drawing and assembly techniques, and use of national and international standards. The role of standards-setting bodies and methods for the development of producttesting standards used in industry and commerce will be reviewed.

IE 451
Industrial Measuring Systems 3-0-3
Prerequisite: Math 333. The course reviews contemporary measuring systems. It will provide a basic understanding of the various methods, their accuracy, reliability, and relative costs to perform. It will include measuring methods needed for compliance evaluation in accordance with occupational and safety legislation, industrial processes, and product design.

IE 456
Human Factors Engineering 3-0-3
Open to any fourth-year engineering student. Study of man-machine systems with emphasis on investigation of human sensory and motor processes, tool design and ma-

chine control devices, and the effects of environmental conditions on human performance. Special attention is given to application and interpretation of the Williams-Steiger Occupational Safety and Health Act of 1970 as it relates to human factors consideration in industrial engineering work. Field trips to industrial human factors laboratories are arranged, in which application and implementation of human factors research findings are demonstrated.

IE 457
Marketing and Distribution Systems 3-0-3
Prerequisites: Math 333, IE 221. This course includes basic marketing and distribution problems, with special reference to operational problems solvable by the mathematical methods of management science. Among the problems treated are decision making in marketing planning, market research, statistical treatment of opinion "polls," product strategy, industrial marketing, and distribution systems.

IE 459
Production Planning and Control 3-0-3
Prerequisites: CS 101, IE 221. A study of the components and functioning of integrated production, planning, and control systems. Consideration is given to material, equipment, and manpower requirements for optimizing continuous and intermittent manufacturing operations. The use of a computer to simulate such models is introduced.

IE 461
Product Quality Assurance 3-0-3
Prerequisite: IE 331. Introduction to the philosophy and methodology needed to assure the design and manufacture of a product of acceptable quality and reliability. Quality control techniques, reliability measurement techniques, maintainability techniques, and related areas such as physics of failure and logistics support will be surveyed.

IE 462
Budgetary Planning and Control 3-0-3
Prerequisites: IE 334, IE 335, SS 201. Introduction to budgeting procedures as a tool for planning and control in the areas of production, sales, indirect expense, cash, inventory, and capital expenditures. Emphasis is placed on the application of industrial engineering principles in the preparation and execution of budgets for profit planning and management.

IE 463
Organization Planning and Control 3-0-3
Open to fourth-year industrial engineering students. A study of classical and behavioral approaches to organization planning, this course integrates both functional and adaptive points of view in regard to the delineation of the duties, responsibilities, authorities, and relationships of the positions of a business enterprise. Included in the course is a survey of current practice in organization design and control.

IE 465
Patent Law 3-0-3
Open to any fourth-year engineering student. A broad coverage of the principles and philosophy of patent law is treated in this course. The main goal is to point out more effective protection and exploitation of ideas and inventions. Also, trademark selection and protection will be considered.

IE 466
Activity Analysis and Facilities Layout 3-0-3
Prerequisites: IE 331, 224. Analysis of organized human activities typified by industrial and office operations. Modern methods are applied to location and layout of facilities so that they may be utilized in a healthful and effective manner. Logistics of motion of people and materials, flow analysis, plant layout, and material handling techniques are included.

IE 467
Quantitative Methods in Forecasting 3-0-3
Prerequisites: IE 439, Math 333. An analytical approach to forecasting based on time series technique, with application to marketing, inventory control, and management. Techniques include regression, auto-regression, and moving average processes and exponential smoothing. Applications and computational efficiency are stressed.

IE 471
Product Liability Law 3-0-3
Open to any fourth-year student in a bachelor's degree program. A presentation of the laws applicable to product liability, the quantitative cost analysis and the effect of legal doctrines on minimizing product liability. Use of actuarial techniques applicable to design, manufacturing, and marketing problems. Some of the topics to be discussed are: warranties, notices, disclaimers, definition of liability, and use of expert witnesses. When possible, an observance of an actual trial will be arranged.

IE 472
Product Liability Engineering 3-0-3
Open to any fourth-year engineering student. A presentation of the techniques available to the engineer to minimize the hazards of design and manufacturing which result in product liability cases. The effect of legal precedents on design, manufacturing, advertising, marketing, and using a product are discussed within developing technical disciplines such as: reliability prediction and analysis methods, assuring the quality of manufactured products, loss control systems, safety engineering precepts, and design review. A review of government regulations for safety and protection is included.

IE 473
Safety Engineering 3-0-3
Open to any fourth-year engineering student. The principles and practices of safety engineering in product and facilities design. Among the topics treated are safe practices and hazard control, safety standards and codes, inspection procedures, insurance and governmental regulations, and safety statistics. The student will participate in current safety engineering research studies. The Williams-Steiger Occupational Safety and Health Act of 1970 will be covered.

IE 474
Systems Engineering in Hospitals 3-0-3
Prerequisites: IE 335, 443. Analysis and examination of the systems required for the sound design and management of modern hospital facilities. Included in the systems to be discussed are: management control, management information, inventory control, cost control, scheduling of hospital services, systems for establishing standards in a para-professional laboratory, nursing and other service areas. Students will be required to develop a project on assignment in a hospital and will design a hospital system or a portion thereof for the particular hospital.

IE 475
Hospital Unit Processes 3-0-3
Prerequisite: junior class standing. Unit processes in a hospital. Provision of patient care. Planning for hospital services. Functional plans for hospital construction. Functional hospital organization. Business office operations. Medical and surgical services. Nursing services. Laboratory services. Pharmacy services. Medical records. Dietary services. Outpatient services. Hospital visitations. Hospital project required.

IE 476
Hospitals and Health Care Facilities Liability 3-0-3
Prerequisite: IE 446. A course encompassing case law and statutory law to provide an understanding of the liabilities that may be incurred in managing a modern hospital or health care facility.

IE 481
Investigations in Industrial Engineering I 3-0-3
Prerequisite: junior or senior standing. Individual investigation under faculty guidance through consultation, readings, and visits with recognized authorities and institutions, dealing with specialized industrial engineering design problems. Students will explore in depth an area in which they have an interest and will report in a seminar situation.

IE 482
Investigations in Industrial Engineering II 3-0-3
Prerequisite: junior or senior standing. Further individual investigations, a continuation of IE 481.

IE 494
Enterprise Management 3-0-3
Prerequisite: SS 201. A course for electrical and mechanical engineering students which includes sources of investment funds; interest and time value of money; organizational structure; product development and distribution; production management; engineering economy analysis of alternatives; break-even analysis; economy of public project and public utilities; estimating and control of enterprise costs. Emphasis is on operational production management with orientation to cost analysis.

IE 497
Enterprise Management 3-0-3
Prerequisite: SS 201. A course for civil engineering students concerned with organization, design, administration, and operation of enterprises; the economic evaluation of projects and alternatives; and time value of money analysis with special emphasis on their application to civil engineering of public pro-

jects and public utilities. Legal aspects such as contracts, agency, and workmen's compensation are examined.

IE 498
Basic Accounting and Finance for Construction Management 3-0-3
Open to fourth year civil engineering students. A basic background course in the principles of accounting and cost accounting necessary for the understanding of financial data and statistics in connection with the supervision of engineering projects. Sources and methods for financing these projects, both public and private, are discussed.

IE 499
Management and Control of Construction 3-0-3
Prerequisite: IE 498 or permission of the instructor. Introduction to financial and management techniques employed by construction management to maintain operating control. Topics include pre-job procedures, subcontracting policies, insurance problems, change order routines, and profit controls.

INDUSTRIAL MANAGEMENT

IM 110
Industrial Accounting and Budgeting I 3-0-3
Open to first year students in the BSIA program. A course in basic accounting concepts. Basic accounting documents, work sheets, ledgers, and procedures for keeping accounts are covered. Emphasis is given to inventory and job order accounting methods.

IM 111
Industrial Accounting and Budgeting II 3-0-3
Prerequisite: IM 110. A continuation of IM 110 covering valuation, depreciation, costing methods, overhead accumulations and distribution. Emphasis given to standard costs, cost estimating, and budgets.

IM 112
Administrative Systems 3-0-3
Open to first students in the BSIA program. A survey of the concepts and techniques for planning and controlling the business and service functions of an enterprise. Subsystem analysis, flow charting, and work control techniques are applied to sales and service, storekeeping and warehousing, maintenance and engineering, central administration and general office functions. The job of the controller is studied.

IM 230
Cost Analysis 3-0-3
Prerequisites: IM 110, 111. A course in the techniques of evaluating labor material and overhead costs. Rate of return, variance analysis, and break-even analysis are among the subjects covered.

IM 305
Business Statistics 3-0-3
Prerequisite: Math 105. Introduction to business data analysis for application in management decision-making processes. Productivity measures, employment trends, national income data, and consumer price changes are given special attention. The course is applications-oriented and is intended to provide background necessary to meet the needs of industrial administration students. 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 are covered.

IM 329
Management Science in Business 3-0-3
Prerequisite: Math 105. An introduction to statistical and mathematical techniques used in administrative decision making. Students will develop the concepts of management science and use its techniques with unrestricted focus. Operations management applications will be made in factory settings, health care and other service industries, education and government agencies.

IM 330
Operating Control 3-0-3
Open to third-year students in the BSIA program. A study of the modern techniques of control based on systems concepts. The areas covered relate to control of production, quality, materials, cost, and facilities. Special attention is given to use of the computer in operations control.

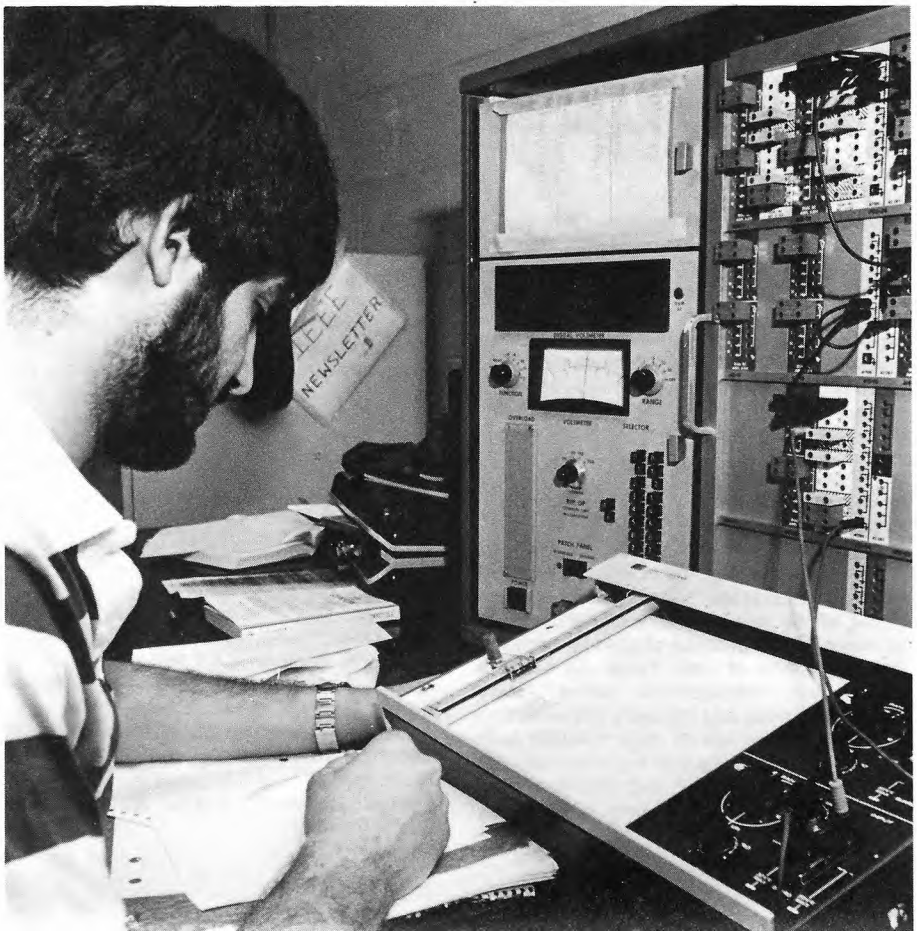
IM 333
Public Finance 3-0-3
Prerequisite: SS 201. A study of financial principles and methods of funding applicable to public projects. Funding sources and administration of projects and the relationship of governmental agencies in the construction and maintenace of public projects are covered. Case studies in public agency and municipality fiscal planning are included.

IM 336
Industrial Safety Administration 3-0-3
Prerequisites: IM 231, OS 361. A course in the planning for and appraising of safety performance. The fundamentals of accident prevention, job safety analysis, accident investigation, and sources of hazards are covered. Attention is given to federal and state standards and occupational health and safety legislation.

IM 339
Computerized Management Control 3-0-3
Prerequisite: CS 202. A treatment of the managerial functions of planning, operating and control in which the computer is used as an information source and an operating device. Applications to order processing, warehousing, machine and process control, forecasting, scheduling, and management reporting are covered. Special problems in manpower scheduling using PERT and CPM techniques are studied.

IM 351
Purchasing and Materials Management 3-0-3
This course considers the functions necessary to effectively and efficiently procure the resources necessary for the operation of the enterprise. Topics include: purchasing system procedures, quality assurance, specification preparation, contracts, and traffic. Emphasized will be materials management.

IM 352
Risk Management 3-0-3
Covers the management of risk in the enterprise. The factors that can cause liability to the firm and the methods that can be employed to minimize these costs will be examined and evaluated. Specific concerns will be fire, property and liability insurance, workmen's compensation, product liability, OSHA, insurance administration.



IM 401
Hospital Administration 3-0-3
Prerequisite: junior class standing. This course is designed to acquaint the student with hospital administration related to the regional area from which the modern hospital's patients are drawn; the federal, state, municipal and other rules, regulations, and requirements that affect hospital administration. The problem involved in fund raising; sources of external financial aid, grants, research funding; relationships between the modern hospital and American Hospital Association, American Medical Association, hospital and medical insurance companies, as well as accrediting and regulatory agencies; hospital management, hospital administration, and sections of modern hospital. The role of the computer in the modern hospital will be discussed, both in terms of the business and control function and in relationship to patient care. Hospital project required.

IM 441
Industrial Marketing 3-0-3
Prerequisites: basic statistics and calculus. A study of the relationship between production and distribution. Among the subjects treated are sales forecasting, product development, packaging, pricing, customer relations, warehousing, advertising, and promotion.

IM 442
Finance of Business Enterprise 3-0-3
Prerequisites: IM 110, 111. A course in the principles and problems of funding the enterprise. Access to capital, means of long and short term financing, instruments of equity and debt, capital budgeting, and analysis of financial statements are studied.

IM 445
Managerial Economics 3-0-3
Prerequisite: SS 201. A course treating the internal and external influences on business enterprises and the methods by which business evaluate and react to these influences. Economic models pertaining to demand forecasting, market strategy, pricing, competition, and profit behavior are studied.

IM 448
Production Simulation Seminar 3-0-3
Prerequisites: IM 111, IM 230, OS 381, SS 201. An exercise in production analysis and control utilizing a digital computer as a simulated enterprise in the ongoing process of production which requires decisions under uncertain conditions in production facilities and equipment, inventory management, capacity utilization, production quotas and control, manpower requirements, and financial needs.

IM 449
Financial Simulation Seminar 3-0-3
Prerequisites: IM 111, IM 230, OS 381, SS 201. An exercise in financial analysis and control. An enterprise, using a management game, will be simulated on a digital computer to measure the process of growth, requiring the generation of new funds. Students in groups of "management teams" select financial sources and measure administrative effectiveness by use of ratio analysis techniques as profitability and liquidity indicants. Capitalization structures and securities management are seminar subjects.

IM 483
Budgeting and Control 3-0-3
An introduction to budgeting and control in the firm. The course concerns itself with such responsibilities as design and maintenance of accounting records, internal audit systems, budgets, payrolls, profit planning, and cost control.

IM 484
Investment Management 3-0-3
An introduction to analytical procedures employed in the making of investment decisions involving commitment of funds. Private and government instruments include common stock, bonds, options, commercial paper, mortgages, federal, state, and municipal obligations. These will be considered in the context of the needs of cash management by corporation, investment of surplus funds, pension fund administration, and investment portfolios.

MANAGEMENT ENGINEERING

EM 501
Industrial Management 3 credits, 1st or 2nd sem.
Prerequisite: senior standing. Not open to industrial engineering students. A course in the field of industrial management stressing the operational aspects of the management techniques. Included topics are organization, product design and development, distribution, logistics, marketing, plant location and layout, materials handling, production planning and control, inventory control, quality control, work analysis, and incentive plans.

EM 502
Engineering Cost Analysis 3 credits, 1st or 2nd sem.
Prerequisites: senior standing. Not open to industrial engineering students. A course stressing the financial, engineering economy, and cost control aspects of industrial management. It treats the accounting cycle and introduces cost accounting procedures and cost model techniques of making cost comparisons through engineering economy studies as an approach to problems of industrial management.

EM 503
Methods and Applications of Industrial Statistics and Probability 3 credits, 1st or 2nd sem.
Prerequisite: senior standing. Not open to industrial engineering students. An analytical approach to basic engineering probability and statistics, with applications drawn from both manufacturing and process industries. Emphasis is placed upon the utility of statistical inference derived from engineering data.

Humanities

Chair: John Patrick Pattinson
Associate Chair: Robert E. Lynch
Professors: Camp, Lynch, Lyngstad, Napier, Pattinson, Winters
Associate Professors: Goldberg, Johnson, Krantz, Lee, O'Connor, Tobias, Wise
Assistant Professors: Badenhausen, Barrett, Donahue, Hodge, D. Sher, Steffen, Stiller, Sturchio
Special Lecturers: Cossa, Esposito, Gile, Paris, R. Sher

Introductory Courses

ENGLISH

Eng 096-097
English as a Second Language I & II 3-1-3
(Institutional Credit)
These courses offer instruction in the basic skills of English as a second language with emphasis on the writing and, to a lesser extent, the speaking of English. In addition, collateral reading and extensive study of vocabulary are provided. Placement in these courses is determined by performance on standardized composition and reading comprehension tests. Students should take Eng. 097 in the semester immediately following Eng. 096.

Eng 098-099
Basic Skills Reading and Writing I & II 3-1-3
(Institutional Credit)
These courses deal with the reading and writing skills necessary for success in a college curriculum. Eng. 098 emphasizes reading comprehension, vocabulary development, and written and oral summaries of expository readings. Eng. 099 emphasizes clarity of expression, correct syntax, grammar, diction, basic organizational principles, and practice in reading and writing longer, more complex material. Placement in these courses is based on performance on standardized composition and reading tests.

Eng 238
Advanced Composition 3-0-3
Prerequisite: Eng. 111 or 115. An advanced course in written and oral communication. Readings in literature and history.

Special Courses

Students should check their departmental curriculum requirements before registering for 300-level humanities courses. These courses are not equivalent to 400-level humanities courses.

Hum 308
Technological Alternatives 3-0-3
See description for MT 308, page 57.

Hum 310
Technology and Human Values 3-0-3
See description for MT 310, page 57.

Eng 339
Practical Journalism 3-0-3
Prerequisite: Eng. 111 or 115. A specialized writing course that includes a descriptive and analytic survey of news systems. Assignments will 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 will include the influence of technological, economic, legal, ethical, and historical factors.

Eng 340
Oral Communication 3-0-3
Prerequisite: Eng. 111 or 115. Development of the principles, attitudes, and verbal skills essential to effective oral communication through studying appropriate speech patterns and delivering a wide range of speeches adapted to the needs of specific occasions and varied contemporary audiences.

Eng 342
Technical Report Writing 3-0-3
Prerequisites: Eng. 111, 115, or 6 credits of humanities for BSET students. An advanced course in written and oral communication, including instruction and practice in preparing technical reports of various types, in writing business letters, and in speaking before groups on technical subjects. Required by some departments. Not a regular humanities elective.

Humanities Electives

Before registering for humanities electives, students should check their departmental curriculum pamphlets. Engineering students should refer also to the statement of humanities requirements on page 20.

Eng 111
English Composition 3-0-3
Required of all freshmen. The course aims to promote the student's proficiency in English composition through systematic practice and appropriate readings. There will also be practice in oral expression.

Eng 115
Composition and Literature 3-0-3
Prerequisite: departmental approval. An honors course parallel to Eng. 111. The course is designed for students whose skill in writing and interest in literature are greater than those of the average student.

HUMANITIES

Hum 112
Man and Culture in Historical Perspective I 3-0-3
Prerequisite: Eng. 111 or Eng. 115. Man's changing view of himself and his world as seen in the history, literature, arts, and philosophy of past eras, from ancient times through the Renaissance. An interdisciplinary approach.

Hum 115
Man and Culture in Historical Perspective I 3-0-3
Prerequisite: Eng. 111 or 115 and departmental approval. An honors course parallel to Hum 112 for selected students.

Hum 231
Man and Culture in Historical Perspective II 3-0-3
Prerequisites: Eng. 111, Hum. 112. Man's changing view of himself and his world as seen in the history, literature, arts, and philosophy of past eras, from the 17th century through the contemporary world. An interdisciplinary approach.

Hum 235
Man and Culture in Historical Perspective II 3-0-3
Prerequisites: Eng. 111, Hum. 112, and departmental approval. An honors course parallel to Hum 231 for selected students.

HISTORY

His 441
The American Experience 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. 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.

His 445
Communication through the Ages 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. 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.

His 451
Ancient Greece and the Persian Empire 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum 231. The political, institutional, and cultural developments of Ancient Greece and the Persian Empire from the Mycenean period to the King's Peace (386 B.C.).

His 452
The Hellenistic States and the Roman Republic 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. The political and cultural developments of the Hellenistic states and their influence on the Republic of Rome to 30 B.C.

His 459
History of the Middle East I 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. 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.

His 460
History of the Middle East II 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. 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.

His 461
The Founding of the American Nation 3-0-3
Prerequisites: ng. 111, Hum. 112, Hum. 231. 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.

His 463
The United States as a World Power 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. American domestic and foreign policy 1n 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.

His 472
Contemporary Europe 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. European society in the 20th century. Nationalism, imperialism, totalitarianism, movements toward European unity, and prominent cultural developments.

His 474
Modern Russian Civilization 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Tsarist and Soviet Russia in the 19th and 20th centuries. Serfdom, industrialization, revolutionary movements, the 1917 revolutions, and the development of the Soviet state and society.

His 476
Political and Social Movements 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Significant movements of political and social dissent in the past century and their justifications, including liberalism, democracy, socialism, communism, fascism, and guerrilla and nonviolent resistance.

His 477
Cities in History: From the Ancient to the Industrial City 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. The process of urbanization as seen in the growth of Near Eastern, European, and North American cities from ancient citadels to complex industrial cities of the nineteenth century: Rome as urban empire, revival of towns in the Middle Ages, Baroque royal capitals, and the transformation of urban forms and functions through industrialization until 1990.

His 478
Cities in History: City and Metropolis in the 20th Century 3-0-3
Prerequisites. Eng. 111, Hum. 112, Hum. 231. The culmination of urbanization in the growth of cities, suburbs, and metropolitan regions since 1900: patterns of city growth, decline, and reconstruction in Europe, the United States, and the less developed world, with special attention to Newark and its region.

His 482
War and Modernization 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Warfare and its effects upon traditional institutions and its role in the process of modernization in the last three centuries. Topics include early modern warfare through Napoleon, the U.S. Civil War and other clashes of the industrial era, the two World Wars, and recent conflicts in less developed regions of Asia and Africa.

His 483
The Making of Modern Thought 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. The formation of contemporary images of man, nature, and society since the mid-19th century Emphasis on Marx, Darwin, and Freud and their legacy to 20th-century thought.

His 485
Technology and Society in Western Europe Since the Middle Ages 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. An introduction to the social history of technology in Western Europe from the agricultural revolution of the Middle Ages to the second Industrial Revolution of the late nineteenth century. Emphasis on such themes as the process of technological innovation, the nature of technological systems, the diffusion

of technological improvements, the changing relations of science and technology, and the role of technology in broader historical movements.

His 486
Technology in American History 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. 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 manufactures, and the development of major technological systems like 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 twentieth century.

His 489
Population and History 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Deals with the interrelation between population, economy, and society in the Western World since 1500. Typical areas considered include the effects of disease, war, and diet on populations and on civilization; the roots of the population explosion; and the impact of demographic and economic change on the daily life of common people.

His 49O
Historical Problems of the 20th-Century Through Film 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. 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.

LITERATURE

Lit 442
Fiction: Themes, Techniques, Traditions 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Readings in the short story and the novel from different countries and eras; study of representative themes and styles, discussion of significant ideas, narrative methods, and socio-cultural attitudes.

Lit 444
Approaches to Poetry 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. An exploration of the properties, devices, and techniques of the art of poetry—sound, rhythm, meter; diction and tone; connotation, metaphor, symbol—as a means of demystifying the reading of poems. Familiarization with the contemporary English and American lyric prior to study of the less accessible poems of earlier centuries. Discussion of the place and purpose of poetry in a technological society.

Lit 451
Greek and Roman Classics in Translation 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Masterpieces of classical literature: the epics of Homer and Virgil; Greek comedy and tragedy; selections from the philosophical work of Plato and Lucretius; some Greek and Roman lyric poems, and examples of Roman satire. These works are studied primarily as literary masterpieces in their own right, but some account is given of their historical setting and of their influence upon subsequent literature.

Lit 453
Twentieth Century American Literature to 1950 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Maturing America's struggle to find itself is surveyed through representations of regionalism, the turmoil of cities, and our new awareness of Europe. The course presents the prose, poetry, and drama of the period through such writers as James, Adams, London, Dreiser, Lewis, Dos Passos, Stein, Hemingway, Faulkner, Frost, Eliot, and O'Neill.

Lit 455
Twentieth Century European Fiction 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Short novels by such writers as Albert Camus, Max Frisch, Guenter Grass, Hermann Hesse, Milan Kundera, Paer Lagerkvist, and Ignazio Silone. Their unique insights into the psychology of self-discovery; their philosophical, religious, and social ideas; their achievements in the art of narrative.

Lit 456
Modern Continental and British Drama 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. An examination of some of the dramas from the late 19th and 20th 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.

Lit 457
American Literature Since 1950 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Fiction, drama, and poetry of the outstanding post-war writers, with emphasis on long and short fiction. In drama, Williams, Miller, Albee; in poetry, Ginsberg, Dickey, Ferlinghetti, Bly, and others; in fiction, Bellow, Mailer, Malamud, Kesey, Cheever, and Vonnegut.

Lit 459
Twentieth Century American Drama 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 112, Hum. 231. An examination of the development of 20th century American drama with emphasis upon the ways, often experimental, in which the playwrights reflect the spirit of the times. A brief survey of American musical theater will be included.

Lit 462
The Russian Novel and Short Story 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Russian fiction of the 19th and 20th centuries. A balance will be maintained between two ways of looking at the material: (1) as artistic expressions of individual visions of man's condition, and (2) as documents that find a definite place within Russian social and intellectual history.

Lit 464
Modern Satire 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Social and political satire of the 20th century. Readings in a variety of satirical forms, with emphasis on contemporary authors.

Lit 465
Modern American Non-Fiction 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Critical readings in important non-fiction from the informal essays of H.L. Mencken to the "new journalism" of Norman Mailer and Tom Wolfe. The subject matter is Americana, as perceived at various instants since the First World War. Emphasis on modern prose style and the place of non-fiction in literature.

Lit 466
The Psychological Novel 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. A study of selected novels exploring the dynamics of the human psyche. The fictional works examined are supplemented by readings of psychoanalytic texts, used partly as a basis for discussion of the literature, partly as an analytic complement to the intuitive insights offered by the fiction.

Lit 469
Historical Literature 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Many novels and plays have been based on actual incidents and historical personalities. This course examines a number of such works. The original historical material will be compared with the literary work it inspired, providing insights into the nature of the creative process and the contrasting purposes of the historian and the creative writer.

Lit 475
William Shakespeare 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Selected plays from the histories, comedies, and tragedies, and some short poems, chosen to typify the various facets of this writer. Attention to Shakespeare's times and to the basis for his distinction among dramatists.

Lit 480
The Philosophy of Language: Patterns 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Examination of formation, tradition, and change in some typical patterns drawn from English, including American English, with the most noted speculations upon the ways of the human mind that these patterns reflect. Consideration of the relations between language and religion, science, and literature.

Lit 484
Literature and Film 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. This course will examine types of prose narrative, including journalistic accounts, novels, short stories, and audio-visual media, such as film and video-tape, with emphasis on the different forms and modes used for presenting significant ideas and cultural attitudes.

Lit 488
The City in Modern Literature 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Diverse images of the pleasures and perils of urban life as depicted by modern novelists, poets, and playwrights with special attention paid to works describing life in the metropolitan area. Such writers as Dreiser, Albee, Bellow, Feiffer, and Claude Brown are included.

Lit 490
Science Fiction 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Selected readings in modern and near-modern science fiction short stories, novels, and criticism. Discussions will focus on both the special nature of science fiction as a literary genre and its function as prophetic extrapolation and social criticism. Whenever possible, discussion will be supplemented by required viewing of appropriate SF films.

PHILOSOPHY

Phil 431
Problems in Philosophy 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. An examination of problems of a social, ethical, aesthetic, religious, and scientific nature and a study of the related principles and methods of philosophy. Readings will be 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.

Phil 450
Representative Philosophies 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. The ideas of a few great thinkers, from a variety of historical periods. The purpose is to show the student at first hand how these philosophers accelerated intellectual progress and how their work may contribute to the solution of modern problems.

Phil 455
The Philosophy of Science 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. An investigation into the foundations and implications of modern science, with special emphasis on the influence of philosophy on scientific thought and of scientific thought on philosophic questions raised by man's consciousness of himself.

ARTS

Arts 431
Developing Musical Perception 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Elements of music—its sensuous basis, rhythm, harmony, etc.—and historical differences in their use will be studied in order to show their function in the listener's response to the whole of a composition. All discussions will bring attention to the problem of the verbal language available to describe music and its effects.

Arts 432
Art Appreciation 3-0-3
A study of the major periods in the history of art. The course will emphasize painting from the Renaissance to contemporary periods, and will concentrate on the development of style in the work of major figures from each period.

Arts 433
History and Criticism of Films 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. The genesis and development of cinema techniques, analyzed with an introduction to criticism of the movie as an art form. Selected American and foreign films are analyzed and criticized.

Arts 434
Elements of the Theatre 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231. Using the resources of the NJIT Theater, students receive instruction in the elements of stage presentation: acting, design, theater history, and lighting and other technologies.

Arts 455
Appreciation of Art 3-0-3
Prerequisites: Eng. 111, Hum.112, Hum. 231. A study of the major periods in the history of art. The course will emphasize painting from the Renaissance to contemporary periods, and will concentrate on the development of style in the work of major figures from each period.

SEMINARS

Hum 491-494
Seminars in the Humanities 3-0-3
Prerequisites: Eng. 111, Hum. 112, Hum. 231 plus recommendations by former humanities instructors. Honors courses. The subjects will be announced at the time of registration. Each seminar is limited to 12 students.

Man and Technology

MT 301
Independent Study 1 credit
MT 302
Independent Study 2 credits
MT 303
Independent Study 3 credits
MT 401
Independent Study 1 credit
MT 402
Independent Study 2 credits
MT 403
Independent Study 3 credits
The prerequisites for independent study courses in Man and Technology are junior standing in the program and written approval of the program coordinator. The courses consist of self-paced study on an individual or small group basis in a specific area integral to a student's Man and Technology concentration but not available on an regular course basis.

MT 308
Technological Alternatives 3-0-3
Prerequisites: Eng. 111, Hum. 112. Survey of methodological approaches to the social study of science and technology. First half of the course presents perspectives from the history of science and technology, sociology, economics, philosophy, and science and technology policy. Second half applies these approaches to specific case studies, such as the interaction of technology and politics in postwar debates over national defense, the control of nuclear power, or the problems of environmental pollution.

MT 310
Technology and Human Values 3-0-3
Prerequisites: Eng. 111, Hum. 112. The course examines the interactions between science-technology and human values. Specifically, it 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.

MT 308 & MT 310 are required for Man and Technology, and are open to other students as free electives or as Hum. OS/SS 300-level electives under the headings Hum. 308, Hum. 310. They do not fulfill the 400-level humanities requirement.

MT 490
Project and Seminar I 3 credits
Prerequisite: senior standing in the Man & Technology program. A comprehensive study of an issue in science technology, and human affairs. The solution will require 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 will be submitted as a detailed written report. The seminar meets weekly. Speakers from education, government, and industry will address themselves to topics of current interest to Man & Technology students.

MT 491
Project and Seminar II 3 credits
A continuation of MT 490.

Mathematics

Chair: Henry Zatzkis
Associate Chair: A. E. Foster
Assistant Chair: Armand Berliner
Distinguished Professor: Zatzkis
Professors: Andrushkiw, Barkan, Blackmore, Foster, V. Goldberg, Perez, Voronka
Associate Professors: Brower, Chase, Cohen, Flatow, Kappraff, Katzen, Lieb, Lione, Plastock, Rausen, Scheinok, Tavantzis
Assistant Professors: Berliner, Sran, Zames
Special Lecturers: Benson, Dios, L. Goldberg,

For Math 141, 142, 242, 340, 341 and 342, see Statistics and Actuarial Science courses, pages 59 and 60.

Math 102
Mathematical Concepts 3-0-3
This course contains an introduction to college algebra and selected topics in analytic geometry. Applications from many fields including science and industry are stressed throughout the course.

Math 105
Probability and Statistics 3-0-3
Prerequisite: Math 102 or equivalent. This course considers notions of probability. The topics studied include the binomial and normal distributions, expected value, and variance. The notions of sampling, hypothesis testing, and confidence intervals are applied to elementary situations.

Math 106
Basic College Mathematics 4-0-4
This course includes topics in algebra, trigonometry, and analytic geometry with an emphasis on problem solving.

Math 107
Introduction to College Mathematics 4-0-4
Topics from algebra, trigonometry, and analytic geometry are covered in this course with particular emphasis on the formulation and analysis of physical problems. This course is a prerequisite to Math 111 if three-and-one-half units of high school mathematics or Math 109 have not been completed.

Math 108
Mathematical Analysis I 3-0-3
Prerequisite: Math 106 or equivalent. This course contains review topics from analytic geometry and elementary calculus along with further topics in differential and integral calculus useful to the technologist and industrial administrator. The notion of a differential equation is included.

Math 109
Introductory Mathematics IE 2-1-2
This course contains review topics from college algebra, trigonometry, and analytic geometry with particular emphasis on the formulation and analysis of physical problems.

Math 110
Calculus IE 2-1-2
Prerequisite: Math 109 or equivalent. This is the first course in a four-course calculus sequence for evening students. This course considers material involving the theory and techniques of differentiation and integration. It includes applications to problems involving maximum and minimum and related rates, and to areas under curves.

Math 111
Calculus I 4-0-4
Prerequisite: three and one-half units of high school mathematics or Math 109 or Math 107. This course considers the theory and techniques of differentiation and integration with applications of both processes to engineering and physics. Included are some topics from coordinate geometry.

Math 112
Calculus II 4-0-4
Prerequisite: Math 111. Topics considered include the differentiation and integration of inverse trigonometric, exponential, and logarithmic functions and further methods of integration. Applications of the definite integral to physical problems are also included.

Math 113
Finite Mathematics and Calculus 4-0-4
Prerequisite: Math 106 or equivalent. This course will consist of four self-contained modules covered in the following order:
1. Trigonometry and triangle problems.
2. Linear equations, matrices, and an introduction to linear programming.
3. Descriptive statistics and an introduction to probability.
4. An introduction to differential calculus.
The focus of the course will be on applications. Throughout the course and in preparation for the calculus module, the students will review their algebra fundamentals.

Math 116
Mathematics of Design 3-0-3
Prerequisite: Math 106 or Math 111 or Math 113 or Math 138. Mathematical tools for design are presented and incorporated into a set of design projects. The areas of study include: theory of graphs, tilings of the plane, lattices, vectors, transformations, symmetry, study of polyhedra, and the theory of proportion in art and architecture.

Math 118
Honors Mathematics I 4-0-4
This is the first semester of an eight-semester program in Honors Mathematics. Topics include rates of change, continuity, theory of differentiation and integration, as well as applications to engineering problems. Admission to this course is by invitation, based on SAT scores and class standing.

Math 119
Honors Mathematics II 4-0-4
Prerequisite: Math 111 or 118. This is the second semester of an eight-semester program in Honors Mathematics. Topics include methods of integration, introduction to vector analysis and parametric equations. Admission to this course is by departmental approval.

Math 138
General Calculus I 3-0-3
This course consists of the introduction to differential and integral calculus of a single variable.

Math 209
Mathematical Analysis II 3-0-3
Prerequisite: Math 108. This course is a continuation of Math 108. Topics include differential equations, Laplace transform techniques, Fourier and other series.

Math 219
Calculus II E 3-0-3
Prerequisite: Math 110. This is the second course of a four-course calculus sequence for evening students. It contains material on the application of the definite integral to problems involving volume, length, and surface areas. It also considers the trigonometric, exponential, and logarithmic functions with applications.

Math 220
Calculus III E 3-0-3
Prerequisite: Math 219. This course is the third course of a four-course calculus sequence for evening students. It considers methods of integration, analytic geometry, hyperbolic functions, and polar coordinates. An introduction to vectors is included.

Math 221
Calculus III 4-0-4
Prerequisite: Math 112. This course is a continuation of Math 112. The main topics considered are partial differentiation, multiple integrals, infinite series, vectors, Fourier series, and the expansion of functions.

Math 222
Differential Equations 4-0-4
Prerequisite: Math 221 and a knowledge of a programming language. Methods for solving ordinary differential equations are studied, together with physical and geometrical applications. Laplace transforms and numerical and series solutions are included.

Math 223
Elementary Differential Equations and Statistical 4-0-4
Prerequisite: Math 221. This course includes an introduction to the solution of ordinary differential equations including linear equations with constant coefficients. Geometrical and physical applications are considered. The course also includes an introduction to probability and statistics.

Math 226
Discrete Analysis 4-0-4
Prerequisite: Math 221. This course is an introduction to discrete mathematics. Topics covered include elementary set theory, logic, permutations and combinations, relations, graphs and trees, groups, rings, and fields.

Math 228
Honors Mathematics III 4-0-4
Prerequisite: Math 110 or 112 and permission of the instructor. This is the third semester of the Honors Mathematics program. It is a rigorous review of elementary calculus, with a detailed discussion of infinite series and the Riemann integral.

Math 229
Honors Mathematics IV 4-0-4
Prerequisite: Math 228 or 221 and permission of the instructor. This is the fourth semester of the Honors Mathematics program. It is a first course in ordinary differential equations in which mathematical depth is considered substantially more important than manipulative skills.

Math 238
General Calculus II 3-0-3
Prerequisite: Math 138. This course is a continuation of Math 138. It includes applications of integral calculus and an introduction to ordinary differential equations.

Math 244
Introduction to Probability Theory 3-0-3
Prerequisite: Math 221. Basic preparation for statistics majors and actuarial science students This course is concerned with set theory, dependent and independent events, discrete and continuous distributions, random variables, moment generating functions, multivariate distributions limit laws, classical distributions, application to reliability theory and signal to noise ratios.

Math 305
Statistics for Technology 3-0-3
Prerequisite: Math 108 or equivalent. This course contains an introduction to the modern concepts of statistics needed by engineering technologists. Topics include descriptive statistics, statistical inference, regression, correlation, analysis of variance, nonparametric methods. Applications to technology are stressed. This course is not intended for engineering students.

Math 329
Calculus IV E 3-0-3
Prerequisite: Math 220. This is the fourth course of a four-course calculus sequence for evening students. It covers material involving three-dimensional analytical geometry, partial

derivatives, multiple integrals, and infinite series. A brief introduction to differential equations is included.

Math 330
Differential Equations E 3-0-3
Prerequisite: Math 329. This course includes the solution of ordinary differential equations. Solutions by means of infinite series, Laplace transforms, and numerical methods are studied. Applications are stressed throughout.

Math 331
Introduction to Partial Differential Equations 3-0-3
Prerequisite: Math 222 or 330. Partial differential equations of physics and engineering. Initial, boundary value problems for the parabolic, hyperbolic and elliptic second order PDE. Stress on operation of variables techniques, special functions, transform methods, and numerical techniques. Fourier series, and wave heat, and potential equations. Solutions include separation of variables, transform methods, and numerical methods.

Math 332
Introduction to Functions of a Complex Variable 3-0-3
Prerequisite: Math 222 or 330. A first course in functions of complex variable Caunchy-Riemann equations, Cauchy-Goursat theories, integration, series, residues, poles, geometrical aspects. Emphasis is placed on techniques. Topics considered include the complex plan. Cauchy-Riemann equations, geometrical aspects, residues, and poles.

Math 333
Probability and Statistics 3-0-3
Prerequisite: Math 221 or 329. This is a course in modern probability, statistics, and statistical inference. Specific topics include discrete and continuous distributions of random variables, probability models in science, and statistical inference.

Math 334
Mathematics for Management Science 3-0-3
Prerequisite: Math 333. This course considers mathematical methods found especially in contemporary fields such operations research and reliability engineering. Topics included are linear programming, graph theory, finite mathematics, differential equations, matrices, and determinants.

Math 335
Vector Analysis 3-0-3
Prerequisite: Math 221 or 329. Algebra and calculus of vectors. Introduction to Green's, divergence, and Stokes theories, curvilinear coordinates. Applications to physical phenomena are considered throughout.

Math 337
Linear Algebra 3-0-3
Prerequisite: Math 112. This course considers matrices, determinants, systems of linear equations, vector spaces, linear transformations, and related topics.

Math 338
Honors Mathematics V 3-0-3
Prerequisite: Math 228 or 222 and permission of the instructor. This is an undergraduate course in complex variables with special emphasis on the evaluation of real integrals. Additional topics include conformal mapping, Reimann surfaces, special functions, and some applications to potential theory.

Math 339
Honors Mathematics VI 3-0-3
Prerequisite: Math 333 or 229, or Math 222 and permission of the instructor. This course is a rapid survey of classical vector analysis followed by an introduction to linear and multilinear algebra. Topics covered include the classical vector integral theorems of Green, Stokes, and Gauss; the theory of linear operations on finite dimensional vector spaces with the associated matrix theory, and modern tensor analysis.

Math 448
Honors Mathematics VII 3-0-3
Prerequisite: Math 338 or 332 and permission of the instructor. This course first considers the topology and multilinear algebra needed to begin a serious consideration of tensors, differential forms, and Stokes' theorems.

Math 449
Honors Mathematics VIII 3-0-3
Prerequisite: Math 448. This course is a continuation of Math 448. It extends further the multivariate analysis begun in Math 448.

Math 491
Independent Study in Mathematics 3-0-3
Prerequisites: senior standing and permission of the department. Each student will work under the direct supervision of a member of the Department of Mathematics. The work will consist primarily of a project applying the mathematical skills the student has acquired to an engineering and science oriented project.

Math 511
Introduction to Numerical Analysis 3-0-3
Prerequisites: calculus, differential equations, and knowledge of at least one procedure-oriented language such as Fortran. This course is designed to familiarize students with theory and techniques of numerical methods applicable to problems in the fields of engineering and the physical sciences. Attention is given to algorithms suitable for digital computer approximation in interpolation, differentiation, and integration; discussion of iteration and convergence; least squares and other types of approximation; roots of algebraic and transcendental equations, and solution of ordinary differential equations.

Math 545
Advanced Calculus I 3-0-3
Prerequisite: undergraduate differential and integral calculus. This course deals with the topics of advanced calculus such as the number system, functions, continuity, differentiability, the Riemann Integral, sequences, series, and uniform convergence.

Math 546
Advanced Calculus II 3-0-3
Prerequisite: Math 545 or equivalent. This course is a continuation of Math 545 and considers such topics as partial differentiation, transformations, implicit function theorem, multiple integrals, and line and surface integrals.

Math 551
Applied Mathematics I 3-0-3
Prerequisites: undergraduate differential equations, physics. Discussion of mathematical methods used in the analysis of problems arising in applied mathematics and engineering. The course covers selected topics from: ordinary differential equations, Fourier series, general orthogonal systems, Laplace and Fourier transforms, boundary value problems, generalized functions.

Math 573
Differential Equations I 3-0-3
Prerequisite: undergraduate differential equations. Advanced topics in ordinary differential equations with applications to engineering problems.

Math 574
Differential Equations II 3-0-3
Prerequisite: Math 573 or equivalent. A companion course to Math 573, dealing with partial differential equations, with emphasis on those of physics and their solution by means of Fourier series, Bessel functions, and Legendre polynomials.

Math 577
Stochastic Processes 3-0-3
Prerequisite: undergraduate differential equations. The course begins with the development of basic probability concepts of discrete and continuous random variables. Gaussian processes, correlation functions, and Power spectra are introduced. Applications include the response of linear communication systems to random input signals.

STATISTICS AND ACTUARIAL SCIENCE

The following courses are intended primarily for students in the Statistics and Actuarial Science Program, but others may elect them:

Math 141
Introduction to Actuarial Science 3-0-3
Prerequisite: High school algebra (two years). Corequisite: CIS 101 or CIS 202. This course is designed to serve as an introduction to the mathematics of life insurance. Topics covered include probability, compound interest, annuities, certain life annuities, life insurance, net premiums, gross premiums, net level reserves.

Math 142
Exploratory Data Analysis 3-0-3
This course presents useful and practical modern methods of plotting and examining data. These include sources of data, stem and leaf plots, symmetrizing transformations, box plots, smoothing sequences, and applications to real data sets.

Math 242
Introduction to Statistics 3-0-3
Prerequisites: Math 142, Math 221. This course begins with elementary distribution-free confirmation statistics followed by a careful introduction to probability and finally a standard exposition of normal theory and applications. It also provides an introduction to statistical inference. Data are analyzed by order of rank with few assumptions on underlying distributions.

Math 340
Applied Numerical Methods & Optimization 3-0-3
Prerequisite: Math 221, CIS 101, or CIS 202, or equivalent. This is an introductory course in numerical methods with emphasis on mathematical models. The course is designed for computer implementation and covers the following topics: solution of linear and nonlinear systems of equations, eigenvalue problems, interpolation and approximation, techniques of optimization, Monte Carlo Methods, and applications to ordinary differential equations and integration.

Math 341
Probabilistic and Statistical Analysis I 3-0-3
Prerequisite: Math 242. This course is a continuation of Math 242 and is an introduction to classical statistical inference and estimation, often assuming data with normal distribution. Topics covered include moment generating functions, Gaussian and related distributions, and random sampling.

Math 342
Probabilistic and Statistical Analysis II 3-0-3
Prerequisite: Math 341. This course is a continuation of Math 341. Topics covered include: Hypothesis testing, repression, analysis of variance, sampling techniques, design of experiments.

Mechanical Engineering

Chair: Bernard Koplik
Associate Chair: Aaron Deutschman
Assistant Chair: Harry Herman (Graduate), Benedict Sun (Mechanical Technology)
Professors: Allentuch, Chen, Cochin, A. Deutschman, Fenster, Herman, Hrycak, Hsieh, Koplik, Linden, Miller, Papas, Pawel, Progelhof, Stamper, Wilson, Yu
Associate Professors: Droughton, Florio, Golden, Hanus, Ketzner, Kirchner, Martin, Rights, Schmerzler, Sun
Assistant Professors: Gaal, Jaffe, Nakamura
Research Professor: Bales
Special Lecturers: Dubrovsky, Geskin, Kountouras, Spencer

ENGINEERING GRAPHICS

EG 101
Engineering Graphics 1-2-2
This course is offered as the student's first experience with the subject of graphics, the engineer's method of expression and communication. A short introduction to theory of orthographical projection through descriptive geometry is employed as a reasonable device for providing the ground-work for understanding the techniques of graphical presentation employed professionally. Assignments are provided to acquaint the student with the "language" standards of the various fields of engineering. Fundamentals of engineering design are also discussed as a logical rationale for developing graphical capability. Freehand sketching and the solution of simple design problems using graphical techniques are also presented.

EG 202
Elements of Mechanical Engineering 1-2-2
Prerequisite: EG 101. This is an introduction to engineering design and computer graphics applicable to mechanical engineering. Emphasis is placed on the fundamental steps necessary in the generation of a sound design. The assignment of an engineering report is used as the vehicle to synthesize basic concepts.

EG 203
Industrial Engineering Graphics 1-2-2
Prerequisite: EG 101. A graphics course for industrial engineering students where particular stress is given to those areas of graphical communication which relate to manufacturing and production. An introduction to the understanding and use of computer graphics is an integral part of the course. The objective of this course is to provide the student with a knowledge of those graphical standards necessary to meet the requirements of present day industrial engineering practice.

EG 204
Civil Engineering Graphics 1-2-2
Prerequisite: EG 101. A graphical course which presents fundamental concepts and related material as they apply to technology of our present society, particularly in the field of civil engineering. It is intended that the assignments in this graphical area will also encourage the students to communicate engineering information through freehand sketches and working drawings in the areas of construction, land planning, and aesthetics. The techniques and standards used in preparing professional drawings and specifications for civil engineering applications will be covered in sufficient detail. The development of the students' vocabulary of technical terms pertaining to the field of civil engineering will be enhanced through practical details and professional designs.

EG 205
Engineering Communication 1-2-2
Prerequisite: EG 101. The objective of this course is to provide the student with practice in written, oral, and graphical communication of scientific and technical information through computer graphics. The precision of technical language and conciseness of expression are stressed. A survey of commercial aids and techniques applicable to publication is made, together with the means of protection by copyright and patent. Graphical and computer methods are used to analyze and present experimental data. This course is required for electrical engineering students.

MECHANICAL ENGINEERING

ME 215
Engineering Materials and Processes 2-2-3
Prerequisite: Chem 116. A combined lecture and laboratory course relating to the study of engineering materials. The processes of forming from liquid and particle state, plastic forming, molding deformation, and metal removal are all studied. The effects of heat treatment on material properties are discussed. Laboratory exercises are performed with basic machine tools, welding and gaging equipment.

ME 231
Kinematics and Dynamics of Machinery 3-1-3
Prerequisites: CIS 101, Mech 230. The design approach is applied to machines such as: cam and follower, speed changers, geared transmission, planetary gear systems, and linkages for generating a specific type of motion. Graphical, analytical, and digital computer methods are used.

ME 303
Design of Machine Elements 3-2-4
Prerequisites: ME 215, ME 231, Mech 232. The various aspects of the design process as well as the design of machine elements are discussed. Projects are used to introduce the student to the design procedures used in engineering practice.

ME 304
Fluid Dynamics 3-1-3
Prerequisites: Mech 230, 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 studied are: dimensional analysis, theoretical and empirical analysis of one-dimensional compressible and incompressible flow, empirical analysis of external and internal flows, and concepts of the hydrodynamic boundary layer.

ME 305
Introduction to System Dynamics 3-0-3
Prerequisites: ME 231, Math 222. Principles of dynamic system modeling and response with emphasis on mechanical systems. Application of computer simulation techniques. Introduction to design concepts.

ME 308
Analysis and Synthesis of Mechanical Systems 2-1-2
Prerequisites: ME 305, ME 303, ME 311. A study of the interaction of elements in the analysis and synthesis of mechanical systems. The design of mechanical systems under various dynamic conditions, including shock and vibration; design for vibration isolation; design of systems that employ vibration as an energy source.

ME 310
Work Experience I
Prerequisite: completion of sophomore year. Approval of department and permission of director of cooperative education. Cooperative education work experience of six months providing industrial reinforcement of academic program. Direct exposure to industrial situations work assignments provided by and approved by director.

ME 311
Thermodynamics I 3-0-3
Prerequisites: Math 221, Phys 111. A course in thermodynamic fundamentals. Among those principles introduced 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 analysis of power producing, refrigeration, and air-conditioning systems. Introduction to solar energy thermal processes, nuclear power plants, and direct energy conversion are also included.

ME 339
Fundamentals of Mechanical Design 3-0-3
Prerequisites: EG 203 and Mech 232. A course in mechanical design for industrial engineering students. Among the topics treated are kinetics of mechanisms, machine components, and a brief introduction to mechanical vibrations. The topics are integrated to provide the student with the ability to deal with design problems from the viewpoint of the non-specialist.

ME 343
Mechanical Laboratory I 2-2-3
Prerequisite: EE 305. Corequisite: ME 304. A laboratory and lecture course in instrumentation and measurement for mechanical engineering students. Applications for the sensing of such variables as pressure, temperature, mass flow, and displacement are covered. Particular attention is directed toward applicability and sensitivity of instruments studied.

ME 361
Thermodynamics 3-0-3
Prerequisites: Phys 111 and Math 221. This course for non-mechanical engineering students includes the basic laws of thermodynamics; fluid, solid, magnetic, and electrical property functions; energy analysis for open and closed systems; gas and vapor cycles; refrigeration; and an introduction to modern dynamic and static energy conversion devices.

ME 403
Mechanical Systems Design I 2-2-3
Prerequisites: ME 215, ME 304, ME 308. Corequisite: ME 407. Lectures and projects covering problem solving methodology in the design, analysis, and synthesis of mechanical and thermal systems. The student's background in all subject areas is utilized together with engineering principles and topics covered in the classroom to serve as a foundation for broad engineering projects. Emphasis is placed on creative thinking and the engineering design process in projects involving the optimal conversion of resources.

ME 404
Mechanical Systems Design II 2-2-3
Prerequisites: ME 403, IE 494. A continuation of Mechanical Systems Design I from a more integrated viewpoint. Concepts in optimization and computer simulation are considered in the design and synthesis of mechanical and thermal systems. The projects are more comprehensive, emphasize creative design, and require design decisions of a more sophisticated nature.

ME 405
Mechanical Laboratory II 1-2-2
Prerequisite: ME 343. Corequisite: ME 407. A laboratory course for mechanical engineering students. Emphasizes the use of fundamental principles and instrumentation systems for the analysis and evaluation of mechanical devices and systems.

ME 406
Mechanical Laboratory III 1-2-2
Prerequisite: ME 405. An advanced laboratory course for mechanical engineering students. Includes 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 are considered using numerical methods in the solution of problems. The theory is applied to the analysis and design of heat exchangers and other applications.

ME 410
Work Experience II
Prerequisite: ME 310 and permission of director of cooperative education. Cooperative education work experience of six months, normally with same employer as ME 310.

ME 437
Structural Analysis 3-0-3
Prerequisite: Mech 232. A course designed to acquaint mechanical engineering students with the fundamentals of structural analysis. Consideration is given to such topics as 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 451
Introduction to Aerodynamics 3-0-3
Prerequisites: ME 311 and 304. A first course in aerodynamics which introduces the student 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 453
Energy Conversion 3-0-3
Prerequisites: undergraduate thermodynamics and EE 305. An elective course for engineering students dealing with the theory, analysis, and design of modern static and dynamic energy conversion devices. The applications include thermoelectrics, magnetohydrodynamics, electrohydrodynamics, fuel cells, reciprocating and rotary energy converters.

ME 455
Automatic Controls 3-0-3
Prerequisites: ME 305. An introductory course covering the principles of automatic controls. Emphasis is placed on mechanical systems considering hydraulic, pneumatic, thermal, and displacement aspects. First and second order linear systems are studied. Various system analysis techniques such as Nyquist and Bode diagrams are introduced. These techniques are applied in system design.

ME 456
Fluid Machinery 3-0-3
Prerequisites: ME 311, ME 304, and Math 222. An introduction to the underlying principles of rotating fluid machinery. The fundamentals of gas dynamics are introduced. Analytical, graphical, and dimensional analysis methods are used in analyzing axial and centrifugal machines. Airfoil, cascade, and channel flow theories are introduced.

ME 457
Electro-Mechanical Systems 3-0-3
Prerequisite: ME 305. An introduction to electro-mechanical systems from both an analytical and a descriptive viewpoint. The analysis and design of practical devices such as accelerometers, valves, missiles, microphones, vibrometers, and electro-static speakers are presented.

ME 462
Energy Conversion and the Environment 3-0-3
Prerequisite: undergraduate thermodynamics. The operation of energy conversion systems and their impact on the environment will be studied. Topics include current and future energy resources (including geothermal, fossil fuel, wind, tide, solar, hydroelectric, and nuclear), factors affecting the rate of energy consumption, energy conversion systems—their efficiency, and limitations, their effect on the environment (air and thermal pollutions), methods of energy conversion, and consideration of future fuel resources.

ME 463
Applied Thermodynamics 3-0-3
Prerequisites: Math 221 and Phys 111. This course presents an introduction to work, heat, and thermodynamic principles. Energy balance analysis methods are used in the solution of applied problems in the areas of power cycles, refrigeration, engines, heat transfer, thermoeconomics, solar energy, and thermal pollution. This course is for non-mechanical engineering majors.

ME 466
Air Pollution Control 3-0-3
Prerequisite: undergraduate thermodynamics. The course objective is to familiarize the student with the sources of air pollution caused by mechanical equipment and to investigate primary industrial contributors to the problem. Various methods of reducing air pollution will be investigated.

ME 467
Aspects of Thermal Pollution 3-0-3
Prerequisite: undergraduate thermodynamics. This course investigates the problems associated with the rejection of waste energy of powergenerating plants and other industrial heatgenerating equipment. The primary concern of this study will be the effects of heat rejection upon the immediate environment and how one can help mitigate the associated problems.

ME 468
Noise Pollution and Abatement 3-0-3
Prerequisite: differential equations. Discussion of sources and characteristics of noise pollution; physiological effects of noise; hearing conservation; study of fundamentals of noise propagation; techniques of noise measurement; product design for abatement of industrial noise and transportation noise; and noise control legislation.

ME 470
Engineering Properties of Plastics 3-0-3
Prerequisite: Mech 232. A study of the physical properties of the various commercial thermoset and thermoplastic resins. An introduction to linear viscoelastic theory and its relationship to measurable mechanical prop-

erties of plastics. Other engineering properties such as flammability, chemical resistance, and electrical properties will be discussed.

ME 471
Introduction to Polymer Processing Techniques 3-0-3
Prerequisites: ME 407 and ME 304 or equivalent. A study of the various plastics processing techniques. Included are 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 480
Introduction to Solar Energy 3-0-3
Prerequisite: undergraduate thermodynamics. An elective course concerned with the use of solar energy for distillation, pool heating, domestic water heating, and space heating and cooling. The thermal processes by which solar radiation is absorbed by a surface, converted into heat, distributed, and stored, will be studied. Calculation procedures for determining the heat loss of buildings and the development of computer models and simulation techniques will also be covered.

ME 490
Mechanical Engineering Project A 2-0-2
Prerequisite: senior standing. A mechanical engineering projects course in which the student works on one or more individually selected projects. The projects usually involve library research, design, cost analysis, planning of testing, and preparation of an engineering report.

ME 491
Mechanical Engineering Project B 2-0-2
Prerequisite: ME 490. A mechanical engineering projects course in which the student works on one or more selected projects. The projects usually involve library research, design, cost analysis, planning of testing, and preparation of an engineering report.

*ME 609
Dynamics of Compressible Fluids 3-0-3
Prerequisites: undergraduate differential equations, fluid mechanics, and thermodynamics. This course covers 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 with an introduction to the method of characteristics; and two-dimensional oblique shock.

*ME 635
Computer-Aided Design 3-0-3
Prerequisite: course or demonstrated competence in computer programming. The course concerns the adaptation of the digital computer to the solution of engineering design problems. Topics treated include design morphology, simulation, and modeling, algorithms, problem-oriented languages, use of available software, computer graphics, automated design and the application of these concepts to specific engineering design problems.

*ME 639
Combustion Engine Emissions and their Control 3-0-3
Prerequisite: undergraduate thermodynamics. This course is a study of the role of gasoline and diesel engines in air pollution. The relationship between fundamental engine design, combustion, and emission formulation is traced for the homogeneous combustion process of the gasoline engine and the heterogeneous combustion process of the diesel engine. A discussion of present and future emission control techniques is included. Experiments and/or demonstrations on fuel characteristics, engine performance, and exhaust emissions are performed.

*ME 670
Introduction to Biomechanical Engineering 3-0-3
Prerequisites: undergraduate thermodynamics, statics, and dynamics. This is an introductory course in biomechanical engineering designed to interpret the functioning of physiological systems in terms of mechanical engineering systems. Topics include fluid flow, structure and motion, transport, and material aspects and energy balances of the body as well as the overall interaction of the body with the environment.

*ME 671
Biomechanics of Human Structure and Motion 3-0-3
Prerequisites: undergraduate statics, kinematics, and dynamics. Principles of engineering mechanics and materials science are applied to the study of the behavior of human structural and kinematic systems and to the design of prosthetic devices. Topics include anatomy human force systems; human motion; bioengineering materials; design of implants, support, braces, and replacement limbs.

*ME 679
Polymer Processing Techniques 3-0-3
Prerequisites: undergraduate courses in fluid dynamics and heat transfer. A course dealing with the processing of plastics. Included are the fundamentals of the various processing techniques, extrusion, injection molding, compression molding, thermoforming, casting, foaming, etc.

**These courses are offered as graduate courses but may be taken as electives with approval of the Chair or Associate Chair of the Mechanical Engineering Department.*

Organizational and Social Sciences

Chair: David T. Geithman
Associate Chair: Naomi Rotter
Distinguished Professor: Helfgott
Professors: Bordman, Geithman, Stochaj, Zaner
Associate Professors: Kahng, LaVerda, Lubin, Mills, Rotter, Schachter
Assistant Professors: Levinson, Spector, Spitz
Special Lecturers: Albright, Fairfield, Horowitz, Lally, Melnick

ORGANIZATIONAL SCIENCE

OS 171
Industrial Organization and Management 3-0-3
Not available to engineering or technology students. An 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 are discussed.

OS 261
Introduction to the Behavioral Sciences 3-0-3
Prerequisites: one of the following: SS 202, 210, 221, or 231. The content, methods, and prospectus of the behavioral sciences; analysis of the needs that have emerged from organizational and human interaction in a democratic society; the development of interdisciplinary scholarly pursuits; and critical examination of selected behavioral studies. Emphasis is placed upon research methodology, particularly within the business setting.

OS 281
Advertising 3-0-3
Prerequisite: junior standing. Advertising and other sales promotional methods are studied from the perspective of communicating with the market. Special emphasis is placed on the development of creativity in the students. Topics include advertising's place in the marketing mix, media selection, advertising research, and production and sales promotional strategies.

OS 310
Work Experience I
Prerequisite: completion of sophomore year. Approval of department and permission of director of cooperative education. Cooperative education work experience of six months providing industrial reinforcement of academic program. Direct exposure to industrial situations. Work assignments provided by and approved by director.

OS 371
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 inter-relationships with upper management and labor union representatives. The conference method and case study techniques are utilized.

OS 381
Personnel Management and Industrial Relations 3-0-3
Background and operating concepts governing the management of human resources in business, industry, and government. Coverage includes job study and recruitment, selection, training, motivation, wage and salary administration, employment stabilization, personnel records and research, and the management of relations with organized employees.

OS 391
Labor-Management Relations 3-0-3
Prerequisite: OS 381 or SS 202. Labor-management relations. Unions, collective bargaining, management prerogatives, the settlement of disputes, and legislative controls. The role of the supervisor in dealing with employees as members of organized groups, particularly with respect to handling employee grievances.

OS 410
Work Experience II
Prerequisite: SS 310 and permission of director of cooperative education. Cooperative education work experience of six months, normally with same employer as SS 310.

OS 432
American Tradition of Public Administration 3-0-3
Prerequisites: SS 201, SS 231. A survey of the role and functioning of the Federal government bureaucracy in the United States. Historical review of how presidential power has grown; administrative reform movements; important commissions of inquiry; the power of regulatory commissions and public agencies. How public administration is changing and what it will look like in the future.

OS 452
Contemporary Social and Political Issues 3-0-3
Prerequisites: SS 221 or SS 231. Not available to BSIA students. Who gets what, when, how, in housing, education, transportation, welfare, and public safety. Key social and political issues relating to the distribution of urban metropolitan services. Topics include: overview of present programs in one or two substantive areas; demands and supports of various social groups and organizations; alternatives for the future.

OS 453
Contemporary Labor Issues 3-0-3
Prerequisites: SS 201 and one of the following: SS 202, SS 210, SS 221, SS 231. The major problems affecting the relationship of labor with management and the total society. Labor market issues and their impact on the nation's economy: productivity, wages, and inflation, unemployment, minimum wages, Social Security, equal employment opportunity, and manpower policy.

OS 454
Contemporary Economic Issues 3-0-3
Prerequisite: SS 201. The major problems and policy issues confronting the U.S. economy in the 1980s. Topics include: inflation, unemployment, the dollar in foreign exchange markets, economic growth and productivity, energy and the economy, international trade and investment, urban economic problems, health care, taxation and public expenditures, and national resource policies.

OS 455
Contemporary Management Issues 3-0-3
Prerequisites: OS 471 or OS 472 or OS 474. The impact of government regulation on management. The social responsibility of organizations. Ethics in public and private organizations. The impact of rapidly changing technology on management practices. Managing human resources in the future.

OS 456
Contemporary Ecological Issues 3-0-3
Prerequisites: SS 201 and one of the following: SS 201, SS 210, SS 221, SS 231. Not available to BSIA students. The nature and causes of environmental problems and evaluation of related policy questions. Topics include: air and water pollution, environmental aspects of alternative energy technologies, depletion of population growth, food supplies, and global interdependence for key resources.

OS 457
Technology and Society I 3-0-3
Prerequisite: two semesters of science. Not available to engineering students. Critical analysis of technological progress and its impact upon society. The directions provided by modern science and research, engineering, production, distribution, and consumption. Examination of the effects of private and public policy direction and management. Discussion of the resulting problems of ecological decay and energy deployment.

OS 458
Technology and Society II 3-0-3
Prerequisite: OS 457. Not available to engineering students. An interdisciplinary approach to planning and utilizing human and material resources. Technological assessment which integrates the needs of business, government, the consumer, and the citizen for both the short-run and long-term. Discussion of approaches and models for solving societal problems which have resulted from technological advances. Topics include a systems approach to planning and utilizing human and material resources, the decision-making process and the use of feedback and computer applications.

OS 461
Group Development and Dynamics 3-0-3
Prerequisite: OS 371. The study of individual needs in relation to the formation of groups in business and industry. Introduction to interaction analysis and group life. A review of several major behavioral studies upon which the field of group dynamics is founded. The course includes an analysis of group process as it is applied in sensitivity training, encounter groups, and action research.

OS 471
Management Practices 3-0-3
Not available to students who have taken OS 472 or OS 474. The concepts and programs of modern management with emphasis upon the role of the engineer at all levels of responsibility. Organization, motivation, and morale; scientific management and human relations; the functions of planning, directing, and controlling; the influence of industrial engineering, labor unions, staff personnel departments, and research.

OS 472
Management and Organizational Behavior 3-0-3
Not available to students who have taken OS 471 or OS 474. The concepts and programs of modern management with emphasis on technological progress and its effect upon organizational behavior. Coverage includes structure of industrial organization, leadership styles, labor-management relations, innovation, and decision making. The course will introduce methods and findings of the behavioral sciences as these apply to management and organizational behavior.

OS 473
Employee-Management Communications 3-0-3
Prerequisite: OS 371. The establishment and maintenance of effective channels of both formal and informal oral and written communication among and between management and workers, including attention to the technical essentials of impressive presentation of ideas. Techniques for handling supervisory conferences and reports. The preparation, use, and revision of handbooks and various directives, instructions, and manuals of information.

OS 474
Human Resources Management 3-0-3
Not available to students who have taken OS 471 or OS 472. An examination of selected problems in human resources management related to the role of the industrial and/or management engineer. Operating with labor contract provisions, arbitration awards, wage incentive plans, performance appraisal systems, and management by objectives. The process of establishing and maintaining progressive programs of industrial relations. The needs of supervisors at all levels to participate in decision making. Case studies and participative techniques are utilized.

OS 475
Organizational Strategies for Productivity Improvement 3-0-3
Prerequisite: OS 471, OS 472, or OS 474. Productivity: definition and trends. Job analysis and design. Use of selection and assignment profiles. Designing organizations for dynamic productivity improvement. Management by objectives: goal setting, management and employee training, performance appraisal, and project and team organization development. New techniques for measuring and monitoring productivity. Motivational dynamics for productivity, including quality of work programs, human resource assessment centers, and incentive programs such as the Scanlon Plan. Use of staff specialists such as interaction and change agents.

OS 481
Job and Wage Analysis 3-0-3
Prerequisite: SS 201. Investigation of the remuneration of groups of workers and study of formulation of policy or decisions which must take into account numerous economic and organizational relationships which are part and parcel of the practical problems of wage and job control. Particular emphasis is placed on job evaluation techniques. The nature of incentives, particularly for jobs in a highly mechanized production operation, is studied. Multiple factor incentive plans are analyzed.

OS 482
Training and Development 3-0-3
Prerequisite: OS 381. Analysis of programs of manpower planning and development to strengthen the organization's capability by improving its human resources. Planning employee and management development programs to provide the individual the opportunity for advancement consonant with the requirements of the organization. The process

involved in identifying training needs, the design of training programs, simulations and use of evaluation systems for determining the effectiveness of training programs.

OS 484
Administration of Equal Employment Opportunity Programs 3-0-3
Prerequisites: OS 471, OS 472 or OS 474. Organizational programs and problems in the field of equal employment opportunity and affirmative action. The fundamental laws, regulations, and guiding principles relative to EEO and AA. Management's responsibilities in handling discrimination complaints. The impact of EEO and AA on organizational selection and testing programs. Affirmative action: program planning and development goals, time tables, progress, and evaluation procedures. Case studies and role-playing utilized.

OS 490
Project and Seminar I 3 credits
Prerequisite: senior standing in the Industrial Administration program with an elective concentration in industrial relations. A comprehensive experience with practical problems in industrial relations. The student must become intimately involved in one or more of the industrial relations functions in a public or private organization in areas such as recruitment and placement, equal employment opportunity and affirmative action, labor relations, wage and classification, training, and overall industrial relations organization and evaluation. Attendance at appropriate seminars required. Student progress evaluated through written reports and/or oral conferences with instructing staff. The student is required to submit a comprehensive report summarizing accumulated experiential data in relation to professional growth.

OS 491
Project and Seminar II 3 credits
A continuation of OS 490.

SOCIAL SCIENCE

SS 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.

SS 202
Labor Relations 3-0-3
Development of unionism and collective bargaining in the United States. Government regulation of labor-management relations. The labor force, wages and hours, wage structure, productivity, unemployment and inflation, equal employment opportunity, and manpower analysis. Public policy with respect to labor market problems.

SS 210
General Psychology 3-0-3
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.

SS 221
Sociology 3-0-3
An examination of modern society and culture, analyzing the forces for stability and change. Topics covered are: the individual and society—socialization, conformity, alienation, class structure; social institutions—religion, law, education, family, state, social process—conflicts and harmony, cohesion and dissolution, power, authority and revolution; urbanization, industrialization and technological change.

SS 231
Political Science 3-0-3
The course analyzes the concept of the state, authority, institutions of control, monarchy, dictatorship, democracy; constitutionalism and liberty; and the relationship between the law, the state, and the individual.

SS 301
Economic Analysis: Theory and Applications 3-0-3
Prerequisite: SS 201. Supply and demand analysis; the economics of households and firms; resource allocation; determination of product and factor prices under varying market structures; non-price sector; welfare economics. Attention is focused on public policy issues, including the effects of government intervention in the market through taxes, subsidies, price regulations, and anti-trust.

SS 311
Industrial Psychology 3-0-3
Prerequisite: SS 210. The many applications of psychology to the industrial scene are studied. The course deals with industrial environments, personnel psychology, men and machines, special groups in industry, and social interaction and adjustments.

SS 314
Consumer Behavior 3-0-3
Prerequisites: Math 105 or equivalent and either SS 210 or SS 221 or OS 261. Examines psychological, social, and economic influences on consumer behavior. Considers the application of consumer behavioral information to marketing decisions. Topics include research and measurement techniques, individual influences, environmental influences, and consumer information processing and decision making. As part of the course a field research project will be undertaken.

SS 316
Promotion, Persuasion & Marketing Communications 3-0-3
Prerequisite: SS 314. Considers the communication activities of marketing in relation to promotion and advertising. Examines the effects of source, message, and media factors on audience response to communication campaigns.

SS 401
The Economics of Consumption 3-0-3
Prerequisite: SS 201. Economic concepts as applied to issues that are involved in consumption and marketing. The special role of consumption in both micro and macro economic theory. The changing structure of the American economy and how it effects consumers, including issues such as anti-trust, technology and innovation. The unique characteristics of the American market in terms of demographic trends, income distribution and consumer buying patterns.

SS 402
Labor Market Analysis 3-0-3
Prerequisites: SS 201 and junior standing. Nature of a free labor market. Concepts and measurements of labor force, participation rate, employment, and unemployment. The impact of technological and economic changes on the structure of employment. Women and minorities in the labor market. Structure of labor markets and special problems of urban labor markets. Recruitment and development of a labor force by a firm; internal labor markets. Wage structure, sources of wage information, and importance of productivity.

SS 403
Social Insurance and Employee Benefits 3-0-3
Prerequisites: SS 201 and one other social science course. The causes of economic insecurity in an urban, industrial society and the personal and social consequences. Examination of Social Security, unemployment insurance, workers' compensation, public assistance, and other government programs, as well as 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.

SS 411
Money and Banking 3-0-3
Prerequisites: SS 201, SS 301. Nature and functions of money. The commercial banking system. The Federal Reserve System. Demand for money, its behavior, and relation to income. Monetary and fiscal policy. Inflation. International finance.

SS 412
The Financial System 3-0-3
Prerequisite: SS 201. A study of the financial system with emphasis on commercial banks and their role in industrial organization in the United States. A look at bank lending, investments, and trust operations as well as financial intermediaries and the role of the government. A study of the technological changes that have faced the banking industry over the last 30 years.

SS 420
International Economics 3-0-3
Prerequisite: SS 201. The structure and organization of the international economic system. The role and importance of trade in developed and developing countries. The mechanics of trade and an international financial and monetary system; foreign exchange; the transfer of funds. The role of multinational companies, the World Bank, the International

Monetary Fund, the European Economic Community, and OPEC.

SS 421
International Business Operations 3-0-3
Prerequisite: SS 201. The operation of business in the international economy. The scope of international business activities: exporting of goods and services, overseas investment, licensing, joint and mixed ventures, whollyowned subsidiaries, multinational enterprises, trading companies, turn-key operations. Financing international operations. Managing international operations. Case studies will be emphasized.

SS 431
Municipal Government in Contemporary Society: Theory and Practice 3-0-3
Prerequisite: junior standing. This course is designed to provide the municipal engineer or planner with a foundation for planning and operational efficiency based upon the concepts and problems of local government. Attention is focused on such topics as fiscal management, intergovernmental relations, and planning and operation of public works.

SS 451
International Relations 3-0-3
Prerequisite: SS 201 or SS 231. 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.

SS 452
Social, Political and Economic Implications of Race and Ethnicity 3-0-3
Prerequisite: Basic Social Science. An examination of cultural and psychological patterns of behavior as a manifestation of how minorities in the United States function within a multi-cultural, multi-ethnic society. Some consideration will be given to divergent value systems, ethical codes, patterns of racism and prejudice, and the social and psychological implications of being bilingual and bicultural. Emphasis will be placed upon the Black and Hispanic experiences.

SS 506
Technology Assessment 3-0-3
Prerequisites: SS 201 and a course in calculus or statistics. A framework for assessing the impact of technology on society, taking into account both present and future interactions of economic, social, and environmental factors. The approach to existing problems will be multidisciplinary, and analytical techniques for evaluation and forecasting will be utilized and demonstrated (i.e., benefit-cost analysis, cross impact matrices).

SS 511
Economics of Energy 3-0-3
Prerequisites: at least one course that includes micro- and macroeconomics. The demand for energy, its sources and determinants (elasticity measures); trends in patterns of energy use and future prospects; international aspects. The supply of energy; alternative sources (coal, nuclear, geothermal, solar); economic analysis of shifts among sources; industrial and market structures in the energy production sector; significance for supply elasticities and energy prices. The "energy crisis"—analysis and evaluation. The economics of long-range energy decisions—new sources, conservation, and environmental protection; evaluating costs and benefits; decision model for energy technology assessment; the breeder deferment decision; energy economy interactions; energy sector share of GNP; impact of energy cuts on GNP; alternative economic techniques for reducing energy consumption.

SS 521
Urban Social Structure 3-0-3
Prerequisite: at least one course in social science. An introduction to the city as a social system. The study of the conflict relations among various segments of the urban population; race and religion—their implications; the changing systems of social stratification; urban family structure; and the concept of a "culture of poverty." The impact of social and technological change upon urban society, the physical and environmental characteristics of a city as outputs of social systems as well as constraints upon behavior.

Physical Education

Director/Professor: J. Malcolm Simon
Associate Director/Associate Professor: Paul C. Hausser
Instructors: DeNure, Felczak, Moiseenko, Snidet

PE 101
Physical Education I
This class, offered only in the Fall semester, will introduce a variety of those individual, dual, and team sports available at NJIT.

PE 102
Physical Education II
A continuation of P.E. 101; students may participate in a variety of activities or develop an area(s) of concentration.

PE 103
Swim Instruction
The student will have an opportunity to develop aquatic skills. Students will be grouped according to ability. Limited to ten students.

PE 104
Survival Swimming
This course is designed for the average, weak or non-swimmer and will emphasize survival swimming, basic rescue and water safety techniques, and swimming instruction.

PE 105
Advanced Life Saving
An American Red Cross certification course. The purchase of textbooks will be required. Students must have the hour following class free.

PE 106
Water Safety Instructor
Prerequisite: Valid Advanced Lifesaving certification. An American Red Cross certification course. The purchase of textbooks will be required. Students must have the hour following class free.

PE 107
Aerobics (Women)
This class will emphasize cardiovascular activities, utilizing dance steps and conditioning exercises. Shape up and have fun learning and choreographing aerobic dances. Limited to twenty women.

PE 108
Sports For Women
This course is designed specifically for women to learn and compete in the individual, dual and team sports of racquetball, paddleball, volleyball, basketball and softball.

PE 109
Ice Skating
Students will engage in a leisuretime activity and develop the basic skills necessary to enjoy recreational skating. The class will be held at South Mountain Arena in West Orange and will cost approximately $3.00 per session.

PE 110
Skiing
A course of instruction and practical experience in recreational skiing designed for the novice and intermediate skier. The course will include lectures on safety, equipment and clothing, first aid and injuries, tuning and repair; four or more sessions at Vernon Valley and Hidden Valley; and possible one weekend trip to Vermont. Students will be responsible for costs of lift tickets and any equipment rentals. Transportation will be provided.

PE 111
Introduction To Bowling And Archery
A course designed to teach the rules, techniques and scoring of each sport. Archery equipment will be provided. For bowling, students must have their own bowling shoes or pay a $2.00 rental fee.

PE 112
Lifetime Sports
Students will have the opportunity to learn and practice one or more lifetime sports that best meets their needs and interests. Individual, dual and co-recreational sports will be emphasized.

PE 114
Personal Development
This course will deal with improving and maintaining physical fitness. Areas covered will include cardiovascular and strength training, nutrition, goal setting and record keeping.

PE 115
Weight Training
The course will deal with specific training to meet the individual student's interests. Areas covered will include programs, technique, goal setting and record keeping.

PE 116
Slimnastics And Body Building
Shape up for the summer by engaging in an activity that tones all areas of the body and reduces inches from arms, waist, hips and thighs.

PE 117
Jogging
Designed to provide instruction for the beginning jogger and running opportunities for the intermediate to advanced jogger.

PE 118
Walking
Students must have two periods free for walks in Branch Brook Park, South Mountain Reservation, New York City and other sites.

PE 119
Bicycling
A course of instruction and experience in biking designed to prepare the novice biker for a short tour. Students should supply their own bicycles and have two periods free. The class will include some weekend tours.

PE 120
Introduction To Racquet Sports
An introduction to the racquet sports of badminton, paddleball and tennis. The course will include rules of play, service, strokes and playing strategy for singles and doubles.

PE 121
Badminton
The course will include the rules, skills, strokes and strategies of badminton and will provide an opportunity for competition.

PE 122
Paddleball And Racquetball
Designed as an introductory course, there will also be ample opportunity for free play.

PE 123
Tennis For Beginners
This course will introduce students to the basic techniques and strategies of tennis. An indoor court rental fee will be charged.

PE 124
Intermediate Tennis
This class will emphasize strokes, strategies, drills and tournament play. Students will be required to pay an indoor court rental fee.

PE 125
Golf
Designed for the beginner or intermediate golfer. Areas to be covered are grip, stance, swing, strokes and use of clubs, progressing towards actual course play. Students will have to provide their own clubs and pay green fees.

PE 126
Gymnastics
An introductory course pertaining to tumbling skills and the development of floor exercise routines. Students will learn skills, techniques and methods of spotting. Class is limited to twelve students.

Physics

Chair: Eugene Stamper (Acting)
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Assistant Professors: Giordano, Jermakian, Kingery, Reisman, Reiziss

Phys 100
Introductory Physics 3-2-4
This course is designed for students who have not had high school physics and for those who wish to review the subject. It may be taken in the summer preceding the freshman year or in the first semester of the freshman year. It consists of a survey of introductory physics with special emphasis on those portions of the subject matter which are most useful to engineering students.

Phys 102
General Physics 3-2-4
Prerequisite: satisfactory completion of two units of high school mathematics and two units of high school science. This course is intended for students in architecture. It is an elementary course in statics and dynamics. Subjects discussed are kinematics, Newton's laws of motion, energy, momentum, conservation principles, and mechanical properties of matter.

Phys 103
General Physics 3-2-4
Prerequisite: Phys 102. This course is intended for students in architecture. Topics discussed are heat, thermodynamics, sound, wave motion, illumination, geometric and physical optics, and color.

Phys 105
Physics A 3-2-4
Corequisite: Math 111. This course constitutes a study of elementary mechanics. Emphasis is 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.

Phys 106
Physics B 3-2-4
Prerequisite: Phys 105. This course is an extension of Physics 105 in the area of mechanics and an introduction to electricity and magnetism.Topics discussed will include circular motion, moment of inertia and radius of gyration, angular motion, dc circuits, electric fields, and magnetic fields.

Phys 107
Physics C 3-2-4
Prerequisite: Phys 106. This course is a continuation of Physics 106 and includes relationships between electric and magnetic phenomena, magnetic properties of matter, and simple ac circuits.

Phys 111
Physics I 3-2-4
Corequisite: Math 111. This course deals with the study of elementary mechanics. Emphasis is placed on the fundamental concepts and laws of mechanics especially the conservation laws. Topics discussed are: scalar and vector quantities of mechanics; rectilinear and circular motion; equilibrium and Newton's laws of motion; work, energy, momentum; the conservation laws. Correlated experiments and computations run concurrently with lecturers and recitations.

Phys 112
Physics I H 3-2-4
Corequisite: Math 111. This is the first semester of a three-semester program in Honors Physics. This course covers the material taken up in Phys 111, but topics are treated more comprehensively and in greater depth. More extensive use of mathematics is made in Phys 112.

Phys 121
Physics II 3-2-4
Prerequisites: Phys 111 or 112 and Math 111. This course deals with an introduction to electricity and magnetism. Topics discussed include simple dc circuits, the electric field, the magnetic field, relationships between electric and magnetic fields, magnetic properties of matter, and simple ac circuits. Correlated experiments and computations are assigned concurrently with lectures and recitations.

Phys 122
Physics II H 3-2-4
Prerequisites: Phys 111 or 112 and Math 111. 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.

Phys 201
Concepts of Physical Science 3-0-3
Prerequisites: Admission to BSIA program. This course is intended for BSIA students only. It presents a summary and outline of physical concepts through the historical development of physics. Topics to be covered include the contributions of the ancient Greeks, Galileo, Newton, and the men of more recent times.

Phys 230
Physics III 4-1-4
Prerequisites: Phys 121, Math 111. This course is intended for students in chemical engineering only. Elements of simple harmonic motion, wave motion, geometric and physical optics are treated. Modern theories of matter and radiation are discussed. The equivalence of mass and energy is also discussed. Two-hour laboratory sessions are held bi-weekly.

Phys 231
Physics III 4-2-5
Prerequisites: Phys 121, Math 111. 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 law of equivalence of mass and energy. Experiments complement lectures and recitations.

Phys 232
Physics III H 4-2-5
Prerequisites: Phys 121 or 122 and Math 122. This is the third semester of a three-semester program in Honors Physics. This course covers the material given in Phys 231. 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.

Phys 310
Introduction to Atomic and Nuclear Physics 3-0-3
Prerequisites: Phys 230, 231, or 232, and Math 222. Selected topics in atomic physics including the Pauli Exclusion Principle and the Atomic Shell Model will be discussed. In nuclear physics, the two-body problem, nuclear models, and alpha, beta, and gamma radiation will be studied. Accelerators and nuclear detectors will also be treated.

Phys 320 **Astronomy** 3-0-3
Prerequisites: Phys 102, 201, or 111. A quantitative introduction to the astronomy of the polar system, the stars, the galaxy, and galaxies in general with an emphasis on the physical principles involved.

Phys 390
Selected Topics of Current Interest in Physics 1-0-1
Prerequisites: Phys 230, 231, or 232. This is a seminar course covering topics that are currently in the forefront of physics. The lecture series offers exposure to such topics as nuclear physics, solid state physics, plasma physics, the special and general theories of relativity, and the history and philosophy of science.

Phys 441
Modern Physics 3-0-3
Prerequisites: Phys 230, 231, or 232, and Math 222. After a brief review of classical physics and kinetic theory, the course considers nuclear and atomic structure. Key experiments illustrating the wave-particle duality are discussed and elements of wave mechanics are introduced, followed by applications of two-state quantum systems. The motion of an electron in a periodic lattice is then discussed, leading to a consideration of the band theory of solids. The electrical, thermal and magnetic properties of solids follow. The course ends with a semi-quantitative description of plasmas and superfluid systems.

Phys 442
Introduction to Quantum Mechanics 3-0-3
Prerequisites: Phys 230, 231, 232 and Math 222. After a brief review of the experiments leading to the development of quantum mechanics, the course deals with matter, waves, Schrodinger's wave equation, Heisenberg's uncertainty principle, operations, and commutators. This leads to the concept of standing waves applied to particles bound in potential wells, the harmonic oscillator, the hydrogen atom, potential barriers, and angular momentum. This is followed with the concepts of degeneracy, composite states, and the general properties of eigenfunctions.

Phys 443
Optics 3-0-3
Prerequisites: Phys 230, 231 or 232, and Math 222. This course deals with geometric and physical optics. Geometric optics includes thick lenses and lens design. Physical optics is based on the electro-magnetic theory of light and includes dispersion, absorption, optical activity, Fresnel and Fraunhofer diffraction, resolution of optical instruments, and phase contrast microscopy. Time permitting elements of fiber optics and non-linear optics will be introduced.

Phys 444
Theoretical Physics I 3-0-3
Prerequisites: Phys 230, 231 or 232, and Math 222. This is a course in the physics of particles. It begins with a study of single particles and extends to an analysis of a collection of particles. Included in the course are Newtonian mechanics, Lagrange's equations, Hamilton's Principle, and other variational principles.

Phys 445
Theoretical Physics II 3-0-3
Prerequisites: Phys 230, 231, or 232, and Math 222. This is a course in the physics of fields. The concepts of fields are applied to elastic media and wave propagation in such media, fluid dynamics, heat and the electromagnetic field, concluding with Maxwell's equations. Topics of special interest to students will be included in the remainder of the course.

Phys 446
Solid State Physics 3-0-3
Prerequisite: Phys 441. This course is 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.

Phys 447
Thermodynamics 3-0-3
Prerequisites: Math 222 or 330, and Phys 230, 231, or 232. An integrated approach to thermodynamics, encompassing classical and quantum properties of matter. An essential aspect of the course is that macroscopic properties of matter are derived from its microscopic properties. Examples from many fields, including gases, liquids, solid, liquid and gaseous conductors, and magnetic materials are used extensively to show the universality of the application of thermodynamic analysis.

Phys 448
Semiconductor Physics 3-0-3
Prerequisite: EE 212. 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.

Phys 449
Advanced Physics Laboratory 0-6-3
Prerequisites: senior standing and permission of the department. Students will draw on previous studies to examine experimentally the interaction of photons and particles. These interactions will be examined by optical and spectroscopic methods involving non-monochromatic as well as laser light, by electrical and electronic devices, using vacuum, thin film, and Hall-measurement techniques, by nuclear irradiations involving a subcritical reactor and the necessary associated measuring methods. Independent study, library research, and data reduction involving advanced error analysis form an integral part of the course.

MATERIALS SCIENCE

MtSc 311
Properties of Materials 3-0-3
Prerequisite: 2 semesters of college physics or equivalent. This course is intended for bachelor of technology students and is an introduction to the principal metallic and non-metallic engineering materials, including their physical properties, response to heat treatment, corrosion resistance, machining characteristics, surface finishing, and extrusion processes.

MtSc 318
Engineering Materials 3-2-4
Prerequisite: Chem 116, Phys 231. This course 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.

MtSc 319
Engineering Materials 3-0-3
Prerequisites: Chem 116, Phys 231. This course is identical to MtSc 318, with the laboratory omitted.

MtSc 450
Electron Microscopy 2-2-3
Prerequisites: Chem 116, Phys 231. This course 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.

MtSc 451
X-Ray Diffraction 2-2-3
Prerequisites: Chem 116, Phys 231. This course 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.

MtSc 452
Materials Science I 3-0-3
Prerequisites: Chem 116, Phys 231, and ME 361 or Chem 345 or Phys 447. This course emphasizes the structure and properties of materials and the relationsnips between them. The primary topics include the thermodynamics of solids, fracture mechanisms, diffusion, elasticity, plasticity, fatigue strength, viscosity, and creep.

MtSc 453
Materials Science II 3-4-5
Prerequisites: Phys 448 or Phys 446 or EE 461 and ME 361 or ChE 345 of Phys 447. This course emphasizes the electronic properties of materials in conjunction with an introduction to ceramics. Topics included are semiconductors, thermoelectricty, magnetism, conductivity, dielectric, optical properties,

and an introduction to the properties and behavior of ceramics.

NUCLEAR ENGINEERING

NE 407
Nuclear Engineering 3-0-3
Prerequisites: Math 222, Phys 230 or 231 or 232. The basic concepts of nuclear engineering practice are introduced and developed in ways that suit their ultimate applications to the design of a nuclear reactor. Topics include nuclear instability and radioactive decay, nuclear interactions, nuclear fission, neutron slowing down, and reactor criticality.

NE 408
Nuclear Engineering 2-2-3
Prerequisite: NE 407. The course is largely a laboratory and consists of basic experiments in nuclear instrumentation and experiments with a sub-critical reactor. The experiments performed are of such a nature as to assist the nuclear engineer in the general areas of reactor analysis and design.

NE 409
Nuclear Reactor Theory 3-0-3
Prerequisite: NE 407. Selected topics in the analysis, design, and construction of nuclear reactors including neutron diffusion, one, two, and multi-energy-group as well as Fermi age calculations, reactor kinetics, poisoning, reactor control, temperature effects, and numerical calculations.

NE 410
Neutron Transport Theory 3-0-3
Prerequisites: Math 222, Phys 230 or 231 or 232. A geometric approach to problems dealing with the ways in which neutrons distribute themselves in various regions of space is presented for situations that have exact analytic solutions. The mathematical laws which describe these neutron distributions are developed. Solutions of the mathematical equations, both exact and those using various numerical approximations, are compared to provide an understanding of how neutrons are distributed in various regions of a nuclear reactor and a radiation shield.

Surveying

(The program in surveying is administered by the Department of Civil & Environmental Engineering. For course reference and faculty listing, please turn to page 41).

CE 200
Surveying 3-3-4
Prerequisite: Math 111. Angle and distance measurement; leveling; tachometry; topographic mapping; traverse and area computations.

CE 300
Advanced Surveying Laboratory 0-3-1
Field exercises for students in the surveying program who are enrolled in CE 301.

CE 301
Advance Surveying 3-0-3
Prerequisite: CE 200. Plane table; barometric and precise leveling; least squares adjustment; azimuth from sun and polaris observations.

CE 302
Geodesy 3-0-3
Prerequisites: CE 402 and CE 409. Spherical coordinate systems; ellipsoid, geometric, satellite, and gravimetric geodesy; deflection of the vertical and Laplace observations.

CE 303
Photogrammetry I 3-0-3
Prerequisites: Math 223 and CE 305. Photographic principles and optics; relationship between map accuracy and altitude; general cartagraphic principles; each student will work with both scribing and ink. (Approximately onethird of the lectures will be devoted to laboratory work.)

CE 304
Adjustment Computations I 3-0-3
Prerequisites: Math 223 or Math 333. Error theory; variance and covariances; observation equations; condition equations; introduction to least square adjustment.

CE 305
Aerial Photographic Interpretation 3-0-3
Prerequisites: CE 200 and CE 342. Analysis and study of photographic techniques and procedure land forms; surficial soils and rock formation by the use of aerial photos and stereograms with special emphasis on the engineering siginificance of the results. The applications of other remote sensing devices and of aerial photography to land surveying, transportation engineering, environmental and sanitary engineering, construction engineering, soil mechanics, and geological engineering are discussed.

CE 306
Surveying Law 3-0-3
Prerequisite: CE 200. Rules of evidence; resurveys; subdivisions; condominiums; riparian rights, wetlands; eminent domain; adverse possesion; title; deeds; descriptions; etc. The emphasis will be on New Jersey law; however, other laws including those of the Public Land System will be considered.

CE 307
Geometric Design for Highways 3-0-3
Prerequisite: CE 200. A course in highway design based on a study of traffic distribution, volume, and speed with consideration for the predictable future. The elements of at-grade intersections and interchanges are analyzed. Studies are made of the geometrics of highway design and intersection layout with advanced curve work including compound and transition curves.

CE 308
Subdivision Design 3-0-3
Prerequisite: CE 200. A design course in the preparation of major and minor subdivision plans.

CE 309
Site Planning and Land Development 3-0-3
Prerequisite: junior and senior standing. A design course in the preparation of site, land development, and related plans.

CE 401
Photogrammetry II 3-3-4
Prerequisite: CE 303. Theory of direct projection and optical train plotters; introduction to aerotriangulation; writing and evaluating photogrammetric specifications and proposals; national map accuracy standards; introduction to terrestrial photogrammetry. (Each student will plan and write specifications for an aerial mapping project.)

CE 402
Adjustment Computations II 3-0-3
Prerequisite: CE 304. Least squares adjustment; error ellipses; matrix methods in adjustments; solving large system of equations.

CE 403
Hydrographic Surveying and Charting 3-0-3
Prerequisite: senior standing. Stream gauging, soundings; wires; tide gauges; electronic methods; shoreline and tideland surveys; snow surveys; preparation of maps and charts for navigation. (Approximately one quarter of the lectures will be devoted to field observations.)

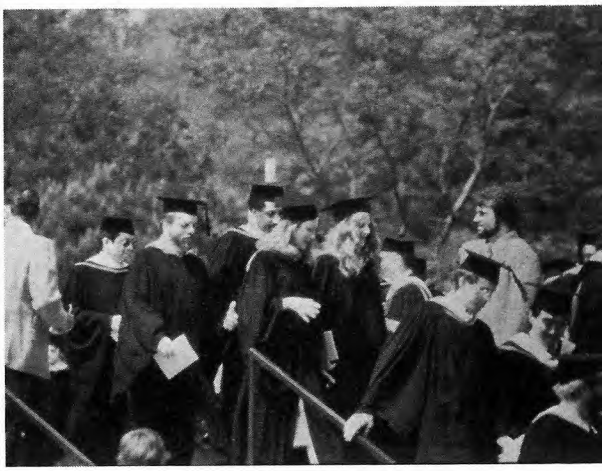
CE 405
Geodetic Surveying 3-3-4
Prerequisites: Math 223 and CE 301. Triangulation, precise traverse, trilateration; adjustment of geodetic figures; baseline measurement; map projections, State coordinate systems.

CE 406
Remote Sensing 3-0-3
Prerequisite: CE 402 and CE 403. Review of remote sensing systems including infra-red scanners, side looking radar, thermal, airborne, and satellite systems, introduction to digital and thematic mapping.

CE 407
Electronic Surveying 3-0-3
Prerequisite: CE 200. Theory of visible light, laser, infrared and microwave measuring systems; accuracy of various equipment; atmospheric corrections and effects; long line measurements; reduction of arc distance to chord and of chord distance on the ellipsoid. (Approximately one quarter of the lectures will be devoted to field observations.)

CE 408
Analytical Aerotriangulation 3-0-3
Prerequisites: CE 401 and CE 402. Theory and applications of analytical aerotriangulations will be stressed, investigation of existing computer software, various computer solutions will be executed by each student.

CE 409
Geodetic Astronomy 3-0-3
Prerequisite: CE 200. Spherical trigonometry; stellar coordinate systems; time; ephemerides; and star catalogues determination of azimuth, latitude, longitude, and time. (Approximately one quarter of the lectures will be devoted to field observations.)



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+Registered Architect

ALLENTUCH, ARNOLD, Professor of Mechanical Engineering (1966), and Associate Vice President for Research and Graduate Studies (1980). Worcester Polytechnic Institute, B.S.M.E., 1953; Cornell University, M.S. Applied Mathematics, 1959; Polytechnic Institute of Brooklyn, Ph.D., 1962. Vice President—Research, The Foundation at NJIT.

ANDRUSHKIW, ROMAN I., Professor of Mathematics (1964). Stevens Institute of Technology, B.E., 1959; Newark College of Engineering, M.S.E.E., 1964; University of Chicago, M.S., 1967; Stevens Institute of Technology, Ph.D., 1973.

ANSARI, FARHAD, Assistant Professor of Civil and Environmental Engineering (1983). University of Illinois, B.S., 1975; University of Colorado, M.S., 1978; University of Illinois, Ph.D., 1983.

ARMENANTE, PIERO, Assistant Professor of Chemical Engineering (1984). University of Rome, Laurea in Ingegneria Chimica (Equivalent to B.S.), 1977; University of Virginia, Ph.D., 1984.

AROCHO, OMAR R., Capt., U.S.A.F., Assistant Professor of Aerospace Studies (1983). University of Maryland, B.S., 1979; State University of New York, M.S., 1981.

AYOUB, HENRY R., Associate Professor of Electrical Engineering (1957). Alexandria University, B.S.E.E, 1947; B.S.M.E., 1948; Newark College of Engineering, M.S.E.E., 1959.*

BADENHAUSEN, OTTO P., Assistant Professor of History (1967). Hamilton College, A.B., 1954; Berlin Free University, M.A., 1959.

BALES, ERVIN L. Research Professor (1984). University of South Carolina, B.S., 1957; Bradley University, M.S., 1962; University of Illinois, Ph.D., 1967.

BALL, WARREN, Professor of Electrical Engineering (1968). Nova Scotia Tech., B.S., 1944; University of Toronto, M.S., 1946; Cornell University, Ph.D., 1957.*

BALTRUSH, MICHAEL A., Associate Professor of Computer and Information Science (1975). University of Connecticut, B.S.E.E., 1968; Ph.D., 1976.

BALTZIS, BASIL C., Assistant Professor of Chemical Engineering (1983). National Technical University of Athens (Greece), Diploma in Ch.E., 1978; University of Illinois at Urbana-Champaign, M.S.Ch.E., 1980; University of Minnesota, Ph.D., 1983.

BARKAN, HERBERT, Professor of Mathematics (1946). Brooklyn College, B.A., 1944; Columbia University, M.A., 1945.

BARRETT, EDWARD C., Assistant Professor of English (1981). Brooklyn College, B.A., 1971; Harvard University, M.A., 1972; Ph.D., 1978.

BART, ERNEST N., Assistant Professor of Chemical Engineering (1968). New York University, B.Ch.E., 1957; M.Ch.E., 1960; Ph.D., 1971.

BERLINER, ARMAND, Assistant Professor of Mathematics (1963), and Assistant Chair of the Department. Rutgers University, B.A., 1963; Newark College of Engineering, M.S., 1965.

BLACKMORE, DENIS, Professor of Mathematics (1971). Polytechnic Institute of New York, B.S., 1965; M.S., 1966; Ph.D., 1971.

BORDMAN, SANFORD, Professor of Economics (1968). City College of New York, B.S., 1949; City University of New York, Ph.D., 1969.

BOZZELLI, JOSEPH W., Professor of Chemistry (1975). Marietta College, B.S., 1964; University of Dayton, M.S., 1968; Princeton University, Ph.D., 1972.

BROWER, WILLIAM D., Associate Professor of Mathematics (1960). St. Peter's College, B.S., 1951; Columbia University, M.A., 1956.

BROWN, GARY E., Lt. Col. U.S.A.F., Professor of Aerospace Studies and Chair of the Department (1984). Brigham Young University, B.E.S. in Engineering Mechanics, 1967; University of Utah, M.S. in Mechanical Engineering, 1976.

BUTEAU, LEON J. Jr., Professor of Materials Science (1959). Newark College of Engineering, B.S.M.E., 1958; Stanford University, M.S., 1959; University of Florida, Ph.D., 1963.*

CAGNATI, VINCENT N., Assistant Professor of Chemistry (1958). Columbia University, B.A., 1949; Stevens Institute of Technology, M.S., 1952.

CAMP, JAMES E., Professor of English (1963). Louisiana State University, B.A., 1949; Columbia University, M.A., 1952; University of Michigan, Ph.D., 1965.

CAPECELATRO, ACHILLE, Professor of Physics (1947). Rensselaer Polytechnic Institute, B.S.E.E., 1936; M.S., 1937; Ph.D., 1939.

CARLUCCIO, JOSEPH, Associate Professor of Electrical Engineering (1957). Newark College of Engineering, B.S., 1946; M.S., 1952.*

CHAN, PAUL C., Associate Professor of Civil and Environmental Engineering (1966). Chu Hai College, B.Sc., 1958; Worcester Polytechnic Institute, M.Sc., 1962; Texas A & M University, Ph.D., 1968.*

CHASE, HAMILTON, Associate Professor of Mathematics (1968). City College of New York, B.E.E., 1947; New York University, M.S., 1950; Case Institute of Technology, Ph.D., 1964.*

CHEN, MIN-HSUAN, Assistant Professor of Computer and Information Science (1983). Fujen University (Taiwan), B.S., 1973; M.S., 1975; University of Michigan at Ann Arbor, Ph.D., 1983.

CHEN, RONG-YAW, Professor of Mechanical Engineering (1966). National Taiwan University, B.S., 1957; University of Toledo, M.S., 1963; North Carolina State University, Ph.D., 1966.*

CHENG, SU LING, Professor of Civil and Environmental Engineering (1966). Purdue University, B.S., 1959; M.S., 1962; University of Florida, Ph.D., 1966.*

CHEREMISINOFF, PAUL N., Associate Professor of Environmental Engineering (1973). Pratt Institute, B.Ch.E., 1949; Stevens Institute of Technology, M.S., 1952.*

CHIANG, YI-LING F., Assistant Professor of Computer and Information Science (1981). National Taiwan University, B.S., 1954; University of South Carolina, M.S., 1959; Rutgers University, Ph.D. 1981.

CHOW, CHUNG-WEI, Associate Professor of Electrical Engineering (1962), and Assistant Chair of the Department. Chiao-Tung University, B.S., 1947; Oregon State College, M.S., 1960.*

CIESLA, MATTHEW, Associate Professor of Applied Mechanics (1957), and Assistant Chair of the Department for Undergraduate Studies. Newark College of Engineering, B.S.M.E., 1957; M.S.M.E., 1959; New York University, Ph.D., 1968.*

CLEMENTS, WAYNE, Associate Professor of Electrical Engineering (1959). Newark College of Engineering, B.S., 1957; M.S., 1961; University of Pennsylvania, M.S. 1975.*

COCHIN, IRA, Professor of Mechanical Engineering (1964). City College of New York, B.S., 1949; New York University, M.S., 1952; Cooper Union, Ph.D., 1969.

COHEN, EDWIN, Professor of Electrical Engineering (1962). Cairo University, B.E.E., 1957; Newark College of Engineering, M.S.M.E., 1964; Polytechnic Institute of Brooklyn, Ph.D., 1970.*

COHEN, SIMON, Associate Professor of Mathematics (1974). Polytechnic Institute of Brooklyn, B.S., 1964; M.S., 1966; Ph.D., 1971.

CORNELY, ROY H., Professor of Electrical Engineering (1971). Drexel Institute, B.S.E.E., 1960; University of Pennsylvania, M.S.E.E., 1962; Rutgers University, Ph.D., 1972.

CRAIG, ROBERT JOHN, Associate Professor of Civil and Environmental Engineering (1975). Purdue University B.S.C.E., 1966; M.S.C.E., 1969; Ph.D., 1973.*

DAUENHEIMER, EDWARD G., Professor of Civil and Environmental Engineering and Associate Chair of the Department (1975). Rensselaer Polytechnic Institute, B.S.C.E., 1960; M.E., 1966.*

DAUERMAN, LEONARD, Associate Professor of Chemistry (1969). City College of New York, B.S., 1953; Purdue University, M.S., 1955; Rutgers University, Ph.D., 1962; Rutgers Law School, J.D., 1973.

DENNO, KHALIL L., Professor of Electrical Engineering (1969). University of Baghdad, B.S., 1955; Rensselaer Polytechnic Institute, M.S., 1959; Iowa State University, Ph.D., 1967.*

DeNURE, DAVID, Recreation Supervisor, Physical Education Department (1982). East Stroudsburg State College, B.S. 1978.

DEUTSCHMAN, AARON D., Professor of Mechanical Engineering (1963), and Associate Chair of the Department (1982). Polytechnic Institute of Brooklyn, B.M.E., 1943; M.M.E., 1947; New York University, M.S. 1968.*

DEUTSCHMAN, HAROLD, Professor of Civil and Environmental Engineering (1968), and Assistant Vice President for Extension Programs (1980). City College of New York, B.S.C.E., 1961; University of Missouri, M.S., 1962; Northwestern University, Ph.D., 1969.*

DRESNACK, ROBERT, Professor of Civil and Environmental Engineering (1966). City College of New York, B.S.C.E., 1961; New York University, M.S.C.E., 1963; Ph.D., 1966.*

DROUGHTON, JOHN V., Associate Professor of Mechanical Engineering (1960). Rutgers University, B.S., 1959; Newark College of Engineering, M.S., 1962; Rutgers University, Ph.D., 1969.*

ELWELL, DAVID JR., Associate Professor of Architecture (1975). Yale University, B.S., 1957; Cambridge University, B.A., 1963; Princeton University, M.F.A., 1965.+

FARBER, ELLIOT, Associate Professor of Physics (1967). Brooklyn College, B.S., 1954; Columbia University, M.S., 1956; Stevens Institute of Technology, Ph.D., 1966.

FEATHERINGHAM, TOM R., Associate Professor of Computer and Information Science (1975), and Associate Chair of the Department. Kent State University, B.S., 1964; University of Pittsburgh, Ph.D., 1975.

FENSTER, SAUL K., President of New Jersey Institute of Technology, and Professor of Mechanical Engineering (1978). City College of New York, B.M.E., 1953; Columbia University, M.S., 1955; University of Michigan, Ph.D., 1959.

FINK, TOBIN, Associate Professor of Physics (1966). University of Colorado, B.S., 1959; M.S., 1961; Rutgers University, Ph.D., 1968.

FLATOW, PAUL, Associate Professor of Mathematics (1963). Columbia University, B.S.E.E., 1947.

FLORIO, PASQUALE J. JR., Associate Professor of Mechanical Engineering (1966). Newark College of Engineering, B.S., 1959; New York University, M.M.E., 1960; Ph.D., 1967.

FOSTER, ACHILLES E., Professor of Mathematics, and Associate Chair of the Department (1951). University of Tennessee, B.S., 1943; M.A., 1944; University of Kentucky, Ph.D., 1951.

FRANCK, KAREN A., Associate Professor of Architecture (1981). Bennington College, B.A., 1970; City University of New York, Ph.D., 1978.

FRANK, JOSEPH, Associate Professor of Electrical Engineering (1968). City College of New York, B.S., 1952; Columbia University, M.S., 1960; Brooklyn Polytechnic, Ph.D., 1975.*

GAAL, RICHARD A., Assistant Professor of Mechanical Engineering (1955). Newark College of Engineering, B.S., 1955; M.S.M.E., 1957; New York University, M.S. (Aero) 1959.*

GAGE, HOWARD, Associate Professor of Industrial Engineering (1972). City College of New York, B.M.E., 1960; New York University, M.M.E., 1965; Ph.D., 1972.*

GAUTREAU, RONALD, Professor of Physics (1966). Lehigh University, B.S., 1961; M.S., 1963; Stevens Institute of Technology, Ph.D., 1965.

GEITHMAN, DAVID T., Professor of Organizational and Social Sciences, and Chair of the Department (1983). University of Florida, B.S., 1960; M.A., 1962; Ph.D., 1964.

GETZIN, DONALD R., Associate Professor of Chemistry (1965). SUNY at Buffalo, B.A., 1960; Columbia University, M.A., 1961; Ph.D., 1967.

GIORDANO, JOSEPH, Assistant Professor of Physics (1955), and Associate Chair of the Department (1981). Wagner College, B.S., 1951; Newark College of Engineering, M.S., 1963.

GOLDBERG, HAYDEN B., Associate Professor of English (1961). Bowdoin College, A.B., 1949; Columbia University, M.A., 1952.

GOLDBERG, VLADISLAV, Professor of Mathematics (1982). Moscow State University (U.S.S.R), M.Sc., 1958; Ph.D., 1961.

GOLDEN, ROBERT G., Associate Professor of Engineering Graphics (1959). Little Rock College, A.B., 1951; Newark College of Engineering, B.S., 1956; Seton Hall University, A.M., 1962; New Brunswick Theological Seminary, M. Div., 1973.*

GOLDMAN, GLENN, Assistant Professor of Architecture (1982). Columbia University, B.A., 1974; Harvard University, M.Arch., 1978.+

GOLUB, EUGENE, Professor of Civil and Environmental Engineering (1968), and Chair of the Department (1978). The Cooper Union, B.C.E., 1962; Columbia University, M.S., 1964; Polytechnic Institute of Brooklyn, Ph.D., 1969.*

GOODE, PHILIP R., Professor of Physics and Chair of the Department (1984). University of California, Berkeley, A.B., 1964; Rutgers University, Ph.D., 1969.

GREENBERG, ARTHUR, Professor of Chemistry (1977). Fairleigh Dickinson University, B.S., 1967; Princeton University, A.M., 1970; Ph.D., 1971.

GREENSTEIN, TEDDY, Professor of Chemical Engineering (1967). City College of New York, B.Ch.E., 1960; New York University, M.Ch.E., 1962; Ph.D., 1967.

GROW, JAMES M., Associate Professor of Chemistry (1977). University of Illinois, B.S., 1968; University of Wisconsin, M.S., 1972; Oregon State University, Ph.D., 1974.

GUND, TAMARA, Assistant Professor of Chemistry (1981). Rutgers University, A.B., 1966; University of Massachusetts, M.S., 1968; Princeton University, Ph.D., 1974.

HANESIAN, DERAN, Professor of Chemical Engineering, and Chair of the Department (1963). Cornell University, B.Ch.E., 1952; Ph.D., 1961.*

HANNIGAN, JEFFREY, Assistant Professor of Architecture (1980). Cornell University, B.Arch., 1971.

HANUS, JOHN J., Associate Professor of Engineering Graphics (1953). Marietta College, B.A., 1950; Bradley University, M.A., 1952.

HATCH, C. RICHARD, Professor of Architecture (1975). Harvard College, A.B., 1955; University of Pennsylvania, M.Arch., 1963; University of Rome, graduate studies, 1961.+

HAUSSER, PAUL C., Associate Professor, and Associate Director of Physical Education and Athletics (1952). Panzer College, B.S., 1950; Columbia University, Cert. in Physical Therapy, 1951; M.A., 1954; Professional Diploma, 1955. New Jersey Licensed Physical Therapist.

HAWK, DAVID L., Associate Professor of Architecture (1981), and Associate Dean of the School of Architecture (Acting). Iowa State University, B.Arch., 1971; University of Pennsylvania, M. Arch., M.City Planning, 1974; Ph.D., 1979.

HELFGOTT, ROY B., Distinguished Professor of Economics (1968). City College of New York, B.S., 1948; Columbia University, M.A., 1949; New School for Social Research, Ph.D., 1957.

HENDERSON, SUSAN, Assistant Professor of Architecture (1981). University of Washington, B.A., 1974; Massachusetts Institute of Technology, M. Arch., 1977.

HERMAN, HARRY, Professor of Mechanical Engineering (1964), and Assistant Chair for Graduate Studies and Research (1979). Cooper Union, B.M.E., 1948; Columbia University, M.S. 1956; Polytechnic Institute of Brooklyn, Ph.D., 1964.*

HICKS, FORREST L., Associate Professor of Civil and Environmental Engineering (1981). University of Southern California, B.A., 1948; Ohio State University, M.S., 1965. Licensed Land Surveyor.

HO, FRED C.M., Assistant Professor of Industrial Engineering (1983). University of Hawaii, B.S., 1974; Iowa State University, M.S., 1976; Ph.D. 1981.

HODGE, ELIZABETH J., Assistant Professor of English and Philosophy (1969). New York University, B.A., 1958; M.A., 1960; Ph.D., 1975.

HRYCAK, PETER, Professor of Mechanical Engineering (1965). University of Minnesota, B.S., 1954; M.S., 1955; Ph.D., 1960.*

HSIEH, HSIN-NENG, Assistant Professor of Civil and Environmental Engineering (1983). Cheng-Kung University, B.S., 1970; University of Iowa, M.S., 1973; University of Pittsburgh, Ph.D., 1983.

HSIEH, JUI S., Professor of Mechanical Engineering (1960). Wuhan University, B.E., 1943; University of Kentucky, M.S., 1950; Ohio State University, Ph.D., 1955.*

HSU, C. T. THOMAS, Associate Professor of Civil and Environmental Engineering (1978). Cheng-Kung University, B.S.E., 1964; College of Chinese Culture, M.S., 1967; McGill University, M.E., 1969; Yale University, M.S., 1972; McGill University, Ph.D., 1974.*

HUANG, CHING-RONG, Professor of Chemical Engineering (1966), and Assistant Chair of the Department for Graduate Studies and Research (1981). National Taiwan University, B.S., 1954; Massachusetts Institute of Technology, M.S., 1958; University of Michigan, M.S., 1965; Ph.D., 1966.

HUSSEIN, RAFAAT, Assistant Professor of Civil and Environmental Engineering (1983). El-Azhar University, B.Sc. (Hon.), 1974; Concordia University, M.Eng., 1978; Ph.D., 1980.

JACKSON, BARRY, Associate Professor of Architecture (1977). Rensselaer Polytechnic Institute, B. Arch., 1958; University of California, Berkeley, M. Arch., 1965.+

JAFFE, GERALD, Assistant Professor of Mechanical Engineering (1960). City College of New York, B.M.E., 1947; M.M.E., 1954; Newark College of Engineering, M.S. 1965.*

JERMAKIAN, ARMEN, Assistant Professor of Physics (1966). Stevens Institute of Technology, B.S.E., 1959; M.E., 1960.

JOHNSON, CLARENCE S., Associate Professor of English (1956). Montclair State College, B.A., 1949; M.A., 1951; Rutgers University, Ed.D., 1966.

KAHNG, ANTHONY, Associate Professor of Industrial Relations (1964). Kwansel-Gakuin University (Japan), L.L.B., 1954; Kansai University (Japan), L.L.M., 1956; Tulane University, M.C.L., 1958; Yale Law School, L.L.M., 1962; New York University Law School, J.S.D., 1981.

KAPPRAFF, JAY M., Associate Professor of Mathematics (1974). Polytechnic Institute of Brooklyn, B.Ch.E., 1958; Iowa State University, M.S., 1960; New York University, Ph.D., 1974.

KATZEN, MARTIN, Associate Professor of Mathematics (1963). City College of New York, B.S., 1960; M.S., 1964; City University of New York, Ph.D., 1968.

KAUFHOLD, MICHAEL E., 1Lt., U.S.A.F., Assistant Professor of Aerospace Studies (1983). Pennsylvania State University, B.S., 1979; M.Ed., 1980.

KEBBEKUS, BARBARA B., Associate Professor of Chemistry (1974). Rosemont College, B.S., 1960; Pennsylvania State University, Ph.D., 1964.

KETZNER, ROBERT S., Associate Professor of Engineering Graphics (1961). Indiana State Teachers College, B.S., 1953; Indiana State University, M.S., 1960.

KHERA, RAJ P., Professor of Civil and Environmental Engineering (1966). Ohio State University, M.S.; Northwestern University, Ph.D., 1967.*

KIMMEL, HOWARD S., Professor of Chemistry (1966), and Associate Chair of the Department of Chemical Engineering and Chemistry. Brooklyn College, B.S., 1959; West Virginia University, M.S., 1961; City University of New York, Ph.D., 1967.

KINGERY, BERNARD, Assistant Professor of Physics (1952). Georgia Southern University, B.S., 1948; Columbia University, M.S., 1949.

KIRCHNER, ROBERT P., Associate Professor of Mechanical Engineering (1962). Newark College of Engineering, B.S., 1962; M.S., 1964; Rutgers University, Ph.D., 1968.*

KLAPPER, JACOB, Professor of Electrical Engineering (1967). City College of New York, B.E.E., 1956; Columbia University, M.S.E.E., 1958; New York University, Eng. Sc.D, 1965.*

KNOX, DANA E., Assistant Professor of Chemical Engineering (1983). Rensselaer Polytechnic Institute, B.S., 1977; M.E., 1978; Ph.D., 1982.

KONON, WALTER, Associate Professor of Civil and Environmental Engineering (1974). City University of New York, B.S.C.E., 1966; M.S.C.E., 1970.*

KOPF, JOSEPH E., Assistant Professor of Manufacturing Technology (1975). Newark College of Engineering, B.S.M.E., 1957; M.S. Mg't. Eng., 1962.*

KOPLIK, BERNARD, Professor of Mechanical Engineering, and Chair of the Department (1981). City College of New York, B.M.E., 1955; Columbia University, M.S., 1957; Polytechnic Institute of Brooklyn, Ph.D., 1966.*

KRANTZ, CHARLES K., Associate Professor of History (1968). City College of New York, B.A., 1956; University of Connecticut, M.A., 1958; University of Rochester, Ph.D., 1964.

KRISTOL, DAVID S., Professor of Chemistry (1966). Brooklyn College, B.S., 1958; New York University, M.S., 1966; Ph.D., 1969.

KUHARETZ, BORIS, Associate Professor of Physics and Associate Chair of the Department (1959). Columbia University, B.S., 1951; M.S., 1961; Stevens Institute of Technology, Ph.D., 1980.

KUO, MARSHALL C.Y., Professor of Electrical Engineering (1965). National Taiwan University, B.S., 1954; Texas A & M University, M.S., 1958; University of Michigan, Ph.D., 1964.*

KUPERSTEIN, IRA S., Assistant Professor of Civil and Environmental Engineering (1970). City College of New York, B.C.E., 1963; M.C.E., 1968; New York University, Ph.D., 1973.*

LAMBERT, DONALD G., Associate Professor of Chemistry (1967). Oklahoma State University, B.S., 1956; Virginia Polytechnic Institute, M.S., 1963; Ph.D., 1965.

LANDSMAN, LEON D., Associate Professor of Physics (1958). Columbia University, B.A., 1951; M.A., 1956.

LaSALLE, ANITA J., Associate Professor of Computer and Information Science (1974). Newark College of Engineering, B.S.M.E., 1964; New Jersey Institute of Technology, M.S.M.E., 1971; Stevens Institute of Technology, Ph.D., 1980.

LaVERDA, MICHAEL J., Associate Professor of Economics (1956). Upsala College, B.B.A., 1952; Rutgers University, M.B.A., 1954.

LEE, ALFRED M., Associate Professor of English (1967). Yale University, B.A., 1960; University of Iowa, M.F.A., 1963.

LEI, GEORGE Y., Associate Professor of Chemistry (1975). Ordnance Engineering College of Taiwan, B.S., 1952; University of Windsor, M.S., 1965; Polytechnic Institute of Brooklyn, Ph.D. 1970.

LEVINSON, ALFRED, Assistant Professor of Economics (1981). University of Pennsylvania, A.B., 1955; University of California at Davis, M.A., 1976; University of California at Berkeley, Ph.D., 1978.*

LEVY, DOROTHY, Professor of Mathematics, and Dean of Third College (1983). New York University, B.A., 1952; Harvard University, M.A. 1953; New York University, Ph.D., 1958.

LEWANDOWSKI, GORDON, Associate Professor of Chemical Engineering (1977). Polytechnic Institute of Brooklyn, B.S., 1965; M.S., 1966; Columbia University, Eng. Sc.D., 1970.*

LIEB, MURRAY, Associate Professor of Mathematics (1961). Newark College of Engineering, B.S.E.E., 1961; M.S.E.E., 1963; New York University, M.S., 1965; Polytechnic Institute of Brooklyn, Ph.D., 1970.*

LINDEN, MARTIN J., Professor of Mechanical Engineering (1958). Pennsylvania State University, B.S.M.E., 1947; Newark College of Engineering, M.S.M.E., 1956; Stevens Institute of Technology, D.Sc., 1963.*

LINN, KARL, Associate Professor of Architecture (1977). Kadoorie Agriculture School, Palestine, Diploma in Agriculture, 1941; Psychotechnical Institute, Zurich, Switzerland, Diploma in Psychology, 1948; New School of Social Research, M.A., 1956.+

LIONE, MICHAEL, Associate Professor of Mathematics (1954). University of Newark, B.A., 1942; United States Air Force, Certificate in Meteorological Engineering (N.Y.U.), 1943; New York University, M.S., 1950.

LYNCH, ROBERT E., Professor of English, and Associate Chair of the Humanities Department (1967). St. Francis College, B.A., 1962; New York University, M.A., 1963; Ph.D., 1971.

LYNGSTAD, SVERRE, Professor of English (1962). University of Oslo, B.A.Eng., 1943; Hist., 1946; University of Washington, M.A., 1949; New York University, Ph.D., 1960.

MARTIN, JAMES L., Associate Professor of Mechanical Engineering (1965). Virginia Military Institute, B.S.C.E., 1952; Rutgers University, M.S., 1957; Pennsylvania State University, Ph.D., 1964.*

McCORMICK, JOHN E., Professor of Chemical Engineering (1962), and Associate Chair of the Department. Iowa State University, B.Sc., 1948; University of Cincinnati, Ph.D., 1957.*

McDERMOTT, KEVIN J., Associate Professor of Industrial Engineering 1982. Newark College of Engineering, B.S.E.E, 1965; Columbia University, M.S.I.E., 1970; Fairleigh Dickinson University, Ed.D., 1975.*

McHUGH, JAMES A.M., Associate Professor of Computer and Information Science (1977), and Associate Chair of the Department. Fordham University, A.B., 1965; Courant Institute, New York University, Ph.D., 1970.

MEDSKER, LARRY, Associate Professor of Computer and Information Science (1982). Indiana University , B.A., 1965; M.S., 1967; Ph.D., 1971.

MEOLA, ROBERT R., Professor of Electrical Engineering, and Associate Chair of the Department (1974). Newark College of Engineering, B.S., 1946; Stevens Institute of Technology, M.S., 1949.*

MEYER, ANDREW U., Professor of Electrical Engineering (1965). Studies in Germany, B.S.; Northwestern University, M.S., 1958; Ph.D., 1961.*

MIHALASKY, JOHN, Professor of Industrial Engineering (1956), and Associate Chair of the Department of Industrial and Management Engineering. Newark College of Engineering, B.S.M.E., 1951; M.S., 1954; Rutgers University, M.B.A., 1956; New York University, M.I.E., 1960; Columbia University, D.Ed., 1973.*

MILLER, EDWARD, Professor of Mechanical Engineering (1948), and Associate Dean of Newark College of Engineering (1981). Newark College of Engineering, B.S., 1948; University of Delaware, M.M.E., 1949; Columbia University, M.A., 1951; Stevens Institute of Technology, M.S., 1952; New York University, M.Aero.E., 1959.*

MILLS, MIRIAM K., Associate Professor of Industrial Relations (1973). City College of New York, B.A., 1964; New York University, M.P.A., 1969; Ph.D., 1978.

MISRA, RAJ, Professor of Electrical Engineering (1962). Massachusetts Institute of Technology, B.S., 1941; Cornell University, M.S., 1945; Ph.D., 1955.

MO, DAVID W., Assistant Professor of Industrial Engineering (1982). University of Wisconsin, B.Sc., 1974; Iowa State University, M.Sc., 1976; Ph.D., 1981.

MOORE, SANDRA V., Associate Professor of Architecture (1983). Tuskegee Institute, B.A., 1967; Yale University, M.E.D., 1973; Harvard University, Ed.D., 1982.

MOSHOS, GEORGE J. Professor of Computer and Information Science, and Chair of the Department (1968). University of Michigan, B.S., 1949; M.S., 1949; Case Institute of Technology, Ph.D., 1965.

NAKAMURA, SACHIO, Assistant Professor of Mechanical Engineering (1983). Kobe University (Japan), B.S.E.E., 1970; M.S.E.E., 1972; University of Iowa, M.S.M.E., 1980; Ph.D., 1983.

NAPIER, JAMES J., Professor of English (1955). University of Pennsylvania, A.B., 1949; A.M., 1950; Ph.D., 1959.

NATAPOFF, MARSHALL, Associate Professor of Physics (1956). Cornell University, B.S., 1956; New York University, M.S., 1956; Stevens Institute of Technology, Ph.D., 1968.

NEIDHARDT, W. JAMES, Associate Professor of Physics (1962). Stevens Institute of Technology, B.S.M.E., 1956; M.S., 1958; Ph.D., 1962.

NIVER, EDIP, Assistant Professor of Electrical Engineering (1983). Middle East Technical University (Turkey), B.Sc., 1970; M.Sc., 1973; Ph.D., 1979.

O'CONNOR, JOHN E., Associate Professor of History (1969). St. John's University, B.A., 1965; Queens College, M.A., 1967; City University of New York, Ph.D., 1974.

OLENIK, THOMAS J., Associate Professor of Civil and Environmental Engineering (1970). Newark College of Engineering, B.S.C.E., 1968; M.S.C.E., 1970; Rutgers University, Ph.D., 1974.*

PADALINO, JOSEPH J., Professor of Electrical Engineering (1947). Newark College of Engineering, B.S., 1944; University of Pennsylvania, M.S., 1947; Brooklyn Polytechnic Institute, Ph.D., 1963.*

PAPPAS, MICHAEL J., Professor of Mechanical Engineering (1964). Newark College of Engineering, B.S., 1959; M.S., 1964; Rutgers University, Ph.D., 1970.*

PARKER, RICHARD C., Professor of Chemistry (1966). California State College at Long Beach, B.S., 1962; University of Washington, Ph.D., 1966.

PATTINSON, JOHN P., Professor of English, and Chair of the Humanities Department (1965). Cambridge University, B.A., 1947; M.A., 1949; New York University, Ph.D., 1968.

PAWEL, HANS E., Professor of Mechanical Engineering (1964). Newark College of Engineering, B.S., 1956; M.S., 1966; Rutgers University, Ph.D., 1974.*

PECK, CHARLES F. JR., Professor of Civil and Environmental Engineering (1970). Massachusetts Institute of Technology, S.B., 1941; S.M., 1943; Sc.D., 1947.*

PECKER, CALMAN, Associate Professor of Mechanical Engineering (1982). City College of New York, B.M.E., 1948; Columbia University, M.S.M.E., 1963; Eng.Sc.D., 1971.

PEREZ, MANUEL, Professor of Mathematics (1971). City College of New York, B.M.E., 1961; New York University, M.M.E., 1963; City University of New York, Ph.D., 1968.*

PERLMUTTER, HOWARD D., Associate Professor of Chemistry (1965). Lehigh University, B.A., 1959; New York University, M.S., 1962; Ph.D., 1963.

PERNA, ANGELO J., Professor of Chemical and Environmental Engineering (1967). Clemson University, B.S.Ch.E., 1957; M.S.Ch.E., 1962; University of Connecticut, Ph.D., 1967.

PETROULAS, THEODORE, Assistant Professor of Chemical Engineering (1984). National Technical University, Athens (Greece), Diploma in Chemical Engineering, 1978; Purdue University, M.S., 1980; University of Minnesota, Ph.D., 1984.

PLASTOCK, ROY A., Associate Professor of Mathematics (1975). Brooklyn College, B.S., 1966; Yeshiva University, M.S., 1969; Ph.D., 1972.

PROGELHOF, RICHARD C., Professor of Mechanical Engineering (1967). Newark College of Engineering, B.S.M.E. 1958; Stanford University, M.S.M.E., 1959; Lehigh University, Ph.D., 1962.*

RAGHU, DORAIRAJA, Associate Professor of Civil and Environmental Engineering (1977). Annamalai University (India), B.E.(Hon.), 1961; Madras University (India), M.Sc. (Engg), 1962; University of Kentucky, M.S., 1972; Texas Tech University, Ph.D., 1975.*

RAUSEN, JOHN, Associate Professor of Mathematics (1966). City College of New York, B.Ch.E., 1944; Columbia University, M.A., 1948; Ph.D., 1966.

REISMAN, OTTO, Assistant Professor of Physics and Industrial Engineering (1962). City College of New York, B.S., 1957; New York University, M.S., 1960; Ph.D., 1973.

REISMAN, STANLEY S., Associate Professor of Electrical Engineering (1967). Brooklyn Polytechnic Institute, B.S., 1962; Massachusetts Institute of Technology, M.S., 1963; Brooklyn Polytechnic Institute, Ph.D., 1974.

REIZISS, DANIEL, Assistant Professor of Physics (1955). City College of New York, B.M.E., 1944; Newark College of Engineering, M.S.E.E., 1960.

RIGASSIO, JAMES L., Professor of Industrial Engineering, and Chair of the Department of Industrial and Management Engineering (1958). Newark College of Engineering, B.S., 1948; Yale University, M.Eng., 1949.*

RIGHTS, ROBERT M., Associate Professor of Engineering Graphics (1954). Bethany College, B.A., 1950; Montclair State College, M.A., 1952.

RIPS, ERVINE M., Associate Professor Emeritus of Electrical Engineering (1958 Retired). Massachusetts Institute of Technology, B.S., 1942; Carnegie Institute of Technology, M.S., 1947.*

ROBBINS, WALTER M., Assistant Professor of Mathematics (1978). University of Oregon, B.A., 1947; Princeton University, Ph.D., 1951.

ROCHE, EDWARD C. Jr., Professor of Chemical Engineering (1967). Stevens Institute of Technology, B.S.M.E., 1954; Harvard University, M.S., 1958; Stevens Institute of Technology, Sc.D., 1967.*

ROSE, ROBERT H. II, Associate Professor of Electrical Engineering (1947). Newark College of Engineering, B.S., 1944; Stevens Institute of Technology, M.S., 1966.

ROSENSTARK, SOL, Associate Professor of Electrical Engineering (1968). City College of New York, B.E.E., 1958; New York University, M.E.E., 1961; Ph.D., 1966.*

ROTTER, NAOMI G., Associate Professor of Social Science (1977), and Associate Chair of the Department of Organizational and Social Sciences (1983). Skidmore College, B.A., 1963; New York University, Ph.D., 1974.

RUSSELL, WILLIAM C., Major, U.S.A.F., Assistant Professor of Aerospace Studies (1982). United States Air Force Academy, B.S., 1968; University of Northern Colorado, M.A., 1975.

RUSSO, O. LOUIS, Associate Professor of Physics (1963). Clarkson Institute of Technology, B.S.E.E., 1952; Stevens Institute of Technology, M.S.E.E., 1963; New Jersey Institute of Technology, Dr.Eng.Sc., 1975.*

RYON, JOHN E, III, Associate Professor of Computer and Information Science (1974). Massachusetts Institute of Technology, B.S., 1962; Stevens Institute of Technology, M.S., 1968; Ph.D., 1970.

SALZARULO, LEONARD, Professor of Physics (1953). Newark College of Engineering, B.S.Ch.E., 1951; M.S., 1953; Brooklyn Polytechnic Institute of Technology, Ph.D., 1966.*

SALEK, FRANKLIN, Professor of Civil and Environmental Engineering (1968). Worcester Polytechnic Institute, B.S.C.E., 1959; Rutgers University, M.S.C.E., 1967; Ph.D., 1969.*

SARIAN, EDWARD, Associate Professor of Computer and Information Science (1977). Niagara University, B.S., 1964; University of Michigan, M.S., 1967; Stevens Institute of Technology, Ph.D., 1977.

SAVIN, WILLIAM, Professor of Physics (1960). Newark College of Engineering, B.S.E.E., 1960; M.S., 1962; Rutgers University, Ph.D., 1968.

SCHACHTER, HINDY L., Associate Professor of Social Science (1979). Brooklyn College, B.A., 1966; New York University, M.A., 1968; Columbia University, Ph.D., 1978.

SCHEINOK, PERRY A., Associate Professor of Mathematics (1983). City College of New York, B.S., 1952; Indiana University, Ph.D., 1960.

SCHER, JULIAN, Associate Professor of Computer and Information Science (1971), and Chair of the Department. Brooklyn College, B.A. 1965; New York University, M.S., 1967; Ph.D., 1971.

SCHMERZLER, LAWRENCE J., Associate Professor of Mechanical Engineering (1953). University of Texas, B.S., 1948; Newark College of Engineering, M.S., 1956.*

SCHUMAN, ANTHONY, Assistant Professor of Architecture, (1979). Wesleyan University, B.A., 1965; Columbia University, M.A., 1966; M. Arch., 1970.+

SCHURING, JOHN, Assistant Professor of Civil and Environmental Engineering (1982). Stevens Institute of Technology, B.E. (Hon.), 1974; University of Alaska, M.C.E., 1977.*

SENKEVITCH, ANATOLE, JR., Associate Professor of Architecture (1983). University of Texas (Austin), B.S.Arch. Studies, 1967; University of Virginia, M.Arch., 1970; Cornell University, Ph.D., 1974.

SHER, DORIS, Assistant Professor of History (1970). City College of New York, B.A., 1965; Columbia University, M.A., 1967.

SHILMAN, AVNER, Professor of Chemistry (1963). American University of Beirut, Ph.C., 1945; Columbia University, M.S., 1953; M.A., 1957; Polytechnic Institute of Brooklyn, Ph.D., 1961.

SHRESTHA, RAMESH L. Assistant Professor of Civil and Environmental Engineering (1983). Tribhuvan University, B.S., 1970; North East London Polytechnic, B.S., 1976; Oregon State University, M.S., 1979; University of Wisconsin, Ph.D., 1983.

SOHN, KENNETH, Associate Professor of Electrical Engineering (1966). Upsala College, B.S., 1957; Stevens Institute of Technology, M.S., 1959; Ph.D., 1967.*

SPECTOR, MARION, Assistant Professor of Organizational Science (1974). Brooklyn College, B.A., 1962; City College of New York, M.B.A., 1966; Columbia University, M.A., 1968; New York University, Ph.D., 1974.

SPITZ, HERBERT, Assistant Professor of Social Science (1964). Brooklyn College, B.A., 1947; New School for Social Research, M.A., 1963.

SRAN, KEWAL SINGH, Assistant Professor of Mathematics (1982). Punjab University, B.A., 1946; M.A., 1953; Oregon State University, Ph.D., 1967.

STEFFEN, NANCY L., Assistant Professor of English (1971). Stanford University, B.A., 1965; Brandeis University, M.A., 1969.; Ph.D., 1977.

STEVENSON, BENJAMIN H., JR., Associate Professor of Physics (1965). Newark College of Engineering, B.S.M.E., 1962; Cornell University, M.S., 1966; New York University, Ph.D., 1971.

STILLER, NIKKI, Assistant Professor of English (1981). Hunter College, B.A., 1968; City University of New York, Ph.D., 1973.

STOCHAJ, JOHN J., Professor of Economics (1955). Boston University, B.A., 1951; Rutgers University, M.A., 1956; New York University, Ph.D., 1963.

STONE, GERALD, Associate Professor of Industrial Engineering (1966). City College of New York, B.Ch.E., 1939; Temple University, Cert. in E.E., 1941; M.Ad.E. in Industrial Eng., 1944; New York University, Sc.Eng.D., 1949.*

STRANO, JOSEPH J., Professor of Electrical Engineering (1959), and Chair of the Department (1976). Newark College of Engineering, B.S., 1959; M.S., 1961; Rutgers University, Ph.D., 1969.*

STURCHIO, JEFFREY L, Assistant Professor of History (1981). Princeton University, A.B., 1973; University of Pennsylvania, M.A., 1976; Ph.D., 1981.

SUCHOW, LAWRENCE, Professor of Chemistry (1964). City College of New York, B.S., 1943; Polytechnic Institute of Brooklyn, Ph.D., 1951.

SUN, BENEDICT C., Associate Professor of Mechanical Engineering (1967), and Assistant Chair for Mechanical Technology. National Taiwan University, B.S., 1955; Kansas State University, M.S., 1959; University of Illinois, Ph.D., 1967.*

TASSIOS, DIMITRIOS, Professor of Chemical Engineering (1966). National Technical University, Athens, (Greece), Diploma, 1960; University of Texas, M.S., 1964; Ph.D., 1967.

TAVANTZIS, JOHN, Associate Professor of Mathematics (1976). Columbia College B.A., 1962; Columbia School of Engineering, M.S., 1966; New York University, Ph.D., 1976.

TOBIAS, NORMAN, Associate Professor of History (1965). Rutgers University, B.A., 1959; M.S., 1965; Ph.D., 1969.

TOMKINS, REGINALD P. T., Associate Professor of Chemistry (1977). Birkbeck College, University of Oxford, U.K., B.Sc., 1963; University of London, U.K., Ph.D., 1966.

TOWFIK, NISSIM, Associate Professor of Physics (1955). Bombay University, B.S., 1949; Columbia University, A.M., 1953.

TRATTNER, RICHARD, Professor of Chemistry and Environmental Science (1967). City College of New York, B.S., 1959; Brooklyn College, M.A., 1961; City University of New York, Ph.D., 1967.

TROOP, WILLIAM J., Associate Professor of Electrical Engineering (1963). Newark College of Engineering, B.S.E.E., 1963; M.S.E.E., 1965; Stevens Institute of Technology, Ph.D., 1970.

TUROFF, MURRAY, Professor of Computer and Information Science (1973). University of California, B.A., 1958; Brandeis University, Ph.D., 1965.

VENANZI, CAROL A., Assistant Professor of Chemistry (1982). Catholic University of America,B.A., 1969; Johns Hopkins University, M.A., 1970; University of California at Santa Barbara, Ph.D., 1978.

VORONKA, ROMAN W., Professor of Mathematics (1962). Newark College of Engineering, B.S.E.E., 1962; M.S.E.E., 1964; New York University, M.S., 1967; Ph.D., 1974.

WALL, DONALD, Associate Professor of Architecture (1974). University of Manitoba, B. Arch., 1958; Cornell University, M. Arch., 1959; Catholic University, D. Arch., 1970.

WEBB, MICHAEL, Associate Professor of Architecture (1978). Regent Street Polytechnic, London, Diploma.

WECHARATANA, METHI, Assistant Professor of Civil and Environmental Engineering (1982). Chulalongkorn University, B.E., 1976; Asian Institute of Technology, M.E., 1978; University of Illinois, Ph.D., 1982.

WEISMAN, LESLIE, Associate Professor of Architecture (1975). Wayne State University, B.F.A., 1967; University of Detroit, M.A., 1973.

WEST, TROY, Associate Professor of Architecture (1975). Carnegie Institute of Technology, B. Arch., 1958; M. Arch., 1965.+

WHITMAN, GERALD MARTIN, Professor of Electrical Engineering (1970). City College of New York, B.S., 1963; Columbia University, B.S.E.E., 1963; Polytechnic Institute of Brooklyn, M.S., 1967; Ph.D., 1969.

WILSON, CHARLES E., Professor of Mechanical Engineering (1956). Newark College of Engineering, B.S., 1953; M.S., 1958; New York University, M.S.E.M., 1962; Polytechnic Institute of Brooklyn, Ph.D., 1970.*

WINTERS, STANLEY B., Professor of History (1957). New York University, A.B., 1948; Columbia University, A.M., 1950; Rutgers University, Ph.D., 1966.

WISE, JAMES N., Associate Professor of English (1955). College of Wooster, B.A., 1941; Columbia University, M.A., 1948.

WOLF, CARL, Professor of Management Engineering (1961). City College of New York, B.B.A., 1951; Columbia University, M.S., 1954; New York University, Ph.D., 1971.*

WONG, WING T., Assistant Professor of Chemical Engineering (1981). University of Toronto, B.Sc., 1973; M.Sc., 1975; Princeton University, Ph.D., 1980.

YFANTIS, EVANGELOS, Associate Professor of Computer and Information Science (1983). University of Athens (Greece), B.S., 1969; Fairleigh Dickinson University, M.S., 1972; Rutgers University, M.S., 1973; New Jersey Institute of Technology, M.S. Computer Science, 1975; University of Wyoming, Ph.D., 1978.

ZAMBUTO, MAURO H., Distinguished Professor of Electrical Engineering (1962). University of Rome and Padua (Italy), Ph.D., 1944.

ZAMES, FRIEDA, Assistant Professor of Mathematics (1972). Brooklyn College, B.S., 1954; New York University, M.S., 1966; Ph.D., 1972.

ZANER, THEODORE, Professor of Human Resource Management (1965). City College of New York, B.S., 1940; Columbia University, M.A., 1949; Ed.D., 1955.

ZATZKIS, HENRY, Distinguished Professor of Mathematics, and Chair of the Department (1953). Ohio State University, B.S., 1942; Indiana University, M.S., 1944; Syracuse University, Ph.D., 1950.

ZDEPSKI, M. STEPHEN, Associate Professor of Architecture (1974). Syracuse University, B. Arch., 1969; University of Pennsylvania, M. Arch., 1970.+

Part-Time and Temporary Members of the Teaching Staff

ABRAHAM, JOHN, Division of Technology (1978). Newark College of Engineering, B.S.E.E., 1970.

ALBERS, RICHARD, Organizational and Social Sciences (1979). Fairleigh Dickinson University, B.S., 1964; Seton Hall University, M.Ed., 1974.

ALBRIGHT, PAUL L., Organizational and Social Sciences (1983). Georgetown University, B.S., 1950.

BABINSKI, MARK, Computer and Information Science (1979). Warsaw Polytechnic, M.S.E.E., 1973; Polytechnic Institute of New York, M.S. Computer Science, 1974.

BALLATTY, THOMAS, Civil and Environmental Engineering (1975). Rensselaer Polytechnic Institute, B.C.E., 1951; Columbia University, M.S.C.E., 1961.

BASHEN, SIMA, Civil and Environmental Engineering (1983). Tehran University, B.S., 1965; Illinois State University, M.S., 1968.

BEATTIE, JOHN D., Computer and Information Science (1981). Newark College of Engineering, B.S.En.S., 1974; New Jersey Institute of Technology, M.S.C.S., 1976; B.S.I.E., 1980.

BENOVAR, M'HAMED, Electrical Engineering (1983). California State University at Sacramento, B.A.; B.S.E.E., 1980; M.S.E.E., 1981.

BENSON, JACOB, Mathematics (1981). Rutgers University, M.S.E.E., 1953; Ph.D., 1967.

BOBER, VINCENT E., Computer and Information Science (1976). Newark College of Engineering, B.S.E.E., 1969; M.S.C.S., 1970.

BOSWELL, WILLIAM J., Civil and Environmental Engineering (1973). Fairleigh Dickinson University , B.A., 1953; New Jersey Institute of Technology, B.S.C.E., 1966; M.S.C.E., 1973.*

BOXER, RAYMOND, Organizational and Social Sciences (1963). Upsala College, B.A., 1963; Fairleigh Dickinson University, M.A., 1967.

BRAUDE, ERIC J., Computer and Information Science (1980). University of Natal, B.Sc., 1965; University of Illinois, M.S., 1967; Columbia University, Ph.D., 1971; University of Miami, M.S., 1980.

BRYANT, DIANA, Architecture (1982). New York University, B.A., 1968.

BUTERBAUGH, Gene C., Electrical Engineering (1983). New Jersey Institute of Technology, B.S.E.E., 1979; M.S.E.E., 1983.

BYRNE, MICHAEL, Industrial and Management Engineering (1977). Notre Dame University, B.S.M.E., 1959; Newark College of Engineering, M.S.M.E., 1963.*

CEBULA, CHARLES M., Electrical Engineering (1983). Newark College of Engineering, B.S.E.E., 1971; New Jersey Institute of Technology, M.S.E.E., 1978.*

CERULLO, JOHN F., JR., Division of Technology. Newark College of Engineering, B.S.M.E., 1948.*

CHEN, WENSEN, Civil and Environmental Engineering (1983). Ming-Hsin Engineering College, B.S., 1971; University of Massachusetts, M.S.C.E., 1976; Ph.D., 1981.

CHEREMISINOFF, NICHOLAS P., Civil and Environmental Engineering. Clarkson College of Technology, B.S.; M.S.; Ph.D., 1977.

CIBORSKI, JOHN M., Industrial and Management Engineering (1975). Purdue University, B.S.Ch.E., 1939; Harvard University, M.S., 1940; Purdue University, D.E. (Hon.), 1967; Fairleigh Dickinson University, M.A., 1979.

CIURCZAK, EMIL W., Chemistry (1982). Rutgers University, B.A., 1971; M.S. 1974.

COLL, RICHARD A., Computer and Information Science (1978). Fordham University, B.S.; University of South Florida, M.E.I.A., 1970; Rutgers University, M.A., 1976.

CONLEY, ROBERT J., F.M.S., Chemical Engineering and Chemistry (1981). Marist College, B.A., 1963; Brown University M.A.T., 1968; Ph.D., 1971.

CORCORAN, JOHN M., Industrial and Management Engineering (1977). St. Peter's College, B.S., 1957. Certified Public Accountant.

CORSHU, MATTHEW, Organizational and Social Sciences (1978). University of Wisconsin, B.S., 1969; New School for Social Research, M.A., 1976.

COSSA, FRANK, Humanities (1982). City University of New York, B.A., 1973; Rutgers University, M.A., 1975; Ph.D., 1982.

CROSS, ALVIN, Organizational and Social Sciences (1983). Knoxville College, B.S., 1968; New York University, M.P.A., 1971.

CUOZZI, WILLIAM F., Organizational and Social Sciences (1976). Seton Hall University, B.S., 1942; Rutgers University, LL.B., 1945.

CYBUL, MARTIN, Architecture (1981). Tulane University, B. Arch., 1974; Massachusetts Institute of Technology, M. Arch, 1976.

CZERWIENSKI, GREGORY, Chemistry (1978). New Jersey Institute of Technology, B.S.Ch.E., 1972.

D'ANGELO, GREGORY J., Computer and Information Science (1982). New Jersey Institute of Technology, B.Arch., 1979; M.S. Computer Science, 1981.

DANIELS, STUART F., Computer and Information Science (1983). University of New Hampshire, B.S.E.E., 1963; Case Institute of Technology, M.S.E.E., 1966; Case Western Reserve University, Ph.D., 1970.

DARACK, FAYE B., Chemistry (1979). Yeshiva University, B.A., 1968; M.A., 1971.

DIB, ALBERT, Industrial and Management Engineering (1952). Brooklyn College, B.A., 1947; St. Johns University, J.D., 1951.

DIOS, ROSE ANN, Mathematics (1979). New Jersey Institute of Technology, B.S.E.S., 1977; New York University, M.S., 1979.

DIX, ROBERT, Chemical Engineering (1970). Newark College of Engineering, B.S.Ch.E., 1965; M.S.ChE., 1966; Sc.D., 1970.

DOMASH, LIONEL, Chemistry (1983). New York University, A.B., 1948; Purdue University, M.S., 1950; Ph.D., 1952.

DUBROVSKY, ROMAN, Mechanical Engineering (1983). Mechanical Engineering Institute, Moscow (U.S.S.R.), M.E., 1959; Polytechnical Institute, Moscow University, M.S., 1967; Ph.D., 1972.

DUTTA, SUBHASH, Chemical Engineering (1977). Calcutta University, B.S., 1963; M. Tech., 1966; Indian Institute of Technology, Ph.D., 1972.

EBEN, JEROME LESLIE, Division of Technology (1979). New York Institute of Technology, B.S., 1971.

EDWARDS, MARYANN, Computer and Information Science (1982). Newark College of Engineering, B.S.E.E., 1967; M.S.I.E., 1971.

ELLERBUSCH, FRED, Chemical Engineering (1980). Newark College of Engineering, B.S.Ch.E., 1973; New Jersey Institute of Technology, M.S.Ch.E., 1980.

EMANUELE, ANTHONY, Mechanical Engineering (1977). Newark College of Engineering, B.S., 1952.

ENGLER, PETER E., Mechanical Engineering (1976). McGill University, B.E.E., 1957; Cornell University, M.S.E.E., 1961; SUNY Buffalo, Ph.D., 1974.

ESPOSITO, MARISA D., Humanities (1983). Kent State University, B.A., 1974; M.A., 1977; Ph.D., 1982.

FABISIAK, WALTER, Chemical Engineering (1975). Newark College of Engineering, B.S.Ch.E., 1971; New Jersey Institute of Technology, MS.Ch.E., 1974; Sc.D., 1980.

FAIRFIELD, RICHARD, Organizational and Social Sciences (1977). University of Akron, B.A., 1967; New School for Social Research, M.A., 1973.

FANELLI, ANTHONY J., Chemistry (1977). Brooklyn College-CUNY, A.B., 1962; Polytechnic Institute of Brooklyn, Ph.D., 1971.

FENKART, DOUGLAS R., Chemistry (1983). Fairleigh Dickinson University, B.A., 1976.

FENWICK, ELLEN HETLAND, Computer and Information Science (1983). Rutgers University, B.A., 1964; Bryn Mawr College, M.A., 1967; Temple University, Ph.D., 1976.

FERRANTE, JOHN C., Civil and Environmental Engineering (1983). Newark College of Engineering, B.S.C.E., 1973; New Jersey Institute of Technology, M.S.C.E., 1977.*

FISCHER, ADAM JR., Division of Technology (1967). Newark College of Engineering, B.S.M.E., 1965; New Jersey Institute of Technology, M.S.Mgt.Eng., 1983.*

FOLINUSZ, ROBERT J., Division of Technology (1983). Newark College of Engineering, B.S.M.E., 1948.*

FOUST, WILLIAM D., Computer and Information Science (1983). Harvard University, A.B., 1957; A.M., 1959.

FRANKLIN, WALLACE J., Division of Technology (1967). The College of the City of New York, B.M.E., 1948; Columbia University, M.S., 1954.*

GARTNER, LIA, Architecture (1981). Harvard University, B.A., 1969; Columbia University Graduate School of Architecture, M. Arch., 1973.+

GESKIN, ERNEST S., Mechanical Engineering (1984). Dnepropetrovsk Institute of Metallurgy (U.S.S.R.), M.S.; Moscow Institute of Steel and Alloys (U.S.S.R.), Ph.D., 1967.

GINSBERG, ROSS, Computer and Information Science (1980). Rensselaer Polytechnic Institute, B.S., 1969; Stevens Institute of Technology, M.S., 1975; New York Law School, J.D., 1979.

GOLDBERG, LUDMILA, Mathematics (1982). Moscow Pedagogical Institute, M.Sc., 1958; Institute of Civil Engineering, Moscow (U.S.S.R.), Ph.D., 1972.

GOODHEART, ALAN, Architecture (1975). Harvard College, A.B., 1962; Harvard Graduate School of Design, M.L.A., 1967.

GORDON, ARTHUR, Organizational and Social Sciences (1950). Newark College of Engineering, B.S., 1943; M.S., 1950.

GOYAL, ANUP, Computer and Information Science (1983). New Jersey Institute of Technology, B.S.C.S., 1983.

GRAVEMAN, RICHARD F., Computer and Information Science (1980). Drew University, B.A., 1969; Stevens Institute of Technology, M.S., Computer Science, 1973.

GRECO, FRANK D., Computer and Information Science. New Jersey Institute of Technology, M.S.C.S., 1983.

GREEN, MELVIN R., Organizational and Social Sciences (1978). Newark College of Engineering, B.S.M.E., 1964; M.S., 1967.*

GRUNES, ROBERT L., Chemistry (1974). Polytechnic Institute of Brooklyn, B.S., 1965; Ph.D., 1970.

GUDEMA, NORMAN H., Civil and Environmental Engineering (1983). City College of New York, B.C.E., 1959; Fairleigh Dickinson University, M.B.A., 1969.*

GUPTA, AVINASH, Chemical Engineering (1979). Annamalai University, B.S.Chem.E., 1962; Indian Institute of Technology, M.S.Ch.E., 1966; Brigham Young University, Ph.D., 1974.

HARRINGTON, CHRISTOPHER P., Chemistry (1974). New Jersey Institute of Technology, B.S., 1974; M.S., 1978.

HERITS, THOMAS J., Surveying (1977). Newark College of Engineering, B.S.C.E., 1972; Purdue University, M.S.C.E.

HERMES, JAMIL G., Computer and Information Science (1982). New Jersey Institute of Technology, M.S.C.S., 1982.

HIMELSTEIN, NATHAN, Organizational and Social Sciences (1981). Rutgers University, B.A., 1959; Seton Hall University, M.B.A., 1968.

HOAGLAND, JOHN H., Division of Technology (1953). Montclair State College, B.A., 1940; M.A., 1947.

HOROWITZ, AVERY, Organizational and Social Sciences (1979). Brooklyn College, B.A., 1971; M.A., 1973.

HOWERY, JOHN W., Industrial and Management Engineering (1982). Newark College of Engineering, B.S.M.E., 1954; Seton Hall University, M.B.A., 1966.

HUNDERT, IRWIN, Chemical Engineering (1983). City College of New York, B.Ch.E., 1945; New York University, M.Ch.E., 1948.

HUSAR, EMILE, Division of Technology (1970). City College of New York, B.Ch.E., 1938; M.Ch.E., 1940; Syracuse University, Cert. Pub. Works Mgt., 1962.*

ILIOPOLOUS, COSTAS S., Computer and Information Science (1983). University of Athens (Greece), B.Sc., 1980; University of Warwick, M.Sc., 1981; Ph.D., 1983.

IRWIN, ALAN E., Computer and Information Science (1983). New York University, B.A., 1969; Pratt Institute, M.S.C.S., 1979.

JULIANO, THOMAS M., Mechanical Engineering (1979). Newark College of Engineering, B.S., 1967; M.S., 1970; D.Eng.Sc., 1979.*

KALLEY, GORDON S., Industrial and Management Engineering (1981). University of New Haven, B.S., 1977; New Jersey Institute of Technology , B.S.I.E., 1981.

KARAHAN, BEYHAN, Architecture (1982). SUNY at Stony Brook, B.S., 1973; Columbia University, M.Arch., 1977.

KELBAUGH, DOUG, Architecture (1978). Princeton University, B.A., 1968; M. Arch , 1972.+

KINKADE, MERWIN, Organizational and Social Sciences (1970). Babson College, B.S., 1962; New York University, M.A., 1967; Montclair State College, M.A., 1980.

KNESL, JOHN A., Architecture (1981). Technical University of Vienna, Diploma Engineer in Architecture, 1980; D. of Technical Sciences, 1982.

KONONENKO, OLEG K., Chemistry (1976). State University, Kharkov, (Ukraine), Chemist, 1939; Ukr. Technical University, Munich, M.S., 1948; Ph.D., 1949.

KOPEC, KENNETH, Chemistry (1982). Rutgers University, B.S., 1977.

KORN, ALFRED E., Chemistry (1976). Newark College of Engineering, B.S.Ch.E., 1953; University of Northern Iowa, M.A., 1970.

KORN, CAROL R., Chemistry (1976). University of Buffalo, B.S.Ch.E., 1959; Montclair State College, M.A., 1971.

KOUNTOURAS, HARRY V., Mechanical Engineering (1983). City College of New York, B.M.E., 1971; M.M.E., 1973.

KRESS, ROBERT W., Civil and Environmental Engineering (1980). Yale University, B.S., 1961; M.S. 1964.*

LALANCETTE, DEBORAH, Chemistry (1981). Rutgers University, B.A., 1976.

LALLY, JAMES K., Organizational and Social Sciences (1983). Baruch College - CUNY, B.B.A., 1976.

LARDARO, FRED M., Computer and Information Science (1983). Rutgers University, B.A., 1971; New Jersey Institute of Technology, M.S.C.S., 1983.

LEBDUSKA, JOHN, Architecture (1981). Pratt Institute, B. Arch., 1962.+

LECHNER, LOUIS F., Computer and Information Science (1981). Seton Hall University, B.S., 1979; New Jersey Institute of Technology, M.S., Computer Science, 1981.

LEIBOVITZ, HERB, Organizational and Social Sciences. Fairleigh Dickinson University, B.A., 1951; M.B.A., 1962.

LENOX, CYNTHIA, Architecture (1982). Upsala College, B.A., 1975; Rutgers University, M.L.S., 1980.

LEVINE, DANA B., Chemistry (1976). Barnard College, B.A., 1962; Columbia University, Ph.D., 1967.

LICHTMAN, Irwin, Chemical Engineering and Chemistry (1982). City College of New York, B.S., 1943; New York University, M.S., 1948; Ph.D., 1951.

LIN, CHEN-CHONG, Chemical Engineering (1982). National Taiwan University, B.S., 1951; Doshisha University, M.S., 1958; Technische Universitat, Munchen, Dr. rer. nat., 1965.

LIPNICK, RICHARD, Electrical Engineering (1967). Rutgers University, B.S.E.E., 1957; M.S.E.E., 1967.

LOKHAMMER, PETER, Architecture (1983). Rutgers College, B.A., 1969; B.S.C.E., 1969.+

LOPES, ROBERT J., Electrical Engineering (1982). New Jersey Institute of Technology, B.S.E.E., 1979; M.S.E.E., 1983.

LORENTZEN, ROBERT R., Computer and Information Science (1982). Newark College of Engineering, B.S.E.E., 1961; M.S.E.E., 1965; New Jersey Institute of Technology, M.S.C.S., 1975; Fairleigh Dickinson University, M.B.A., 1978.

LUBLINER, DAVID J., Computer and Information Science (1980). Ramapo State College, B.S., 1974; New Jersey Institute of Technology, M.S. Computer Science, 1977; M.S.E.E., 1981.

MAELAND, ARNULF J., Chemistry (1981). Augsburg College, B.A., 1955; Tufts University, M.S., 1959; University of Vermont, Ph.D., 1965.

MALTZ, HAROLD K., Civil and Environmental Engineering (1983). Newark College of Engineering, B.S.C.E., 1969; M.S.C.E., 1972; New Jersey Institute of Technology, M.S.En.E., 1976.*

MANENTE, NICHOLAS H., Division of Technology (1971). University of Arkansas, B.Arch., 1967.

MARKO, THOMAS MICHAEL, Civil and Environmental Engineering (1983). Newark College of Engineering, B.S.C.E., 1974; New Jersey Institute of Technology, M.S.C.E., 1983.

MARTIN, HAROLD B., Division of Technology. Pratt Institute, A.A.S., 1962.

MARTINEZ, JOSE I., Computer and Information Science (1983). University of Puerto Rico, B.S.E.E., 1968; New York University, M.S.E.E., 1971.

MATTHAEY, STEPHEN, Computer and Information Science (1983). Stevens Institute of Technology, B.S.

McCULLAR, JAMES, Architecture (1981). Rice University, B.A., 1962; B.Arch., 1963; Columbia University, M.Arch., 1967.

MELNICK, GERALD, Organizational and Social Sciences (1983). Fairleigh Dickinson University, B.A., 1961; Yeshiva University, M.A., 1968; Ph.D., 1972.

MELVILLE, THOMAS J., Division of Technology (1980). St. Peters College, B.A., 1968; Seton Hall University, M.A., 1974; William Paterson College, M.A., 1980.

MORRISON, STEPHEN J., Division of Technology (1983). City College of New York, B.S.M.E., 1961; M.S.M.E., 1966.*

MORTIMER, JAMES J., Civil and Environmental Engineering (1983). Manhattan College, B.S.C.E., 1968; New Jersey Institute of Technology, M.S.C.E., 1980.*

MOSTOLLER, G. MICHAEL, Architecture (1983). Rensselaer Polytechnic Institute, B.S., 1960; B.Arch., 1964; Harvard University Graduate School of Design, M.Arch., 1969.+

MOULTON, THOMAS A., Computer and Information Science (1983). New Jersey Institute of Technology, B.S.C.S., 1983.

MUKHERJI, PRITHVIRAJ, Computer and Information Science (1983). University of Madras (India), B.Sc., 1967; M.Sc., 1969; University of Rhode Island, Ph.D., 1976.

MULHOLLAND, JOHN R., Division of Technology (1980). Massachussets Institute of Technology, B.S., 1956.*

MULVANEY, JAMES M., Industrial and Management Engineering (1977). Seton Hall University, B.A., 1969; J.S., 1975.

NIEVAS, LUIS E., Division of Technology (1976). Newark College of Engineering, B.S.M.E., 1974.

NOBLE, ROY E., Division of Technology (1967). Newark Technical School, A.E. Mechanical, 1943.*

NOVEMSKY, LISA, Organizational and Social Sciences (1982). Rutgers University, B.A., 1965; Fairleigh Dickinson University, M.A., 1979.

NUNAN, GERALD A., Division of Technology (1975). Newark College of Engineering, B.S.E.E., 1970; New Jersey Institute of Technology, M.S.E.E., 1975; Seton Hall Law School, J.D., 1983.

OREHEK, PAUL E., Division of Technology (1983). Newark College of Engineering, B.S.E.E., 1966; M.S., 1971.

OSTUNI, LAWRENCE J., Industrial and Management Engineering (1975). Polytechnic Institute of Brooklyn, B.Ch.E., 1957; M.S.I.E., 1969.

PARIS, JEROME M., Humanities (1982). Reed College, B.A., 1964; Johns Hopkins University, M.A., 1965; Cornell University, Ph.D., 1972; Teachers College, Columbia University, M.A., 1979.

PASCHEDAG, ALLAN E., Mechanical Engineering (1977). New Jersey Institute of Technology, B.S., 1975; M.S., 1978.

PELLER, ROSALYN, Chemistry (1979). Boston University, A.B., 1958; University of Pittsburgh, M.S., 1961.

PELLEY, WILLIAM P., Division of Technology (1966). Rutgers University, B.S.E.E., 1960.*

PENROD, JULIAN G., Computer and Information Science (1983). Seton Hall University, B.S., 1977; M.S. 1979.

PERCIVAL, WILLIAM R., Industrial and Management Engineering (1976).*

PHIFFER, CYNTHIA, Architecture (1983). Princeton University, B.A., 1975; M.Arch., 1979.

PILLARI, JOSEPH C., Electrical Engineering (1980). Fairleigh Dickinson University, B.S., 1970; M.S., 1975.

PRAN, PETER C., Architecture (1983). Oslo University, B.Arch., 1961; Illinois Institute of Technology, M.Arch., 1969.+

PRESSMAN, WALTER, Mathematics (1981). New York University, M.S., 1953; Ph.D. 1960.

RASTOGI, ANIL, Chemical Engineering. University of Roarkee, B.S., 1973; New Jersey Institute of Technology, M.S., 1977; D.Eng.Sci., 1981

REISZ, PETER, Industrial and Management Engineering (1975). Northeastern University, B.S.E.E., 1960; Fairleigh Dickinson University, M.B.A., 1972.*

RITTER, ARTHUR B., Chemical Engineering (1981). City University of New York, B.Ch.E., 1961; University of Rochester, M.S.Ch.E., 1968; Ph.D., 1970.

ROSSI, ANTHONY J., Mechanical Engineering (1979). New Jersey Institute of Technology, B.S.M.E., 1977.

SALOMON, ALFRED I., Chemistry (1983). Newark College of Engineering, B.S., Chem.E., 1960; Fairleigh Dickinson University, M.B.A., 1966.

SALTZMAN, HERBERT W., Division of Technology (1980). New York University, B.M.E., 1951.

SAMELY, JACK A., Computer and Information Science. Milwaukee School of Engineering, B.S., 1964; Stevens Institute of Technology, M.S., 1974.

SAPP, ROBERT H., Organizational and Social Sciences (1983). Duke University, B.A., 1966; Rutgers University, M.B.A., 1971; Duke University, Ph.D., 1980.

SCHAFER, JOSEPH L., Division of Technology (1971). Cornell University, B.A., 1949.

SCHMEIDLER, JAMES, Mathematics (1983). Yale University, B.A., 1961; Columbia University, Ph.D., 1976.

SELLITTO, BENJAMIN F. JR., Organizational and Social Sciences (1976). Newark College of Engineering, B.S., 1974.

SEREICO, PETER, Civil and Environmental Engineering (1973). Newark College of Engineering, B.S.C.E., 1961; M.S.C.E., 1971.

SHEIH, MUNG SHIUM, Civil and Environmental Engineering (1976). Taiwan Cheng-Kung University, B.A., 1969; University of Rhode Island, M.S., 1974; New Jersey Institute of Technology, D.Sc., 1979.

SHER, RICHARD B., Humanities (1975). George Washington University, B.A., 1970; University of Chicago, M.A., 1971; Ph.D., 1979.

SIBILIA, ROBERT J., Division of Technology (1954). Newark College of Engineering, B.S.Ch.E., 1951; M.S.Ch.E., 1953.

SIGAL, GEORGE B., Civil and Environmental Engineering (1983). Cordoba University (Argentina), C.E., 1952; Newark College of Engineering, M.C.E., 1960; Carnegie-Mellon University, M.E., 1971.

SIMON, MATTHEW, Computer and Information Science (1982). City College of New York, M.S., 1968; Polytechnic Institute of New York, M.S.C.S., 1978.

SINNOTT, JOHN P., Industrial and Management Engineering (1974). United States Naval Academy, B.S., 1953; United States Air Force Institute of Technology, M.S., 1956; Chase College School of Law, J.D., 1960.

SMITH, RICHARD J., Computer and Information Science (1980). Fairfield University, B.S., 1962; University of Pennsylvania, M.S.E., 1973.

SMITH, ROBERT C., Organizational and Social Sciences (1982). Maine Maritime Academy, B.S., 1974; Pace University, M.S., 1981.

SOMMA, DOMINICK L., Civil and Environmental Engineering (1972). Newark College of Engineering, B.A., 1943; Polytechnic Institute of Brooklyn, M.S., 1949.

SONG, LEILA, Chemistry (1979). National Taiwan University, B.S.Ch.E., 1970; State University of New York at Plattsburgh, M.A., 1973.

SPARTA, WILLIAM, Industrial and Management Engineering (1977). Newark College of Engineering, B.S.I.E., 1971; M.S., 1975.*

STARITA, ROBERT, Industrial and Management Engineering (1982). Newark College of Engineering, B.S.I.E., 1975; Fairleigh Dickinson University, M.B.A., 1982.

STAVISKY, VICTOR, Division of Technology (1975). Newark College of Engineering, B.S.E.E., 1965.

STEINBERG, HARVEY, Organizational and Social Sciences (1982). City University of New York, B.A., 1954; Brooklyn Law School, J.D., 1958.

STEWART, ALAN J., Mathematics (1981). Northeastern University, B.S.M.E., 1952; Adelphi University, M.S., 1961; Ph.D., 1971.

STRAUS, WILLIAM G., Division of Technology (1981). Susquehanna University, A.B., 1965; Fairleigh Dickinson University, M.A., 1966.

STRAUSS, WILLIAM, Architecture (1974). Purdue University, B.S.C.E., 1962; University of Illinois, B. Arch., 1965; University of Pennsylvania, M. Arch., 1969.+

STRENKOWSKI, JOHN G., Electrical Engineering (1981). Newark College of Engineering, B.S.E.E., 1960; Rutgers University, M.S.E.E., 1974.

STULTZ, ALAN J., Computer and Information Science (1981). New Jersey Institute of Technology, B.S.C.S., 1975; M.S.C.S., 1980.

SVARRER, ROBERT W., Electrical Engineering (1982), and Chair of the Division of Technology-HCCC. Newark College of Engineering, B.S., 1967; Marine Corps Command and Staff College, Grad. Cert., 1975.

SWEADOR, JOSEPH, Computer and Information Science (1982). New Jersey Institute of Technology, B.S., 1979; M.S., Computer Science, 1981.

THOMPSON, JOSEPH F., Organizational and Social Sciences (1979). Loyola University, B.A., 1971; Middlebury College, M.A., 1972.

TOMASKOVIC, WILLIAM, Computer and Information Science (1979). New Jersey Institute of Technology, M.S., Computer Science.

TRAVISANO, FRED, Architecture (1981). Cooper Union, B.Arch., 1967.+

TSAI, CHARLES M., Chemical Engineering (1981). National Taiwan University, B.S.Ch.E., 1968; University of Mississippi, M.S.Ch.E., 1972; New Jersey Institute of Technology, D.Eng.Sc., 1982.*

TUTTLE, MARION R., Industrial and Management Engineering (1972). Ladycliff College, B.A., 1960; St. John's University, J.D., 1964.

VALLEY, JOSEPH E., Electrical Engineering (1982). The City College of New York, B.E.E., 1962; M.E.E., 1965; Fairleigh Dickinson University, M.B.A., 1974.*

VINCI, GREGORY, Chemical Engineering (1981). Cooper Union, B.ChE., 1942; Stevens Institute of Technology, M.S.ChE., 1950.

VIVIANI, ALBERT S., Industrial and Management Engineering (1976); Computer and Information Science. Rutgers University, B.A., 1968; Stevens Institute of Technology, M.S., 1971; Newark College of Engineering, M.S.I.E., 1975.

VOGT, WILLIAM JR., Electrical Engineering (1968). Newark College of Engineering, B.S.E.E., 1968; Stevens Institute of Technology, M.S.C.E., 1977; Florida Institute of Technology, M.S.E.M., 1985.

WALDMAN, AARON N., Division of Technology (1951). Cornell University, B.S.M.E., 1944; University of Illinois, M.S.M.E., 1948.*

WALSH, DANIEL S., Industrial and Management Engineering (1974). Newark College of Engineering, B.S.M.E., 1963; Fairleigh Dickinson University, M.B.A., 1969; New Jersey Institute of Technology, M.S. Mgt. E., 1974.*

WANG, RUEY H., Chemical Engineering (1982). Ordinance Engineering College (China), B.S. 1947; Oregon State University, M.S., 1957; University of Texas at Austin, Ph.D., 1963.

WARREN, STEVEN J., Organizational and Social Sciences (1983). City College of New York, B.B.A., 1950; M.B.A., 1952.

WEISS, JULIAN, Architecture (1982). Pennsylvania State University, B.Arch., 1963; Columbia University, M.Arch., M.U.D., 1980.+

WEISSMAN, WILLIAM K., Electrical Engineering (1972). Dartmouth College, A.B., 1950; Jefferson Medical College, M.D., 1956.

WERDER, WALTER, Industrial and Management Engineering (1976). Rutgers University, B.S.C.E., 1949; Stevens Institute of Technology, M.S., 1953.

WHITE, DENNIS T., Division of Technology (1979). Newark College of Engineering, Cert. Arch. Tech., 1967; Pratt Institute, A.A.S. Buildg. and Const., 1972; Yale University, B.Arch., 1975.+

WOHLGEMUTH S. SOLOMON, Computer and Information Science (1981). Yeshiva College, B.A., 1962; Yeshiva University, M.A., 1965.

YOUNG, ROGER A., Computer and Information Science (1981). Case Institute of Technology, B.S., 1970; New Jersey Institute of Technology, M.S., Computer Science, 1980.

YOUNGSTER, HENRY C., Division of Technology (1983). Fairleigh Dickinson University, B.S.E.E., 1968.

ZOLDOS, JOHN, Architecture (1976). Rutgers University, B.C.E., 1948.*

Emeritus Faculty

ANDERSON, ROBERT E., Professor of Electrical Engineering (1949). Newark College of Engineering, B.S., 1939, University of New Hampshire, M.S., 1948.*

BERTSCH, CARL V., Professor of Physics (1946). University of Michigan, B.S., 1928; M.S., 1931; Ph.D., 1937.

BISHOP, JOHN A., Professor of Chemistry (1947). Haverford College, B.S., 1929; New York University, M.S., 1931.

BRANIN, M. LELYN, Professor of Chemistry, and Chair of the Department (1946). Purdue University, B.S., 1923; Columbia University, A.M., 1930; University of Michigan, M.S., 1933; Ph.D., 1934.

CAMBRELENG, PAUL L., Professor of Personnel Relations (1937). Dana College, B.A., 1935; Columbia University, M.A., 1946.

CARLSON, CARL W., Professor of Chemistry (1947). Northland College, B.A., 1929; University of Chicago, M.S., 1936; Michigan State University, Ph.D., 1946.

CRATER, WARREN H., Professor of English and Philosophy (1946). Lafayette College, A.B., 1942; Columbia University, M.A., 1946; Drew University, B.D., 1959.

DiMATTEO, JOHN E., Associate Professor of Mechanical Engineering (1966). Cooper Union, B.S., 1931; Stevens Institute of Technology, M.S., 1950.*

DUURSEMA, CHARLES H., Associate Professor of Physics (1946). Newark College of Engineering, B.S., 1933; Montclair State College, M.S., 1936.

ESTRIN, HERMAN A., Professor of English (1946). Drew University, A.B., 1937; Columbia University, M.A., 1942; Ed.D., 1954.

GOLDSTEIN, IRVING R., Professor of Management Engineering (1947). Newark College of Engineering, B.S., 1939; Stevens Institute of Technology, M.S., 1947.*

GRANIK, GERALD, Professor of Applied Mathematics (1952). Newark College of Engineering, B.S., 1950; M.S., 1954; Stevens Institute of Technology, M.S., 1958; Sc.D., 1965.*

HAZELL, WILLIAM JR., President of Newark College of Engineering (1933). Newark College of Engineering, B.S.E.E., 1930; M.Eng.Ed., 1960; Jersey City State College, Dr. of Letters, 1963.

HOFFMAN, PAUL O., Distinguished Professor of Physics, and Chair of the Department (1933). Newark College of Engineering, B.S., 1933; Columbia University, A.M., 1938; New York University, Ph.D., 1950.

JAFFE, WILLIAM J., Distinguished Professor of Industrial Engineering (1946). New York University, B.S., 1930; Columbia University, M.A., 1931; M.S., 1941; New York University, Engr.Sc.D., 1953.*

JOFFE, JOSEPH, Distinguished Professor of Chemical Engineering, and Chair of the Department (1932). Columbia University, A.B., 1929; B.S., 1930; M.A., 1931; Ph.D., 1933.*

JORDAN, WILLIAM, III, Professor of Electrical Engineering (1929). University of Pennsylvania, B.S., 1927; Stevens Institute of Technology, M.S., 1942.*

KARSTEN, HENRY, Assistant Professor of Engineering Drawing (1956). New York University, B.S., 1929; M.A., 1933.

KEABLES, NELSON C., Associate Professor of English (1945). Middlebury College, A.B., 1938; New York State College, M.A., 1939.

KEEFFE, GEORGE C., Professor of Chemical Engineering, and Associate Chair of the Department (1936). Newark College of Engineering, B.S., 1932; Ch.E., 1935; New York University, M.S., 1936.*

KIEHL, ROBERT E., Professor of Personnel Relations, and Chair of the Department (1946). Columbia University, B.A., 1932; Teachers College, M.A., 1947; Rutgers University, Ed.D., 1957.

KONOVE, CARL, Professor of Mathematics (1937), and Associate Chair of the Department. Newark College of Engineering, B.S.Ch.E., 1937; Montclair State College, M.A., 1941.

KOREN, CHARLES J., Professor of Mathematics (1956). New York City College, B.S., 1930; Columbia University, M.A., 1931; Ed.D., 1933.

KREPS, SAUL I., Professor of Chemical Engineering (1949). City College of New York, B.S., 1937; University of Illinois, M.S., 1938; University of Pennsylvania, Ph.D., 1941; Polytechnic Institute of Brooklyn, B.Ch.E., 1948.

LaLONDE, WILLIAM S. JR., Distinguished Professor of Civil Engineering, and Chair of the Department (1929). Massachusetts Institute of Technology, B.S., 1923; University of Michigan, M.S., 1938.*

LEHMAN, FREDERICK G., Distinguished Professor of Civil Engineering (1947). City University of New York, B.C.E., 1938; Massachusetts Institute of Technology, S.M., 1939; Sc.D., 1960.*

MAINARDI, POMPEY, Professor of Mathematics, and Associate Chair of the Department (1935). Newark College of Engineering, B.S., 1933; Montclair State College, M.A., 1943.*

MANGASARIAN, RICHARD D., Professor of Civil Engineering (1946). City College of New York, B.S.E., 1935; M.C.E., 1937.*

MANGNALL, DAVID H., Registrar (1946). Newark College of Engineering, B.S.M.E., 1942; Stevens Institute of Technology, M.S., 1949.*

MANTELL, CHARLES L., Professor of Chemical Engineering, and Chair of the Department (1948). New York City College, B.A., 1918; Columbia University, M.A., 1924; Ph.D., 1928.

McMILLAN, ROBERT, Associate Professor of Electrical Engineering (1964). Louisiana State University, B.S., 1942; California Institute of Technology, M.S., 1950; Newark College of Engineering, Ph.D., 1970.*

MONACK, ALBERT J., Professor of Applied Mechanics (1954). West Virginia University, B.A., 1927; University of Illinois, M.S., 1929; New York University, Ph.D., 1962.*

NOYES, LEONARD, Assistant Professor of Organizational and Social Sciences (1948). Cornell University, M.E., 1931; Columbia University, M.S., 1953.

POLANER, JEROME L., Professor of Mechanical Engineering (1938). Newark College of Engineering, B.S., 1938; Stevens Institute of Technology, M.S., 1951.*

RAM, GERSON L., Professor of Chemistry (1947). Upsala College, B.A., 1941; Rutgers University, M.S., 1947; Johns Hopkins University, Sc.D., 1953. Licensed Health Officer, State of New Jersey.

RAMBERG, EIVIND G. F., Distinguished Professor of Civil Engineering, and Acting Vice President for Business Affairs (1942). Polytechnic Institute of Brooklyn, B.C.E., 1937; M.C.E., 1941.*

REFF, ISRAEL, Professor of Physics (1954). Cooper Union, B.S.Ch.E., 1938; Indiana University, A.M., 1951; Ph.D., 1953.

RICH, JOSEPH A. JR., Professor of Management Engineering (1941). Rutgers University, B.S., 1941; M.S., 1948; D. Jur., 1952. Licensed Attorney, New Jersey Bar and Federal Bar.

RUSSELL, FREDERICK Arthur, Distinguished Professor of Electrical Engineering, and Special Assistant to the President for Institutional Research (1937). Newark College of Engineering, B.S., 1937; Stevens Institute of Technology, M.S., 1941; Columbia University, D.Engr.Sc., 1953.*

SAGURTON, JAMES, Professor of Physics (1948). Seton Hall University, B.S., 1942; Columbia University, M.S., 1945; Institute of St. Thomas, Ph.D., 1958.

SALAMON, ROBERT G., Professor of Engineering Graphics (1947). Newark College of Engineering, B.S., 1945; Stevens Institute of Technology, M.S., 1948.*

SALAMONE, JEROME J., Professor of Chemical Engineering (1948). City College of New York, B.Ch.E., 1942; New York University, M.Ch.E., 1947; Engr.Sc.D., 1954.*

SCHNEIDER, THEODORE A., Associate Professor of Mechanical Engineering (1942). Newark College of Engineering, B.S., 1941; Stevens Institute of Technology, M.S., 1956.*

SHUKUR, ARTHUR, Associate Professor of Physics (1958), and Acting Dean of Student Services. Newark College of Engineering, B.S., 1958; M.S., 1959.

SMITH, H. HUNTER, Professor of Physics (1956). Davidson College, B.S., 1926; North Carolina State College, M.S., 1930.

SMITHBERG, EUGENE H., Professor of Mechanical Engineering, and Dean of the Graduate Division (1950). College of the City of New York, B.M.E., 1943; Polytechnic Institute of Brooklyn, M.M.E., 1949; New York University, D.Eng.Sc., 1961.

STEPHANS, CLARENCE H., Professor in Industrial Relations, Director of Relations with Industry, Director of Continuing Education Engineering Studies (1932). Newark College of Engineering, B.S., 1932.*

THOM, GEORGE B., Professor of Mechanical Engineering, and Chair of the Department (1949). Lehigh University, M.E., 1920; M.S., 1932; M.A., 1935.*

VAN HOUTEN, ROBERT W., President of Newark College of Engineering (1930). Newark College of Engineering, B.S., 1930; C.E., 1932; Rider College, D.Sc., 1955; Stevens Institute of Technology, D.Eng., 1955; Clarkson College of Technology, Sc.D., 1956; Newark State College, Litt. D., 1961; Seton Hall University, LL.D., 1966; Newark College of Engineering, D.Eng., 1970.*

WACKER, ROBERT L., Associate Professor of English (1954). Northwestern University, B.A., 1947; Columbia University, M.A., 1948.

WELLER, MONROE R., Associate Professor of Physics (1946). Upsala College, B.A., 1935; Montclair State College, M.A., 1937.

WENISH, WERNER J., Associate Professor of Chemistry (1963). Massachusetts Institute of Technology, B.S., 1943; New York University, M.S., 1949; Ph.D., 1955.

WITTES, LEO, Assistant Professor of Applied Mechanics (1953). Rutgers University, B.S., 1928; University of Maryland, M.S., 1931.

WORKMAN, SAMUEL, Distinguished Professor of English, and Chair of the Department of Humanities (1961). Kenyon College, B.A., 1926; Ohio State University, M.A., 1927; Princeton University, Ph.D., 1935.

Travel Directions to NJIT

New Jersey Institute of Technology may be reached via the GARDEN STATE PARKWAY and the NEW JERSEY TURNPIKE from north and south, and from INTERSTATE ROUTE 280 east and west.

From the GARDEN STATE PARKWAY: Take Exit 145 to Route 280. Then follow Route 280 directions EASTBOUND below.

From the NEW JERSEY TURNPIKE: Take Exit 15W to Route 280 West. Then follow Route 280 directions WESTBOUND below.

From ROUTE 280, EASTBOUND: Follow signs marked "High Street—Harrison," staying in right lane. Take High Street Exit 14-A and turn right at traffic light. Proceed through 3 traffic lights. Campus is one block on right.

From ROUTE 280, WESTBOUND: Proceed to State Street Exit Newark. Take exit and turn left at foot of ramp. Go one short block to stop sign. Turn left on High Street (now Dr. Martin Luther King, Jr. Boulevard) and proceed through 4 traffic lights. Campus is one block on right.

From ROUTES 1, 9 OR 22: Northbound traffic departs at exit marked "Newark" which leads to McCarter Highway (Route 21) through Newark. At major business district, turn left onto Raymond Boulevard. NJIT campus lies several blocks west of the business district, at the end of the boulevard.

VISITOR PARKING at the NJIT campus is controlled from a security station on Bleeker Street. Visitor parking must be reserved in advance through your host. Other parking is available on campus during weekend activities and special scholarly or public events.

Other Connections to the Newark Area

From NEW YORK THRUWAY: New York Thruway Exit 14A connects directly to the Garden State Parkway. Then follow the Parkway directions above.

From GEORGE WASHINGTON BRIDGE: Follow New Jersey Turnpike south to Exit 15W onto Route 280 West. Then follow Route 280 directions WESTBOUND above.

From LINCOLN TUNNEL: Proceed westbound on Route 3 to New Jersey Turnpike. Follow Turnpike south to Exit 15W onto Route 280 West. Then follow Route 280 directions WESTBOUND above.

From HOLLAND TUNNEL: Follow signs to New Jersey Turnpike, and take Turnpike NORTH to Exit 15W onto Route 280 West. Then follow Route 280 directions WESTBOUND above.

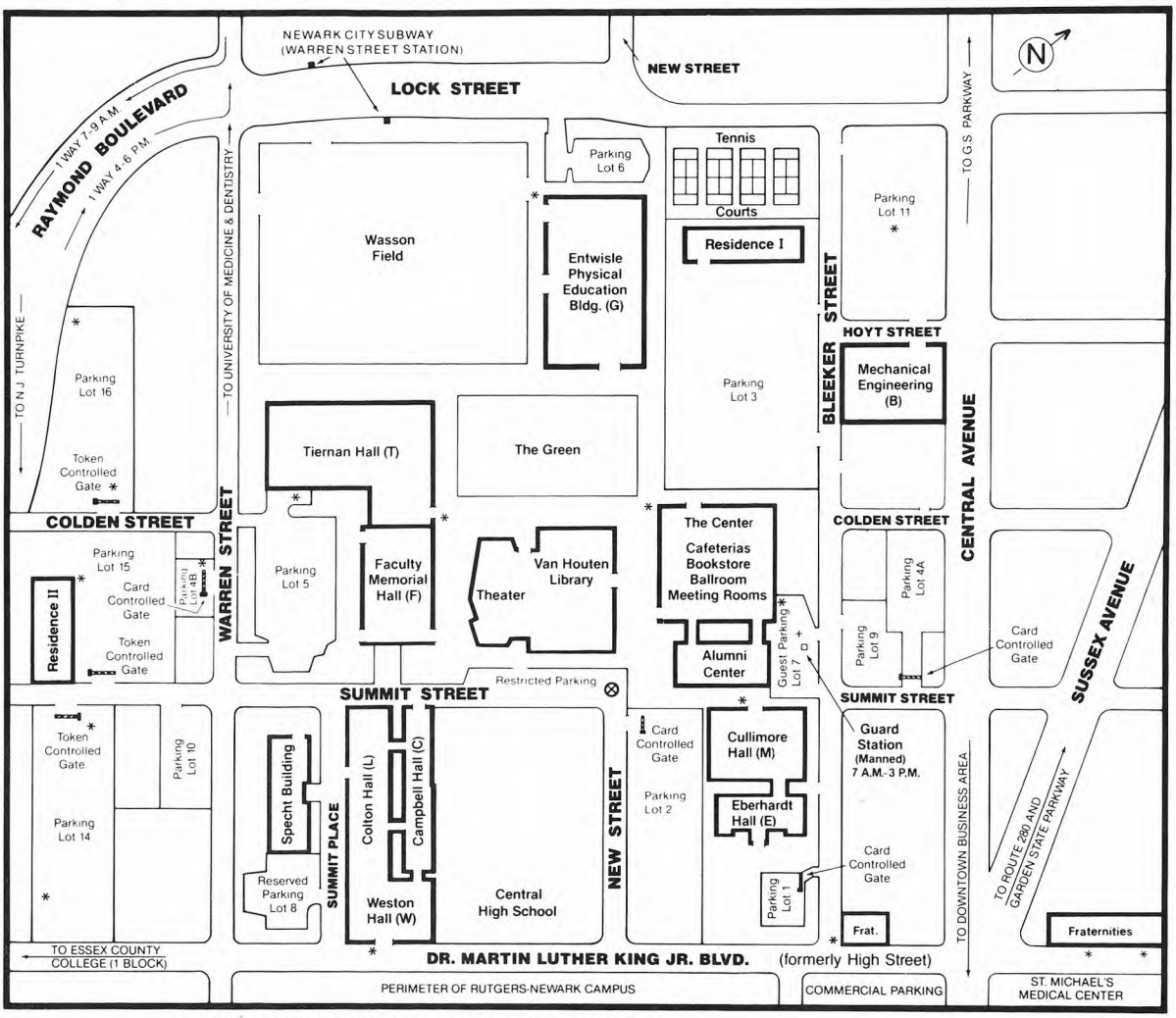
Other Transportation Systems

From NEWARK INTERNATIONAL AIRPORT: An inexpensive minibus (Newark Airlink) connects the airport with Newark's Pennsylvania Railroad Station. Bus, subway and taxi connections may be obtained at the Station.

From ERIE-LACKAWANNA STATION: Taxi service only.

From NEWARK PENNSYLVANIA STATION: Connections to the NJIT campus may be made by taxi, city subway and bus service from the Station. Visitors should seek assistance for departure points and bus numbers from Station representatives.

Map of the NJIT Campus



* INDICATES LOCATION OF NJIT SECURITY TELEPHONES.
\+ GUEST PARKING MUST BE RESERVED IN ADVANCE THROUGH YOUR HOST.
⊗ NJIT-RUTGERS SHUTTLE BUS STOP (SEE CURRENT SCHEDULE FOR TRANSPORTATION DETAILS).

Campus Directory

Administrative Offices
Eberhardt Hall
Cullimore Hall
Admissions Office
Room 16E (Undergraduate)
Room 610 (Graduate)
Aerospace Studies
Room 210F
Alumni Association
150 Bleeker Street
Architecture School
Room 440, Campbell Hall
Bookstore—The Center
Lower Level
Cafeteria—The Center
Ground Level
Campbell Hall (C)
110 Summit Street
The Center
150 Bleeker Street
Chemical Engineering
Room 151T
161 Warren Street
Chemistry
Room 151T
161 Warren Street
Civil Engineering
Room 214C
Colton Hall (L)
17 Summit Street
Computing Center
Room 218L
Cooperative Education
Room 612M
Counseling Center
Room 37E
Cullimore Hall (M)
70 Summit Street
Dean of Engineering
Room 210M
Dean of Students
Room 35E
Division of Continuing Education
Room 612M
Division of Technology
Room 210M
Eberhardt Hall (E)
323 High Street
Electrical Engineering
Room 150T
Entwisle Gymnasium(G)
Faculty Memorial Hall (F)
111 Summit Street
Financial Office
Room 206M
Foundation at NJIT
215 Central Avenue
Graduate Division
Room 610M
Health, Physical Education and Athletics
80 Lock Street
Humanities
Room 314M
Industrial and Management Engineering
Room 502W
Organizational and Social Sciences
Room 402M
Information Switchboard
Room 112M—Dial "0"
Library (H)
99 Summit Street
Mailroom
Room 110M
Mathematics
Room 305M
Mechanical Engineering
Room 403W
Personnel Office
Room 211M
Physical Plant Office
120 Summit Street
Physics
Room 463T
Placement Office
Room 212M
President's Office
Room 28E
Public Affairs
Room 215M
Registrar's Office
Room 11E
Security Office
120 Summit Street
Seminar Rooms
The Center—150 Bleeker Street
Specht Building
120 Summit Street
Special Services
Room 114M
The Theater
99 Summit Street
Tiernan Hall (T)
Weston Hall (W)
367 Dr. Martin Luther King, Jr. Boulevard (High Street)

Academic Calendar 1985-1987

Most offices of the Institute are open between the hours of 8:30 a.m. and 4:30 p.m., Monday through Friday during the Academic Year. For the convenience of students, many offices, including the Registrar's Office, the Finance Office, and the Graduate Division maintain evening hours. These hours vary and students should contact an office before visiting. During the summer, most offices are open between 9 a.m. and 4 p.m. Students should contact the office concerned before visiting outside these times.

Spring Semester 1985

First day of classes	Monday, January 21
George Washington's Birthday	Monday, February 18
Spring Recess	Monday, March 18 through Saturday, March 23
Good Friday	Friday, April 5
Last day of classes	Saturday, May 11
Final exam period	Monday, May 13 through Saturday, May 18

Fall Semester 1985

First day of classes	Tuesday, September 3
Thanksgiving Recess	Thursday, November 28 through Saturday, November 30
Last day of classes	Saturday, December 14
Final exam period	Monday, December 16 through Saturday, December 21

Spring Semester 1986

First day of classes	Monday, January 20, 1986
George Washington's Birthday	Monday, February 17
Spring Recess	Monday, March 17 through Saturday, March 22
Good Friday	Friday, March 28
Last day of classes	Saturday, May 10
Final exam period	Monday, May 12 through Saturday, May 17

Fall Semester 1986

First day of classes	Tuesday, September 2
Thanksgiving Recess	Thursday, November 27 through Sunday, November 30
Final exam period	Thursday, December 11 through Friday, Decmeber 19

Spring Semester 1987

First day of classes	Monday, January 19
George Washington's Birthday	Monday, February 16
Spring Recess	Sunday, March 15 through Sunday, March 22
Good Friday	Friday, April 17
Last day of classes	Friday, May 1
Final exam period	Monday, May 4 through Tuesday, May 12

The Institute reserves the right to make changes to this calendar.

Directory for Correspondence

Mailing Address: New Jersey Institute of Technology, Newark, New Jersey 07102.

Telephone: (201) 596-3000 (Main Switchboard).

Admissions:

(Undergraduate)

For undergraduate admissions, including requests for publications and information on advanced standing, tuition, and fees, contact the director of admissions. Telephone: (201) 596-3300

(Graduate)

For admissions information and requests for publications, contact the director of graduate studies. Telephone: (201) 596-3460

Alumni Activities:

Contact the alumni director. Telephone: (201) 596-3441

Business Matters:

Contact the business office. Telephone: (201) 596-3150/3155

Cooperative Education:

Contact the director. Telephone: (201) 596-3227

Counseling:

Contact the Counseling Center. Telephone: (201) 596-3414

Division of Continuing Education:

Contact the director. Telephone: (201) 596-3060

Division of Technology:

For information concerning certificate programs, contact the assistant director. Telephone: (201) 596-3222

Financial Aid and Scholarships:

Contact the director of financial aid. Telephone: (201) 596-3479

Foundation at New Jersey Institute of Technology:

Contact the vice-president for development. Telephone: (201) 596-3456

Graduate Studies:

Contact the director of graduate studies. Telephone: (201) 596-3460

Placement of seniors and alumni:

Contact the director of placement. Telephone: (201) 596-3643

Plant, Equipment, and Utilities:

Contact the director of physical plant. Telephone: (201) 596-3122

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New Jersey Institute of Technology

Undergraduate Catalog Supplement 1985-1987

This supplement is to be used in conjunction with the 1985–1987 Undergraduate Catalog. It consists of substantive additions and revisions to academic programs and requirements and to courses of instruction.

Academic Programs and Courses of Instruction

■ pages 18–33

The following changes affect all programs except Engineering Technology:

Freshman Seminar — Freshman Seminar replaces Orientation. It is required of all first-time, full-time, day freshman students.

Humanities — Hum 112 and Hum 115 (formerly Man and Culture I) have been changed to Culture and History I.

Hum 231 and Hum 235 (formerly Man and Culture II) have been changed to Culture and History II.

Physical Education — Physical Education is required for all full-time students enrolled in undergraduate degree programs, with the exception of those majoring in Engineering Technology. Other exceptions may be considered by the Director of Physical Education and Athletics.

Lecture and recitation hours, laboratory hours, and credits for all courses should read 1-0-1.

Chemistry — Students in Applied Chemistry and all Engineering programs should refer to chemistry courses listed in this supplement for revised recitation hours, laboratory hours and credits.

Architecture

■ page 18

Revision: Course designation

Professional Program

SECOND YEAR
1st semester
Chem 231 should read:
Hum 231 Culture and History II

Chemistry

■ page 40

Courses

Revision: rec hrs-lab hrs-credits

Chem 111
Fundamentals of Chemistry and Materials I 3½-1½-4

Chem 112
Fundamentals of Chemistry and Materials II 3½-1½-4

Chem 113
Fundamentals of Chemistry and Materials III 3½-1½-4

Chem 115
Chemistry and Materials I 3½-2-4½

Chem 116
Chemistry and Materials II 3½-2-4½

Chem 117
Honors Chemistry and Materials I 3½-2-4½

Chem 118
Honors Chemistry and Materials II 3½-2-4½

Revision: Course descriptions

Chem 335
Physical Chemistry II 4-3-5
Prerequisite: Chem 232. The lecture presents a continuation of Chem 232. The topics include homogeneous and heterogeneous chemical equilibria, ionic equilibria, electrochemistry, kinetic theory of gases, transport phenomena, kinetics, and irreversible processes. The laboratory consists of experiments in which the students apply and extend the basic knowledge of physical chemistry acquired in the lecture and are introduced to the various physical chemical instrumentation methods.

Chem 412
Inorganic Reactions and Processes 2-3-3
Prerequisite: Chem 232. A lecture-recitation-laboratory course in practical inorganic chemistry. The chemistry of most of the elements and their compounds are covered. Preparation in the laboratory will be followed by purification and characterization.

Additions

Chem 440
Fundamentals of Polymers 3-0-3
Prerequisites: Organic and physical chemistry. An introduction to the important fundamental aspects of polymers including preparation, structure, physical states and transitions, molecular weight distributions, viscous flow, mechanical properties of small deformations and ultimate properties.

Chem 443
Introductory Polymer Laboratory 1-4-3
Prerequisite: Chem 440. A course in practical methods useful in the preparation and characterization of macromolecules, including addition and condensation polymerization. Various methods useful in characterizing polymers will be studied, such as solution and bulk viscosity, light scattering, osmometry, D.T.A., T.G.A., X-ray diffraction, and various chromatographic and spectroscopic techniques.

Chem 449
Preparation and Analysis of Organic Compounds 1-4-3
Prerequisite: Chem 344. This course deals with the application of laboratory techniques learned in Chem 344 laboratory to the synthesis and characterization of organic compounds.

Chem 471
Chemical Aspects of Industrial Health 2-3-3
Prerequisite: Chem 116 or equivalent. This course is concerned with occupational health and safety as applied to hazardous modern technology, industrial hygiene, and maximal threshold limits of work exposure. Occupational poisons, their threshold limits, and effects on body systems will be considered also. Sampling and analysis of hazardous materials will be studied in the laboratory.

Chem 472
Chemical Technology of Food and Nutrition 3-0-3
Prerequisites: Physical chemistry and organic chemistry. This course deals with the biochemistry of nutrients, food composition, processing and preservation, safety and sanitary factors in manufacturing and packaging, and food laws and regulations.

Chem 483
Bio-Organic Chemistry 3-0-3
Prerequisite: Chem 116 or equivalent. This course is for non-chemical engineering students interested in environmental or biological engineering. The fundamentals of organic chemistry and biochemistry are studied and applied to living systems.This course is not open to students who have taken or are taking Chem 343.

Chem 484
Modern Analytical Chemistry 1-4-3
Prerequisite: Chem 116 or equivalent. This course teaches the basic principles and techniques of analytical determinations while emphasizing the application of the quantitative approach to the solution of environmental problems. The course includes the fundamental principles and techniques of analytical chemistry together with an introduction to separation techniques and instrumental analysis. These techniques are applied to the determination of environmental criteria.

Chem 486
Introductory Physical Chemistry 3-0-3
Prerequisites: Chem 116 or equivalent, Math 112, Phys 121. This course is for non-chemical engineering students interested in the environmental sciences. The topics covered include an introduction to thermodynamics and thermochemistry, properties of gases, liquids, and solutions, chemical and ionic equilibria, electrochemistry, and kinetics of chemical reactions.

Chem 491
Research and Independent Study 0-6-3
Prerequisite: Senior standing. This course is intended for chemistry students who wish to integrate their knowledge and current work into a meaningful and productive effort, which may be in the form of a laboratory or library project or a theoretical study under the guidance of a member of the department.

Chem 492
Research and Independent Study 0-6-3
Prerequisite: Chem 491. A continuation of Chem 491.

Chem 502
Advanced Organic Chemistry I 3-0-3
Prerequisite: Undergraduate organic chemistry and physical chemistry. Organic molecules are treated from a structural, rather than a mechanistic viewpoint. Topics covered include atomic and molecular structure, stereochemistry, reactive intermediate (cations, anions, radicals and carbenes), and spectroscopy.

Chem 571
Biochemistry 3-0-3
Prerequisites: Undergraduate organic and physical chemistry, or permission of the instructor. An introductory course in biochemistry which includes fundamentals from the viewpoint of physical and organic chemistry and the industrial applications of the field. It is directed particularly to those students who have an interest in biophysics and bioengineering.

Civil and Environmental Engineering

■ page 21

Civil Engineering Day Program

Revisions

SECOND YEAR
CE 210 Constr Matls & Procedures* is paired with CE 200 Surveying

THIRD YEAR
Elective (Lit/Hist/Phil)*** is paired with Basic SS Requirement

THIRD AND FOURTH YEARS

TECHNICAL ELECTIVE:
Out of 9 credits, a minimum of 3 credits of design are required in this sequence.

Evening Program (even and odd year start)

Revision: Mathematics course requirements

Math 111 Calculus I 4-0-4 *replaces* Math 109 Introductory Math IE

Math 112 Calculus II 4-0-4 *replaces* Math 110 Calculus IE

Math 221 Calculus III 4-0-4 *replaces* Math 219 Calculus IIE

Math 223 Elementary Differential Equations and Statistics 4-0-4 *replaces* Math 220 Calculus IIIE

Deletion

THIRD YEAR
Math 329 Calculus IVE and Math 330 Differential Equations E

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Courses

Revision: Course description

CE 301*
Advanced Surveying 3-0-3
Prerequisite: CE 200. Plane table; barometric and precise leveling; azimuth from sun and polaris observations.

Course title

CE 341
Soil Mechanics 3-3-4

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MECHANICS
Change in credits
Mech 232
Mechanics of Materials 3-1-3

Computer and Information Science

■ page 29

B.S. in Computer Science

Revision: Course number

FIRST YEAR
CIS 101 Computer Programming and Problem Solving 2-1-2

SECOND YEAR
Revision: Course title

CIS 331 Machine and Assembly Language Programming 2-2-3

Revision: rec hrs-lab hrs-credits

All Electives 3-0-3
Math 333 Probability and Statistics 3-0-3

B.A. in Computer Science

Revision

Footnote: Interdisciplinary Studies
A list of approved course sequences in a variety of disciplines offered at NJIT or NCAS-Rutgers is available from the advisor.

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Courses

Revision: Course description

CIS 102
Honors Computer Programming and Problem Solving 2-1-2
Admission to the course is by invitation. This course covers the same material as CIS 101 at an accelerated rate. The time thus gained (at least one half of the semester) is devoted to other programming languages such as PASCAL, SNOBOL and LISP, as well as in-depth study of some applications, such as information storage and retrieval, sorting techniques, cryptography, numerical algorithms and simulation.

Change in second sentence

CIS 202
Computer Programming and Business Problems 3-1-3
Problems used in this course will reflect business and managerial decision-making applications.

Removal of "architecture" from last sentence.

CIS 203
Business Programming 1-1-1

Sentence added

CIS 213
Introduction to Computer Science 3-0-3
Programming topics in FORTRAN, PASCAL and assembly language are included.

Change in corequisite

CIS 335
Data Structures and Algorithm Design I 3-0-3
Prerequisite: CIS 213. Corequisite: Math 226.

Sentence added

CIS 461
Systems Simulation 3-0-3
The GPSS language is covered in detail.

Change in corequisite

CIS 490
Guided Design in Software Engineering 3-0-3
Corequisite: CIS 435.

Replacement of last sentence

CIS 491
Computer Science Project 3-0-3
The proposal must be submitted and approved in the prior semester.

Electrical Engineering

■ page 46

Courses

Revision: Prerequisites

EE 440
Medical Instrumentation Systems I 3-0-3
Prerequisites: EE 323 and 344.

Engineering Technology

■ page 25

Revision: 1st and 2nd year requirements
Humanities and Social Science — a minimum of 12 credits with one semester of freshman English is required.

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Revision: Degree Requirements

All candidates for graduation in the B.S.E.T. program must meet the following minimum criteria before a degree will be awarded:
24 credits in mathematics and basic sciences*
24 credits in humanities and social science
48 credits in technical specialties

■ pages 26–28

B.S.E.T. DAY PROGRAMS

All Options

Revision: Title; rec hrs-lab hrs-credits

CIS 202 Computer Programming & Business Problems 3-1-3

Revision: rec hrs-lab hrs-credits

Elective (OS or Tech)
Elective (Lit/Hist/Phil) 3-0-3
Elective (Technical)

Course Addition to **TECHNICAL ELECTIVES**

MET 404 Appl Heat Transfer 3-0-3

Electrical Systems Option

Revision: Course number

CIS 213 Intro to Comp Science 3-0-3

Revision: rec hrs-lab hrs-credits

MET 416 Mechanical Instru Lab 2-2-3

Environmental Technology Option

Revision: rec hrs-lab hrs-credits

ENT 312 Chem & Biology of Water and Wastewater Treatment 3-3-4

Revision: rec hrs-lab hrs-credits

MET 416 Mechanical Instru Lab 2-2-3

Manufacturing Technology Option

SENIOR YEAR

Revision: rec hrs-lab hrs-credits

IET 405 NC for Machine Tools 2-2-3

Replacement

Elective (Hum) *replaced by* Elective (Lit/Hist/Phil) 3-0-3

Mechanical Systems Option

Revision: Option description

The mechanical engineering technology option offers an opportunity for further education to students who have completed an associate degree in mechanical technology at a community college, technical institute, or who have an equivalent education. Students may specialize in:

1. Thermoscience: thermodynamics, fluid machinery & equipment, air conditioning and refrigeration, solar energy systems and instrumentation
2. Machine or System Design: machine design, dynamics of machinery, properties of materials, electrical circuits & machinery, applied mechanical vibrations, automatic control systems, structural design, material science and instrumentation
3. Plastics: plastics technology, plastics processing techniques, material science and instrumentation

NOTE: Students may take technical electives in the manufacturing area with approval from the assistant chair.

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B.S.E.T. EVENING PROGRAMS

Addition of options

Environmental Option

FIRST YEAR

1st Semester
ENT 311 Chemistry of Contaminated Atmospheres & Emissions 3-3-4
Math 106 Basic College Mathematics* *or* Math 107 Intro to College Mathematics* 4-0-4
Eng 342 Technical Report Writing 3-0-3

2nd Semester
ENT 312 Chem & Biology of Water & Wastewater Treatment 3-3-4
Math 108 Mathematical Analysis I* 3-0-3
OS 371 Supervision & Employee Relations 3-0-3

SECOND YEAR

1st Semester
ENT 415 Water & Wastewater Analysis 3-3-4
MET 304 Fluid Machinery 3-0-3
Elective (Hum or SS) 3-0-3

2nd Semester
IET 414 Industrial Cost Analysis 3-0-3
CIS 202 Computer Programming & Business Problems 3-1-3
Elective (Lit/Hist/Phil) 3-0-3

THIRD YEAR

1st Semester
OS 472 Mgmt and Org Behavior 3-0-3
Elective (Technical)

2nd Semester
ENT 416 Unit Operations of Water & Wastewater Treatment 3-0-3
Elective (OS or Tech)

FOURTH YEAR

1st Semester
Elective (Hum or SS) 3-0-3
Elective (Technical)

2nd Semester
Elective (OS or Tech)
Elective (Technical)

*If these courses have been satisfied by prior work, other courses may be substituted with advisor's approval.

Manufacturing Option (even year start)

FIRST YEAR

1st Semester
Math 108 Mathematical Analysis I 3-0-3
Eng 342 Technical Report Writing 3-0-3
IET 317 Manufacturing Oper Anal 2-2-3

2nd Semester
Math 209 Mathematical Analysis II 3-0-3
CIS 202 Computer Programming & Business Problems 3-1-3
IET 318 Mfg Proc Design 2-2-3

SECOND YEAR

1st Semester
IET 315 Industrial Statistics 3-0-3
OS 371 Supervision & Employee Relations 3-0-3
MatSc 311 Prop of Mat'l 3-0-3

2nd Semester
IET 414 Industrial Cost Analysis 3-0-3
IET 420 Quality Control 3-0-3
Elective (SS or Hum)* 3-0-3

THIRD YEAR

1st Semester
IET 423 Motion & Time Study Tech 2-2-3
Elective (OS or Tech)

2nd Semester
IET 424 Facilities Planning 2-0-2
IET 426 Facilities Planning Lab 1-3-2
OS 472 Mgt and Org Behavior 3-0-3

FOURTH YEAR

1st Semester
IET 416 Prod Scheduling 3-0-3
IET 422 Tool Design 2-2-3
Elective (Lit/Hist/Phil) 3-0-3

2nd Semester
IET 405 NC for Mach Tools 2-2-3
Elective (SS or Hum)* 3-0-3
Elective (OS or Tech)

*Hum electives are to be taken from the 400 level.

Manufacturing Option (odd year start)

FIRST YEAR

1st Semester
Math 108 Mathematical Analysis I 3-0-3
Eng 342 Technical Report Writing 3-0-3
IET 315 Industrial Statistics 3-0-3

2nd Semester
Math 209 Mathematical Analysis II 3-0-3
CIS 202 Computer Programming & Business Problems 3-1-3
IET 420 Quality Control 3-0-3

SECOND YEAR

1st Semester
IET 317 Manufacturing Oper Anal 2-2-3
OS 371 Supervision & Employee Relations 3-0-3
Mat Sc 311 Prop of Materials 3-0-3

2nd Semester
IET 318 Mfg Proc Design 2-2-3
IET 414 Industrial Cost Analysis 3-0-3
Elective (SS or Hum)* 3-0-3

THIRD YEAR

1st Semester
IET 416 Prod Scheduling 3-0-3
IET 422 Tool Design 2-2-3
Elective (OS or Tech)

2nd Semester
IET 405 NC for Mach Tools 2-2-3
Elective (Lit/Hist/Phil) 3-0-3
Elective (SS or Hum)* 3-0-3

FOURTH YEAR

1st Semester
IET 423 Motion & Time Study Tech 2-2-3
Elective (OS or Tech)

2nd Semester
IET 424 Facilities Planning 2-0-2
IET 426 Facilities Planning Lab 1-3-2
OS 472 Mgt and Org Behavior 3-0-3

*Hum electives are to be taken from the 400 level.

Mechanical Systems Option

Revision: Change of courses

THIRD YEAR

OS 472 *replaced by* Elective (Technical)
IET 414 *replaced by* Elective (Technical)

FOURTH YEAR

Elective (Lit/Hist/Phil) *replaced by* Elective (SS or Hum)

Humanities

■ pages 54–56

ENGLISH — INTRODUCTORY

Revision: Order of courses

Eng 096-097
English as a Second Language I & II 3-1-3

Eng 098-099
Basic Skills Reading and Writing I & II 3-1-3

Eng 111
English Composition 3-0-3

Eng 115
Composition and Literature 3-0-3

Eng 238
Advanced Composition 3-0-3

HUMANITIES — INTRODUCTORY

Revision: Course titles and descriptions

Hum 112
Culture and History I: From the Greeks to the Renaissance 3-0-3
Prerequisite: Eng 111 or Eng 115. People's changing view of themselves and their world as seen in the history, literature, arts, and philosophy of past eras, from ancient times through the Renaissance. An interdisciplinary approach.

Hum 115
Culture and History I: From the Greeks to the Renaissance 3-0-3

Hum 231
Culture and History II: From the Reformation to the Present 3-0-3
Prerequisites: Eng 111, Hum 112. People's changing view of themselves and their world as seen in the history, literature, arts, and philosophy of past eras, from the 17th century through the contemporary world. An interdisciplinary approach.

Hum 235
Culture and History II: From the Reformation to the Present 3-0-3

continued on next page

SPECIAL COURSES

Students should check their departmental curriculum requirements before registering for 300-level humanities courses. These courses are not equivalent to 400-level humanities courses.

Hum 308
Technological Alternatives 3-0-3

Hum 310
Technology and Human Values 3-0-3

Eng 339
Practical Journalism 3-0-3

Eng 340
Oral Communication 3-0-3

Eng 342
Technical Report Writing 3-0-3

HUMANITIES ELECTIVES

Before registering for humanities electives, students should check their departmental curriculum pamphlets. Engineering students should refer also to the statement of humanities requirements on page 20 of catalog.

ARTS

Deletion

Arts 455
Appreciation of Art 3-0-3

SEMINARS

Revision: Course numbers should read

Hum 491–499
Seminars in the Humanities 3-0-3

HISTORY

Revision: Change in date

Hist 477
Cities in History: From the Ancient to the Industrial City 3-0-3
1990 should read 1900.

Industrial Engineering

■ page 23

Industrial Engineering Day Program

Revision: Course number

IE 355 Human Factors 3-0-3

■ page 24

Industrial Engineering Evening Program (odd year start)

Revision: Course title

CIS 101 Computer Programming 2-1-2

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Courses

Addition

IE 449
Industrial Robotics 3-0-3
Prerequisites: CIS 101 or equivalent, Physics I & II. A course designed to provide students with a knowledge of robotics in manufacturing systems. The field of robotics is studied with emphasis given to the role of programmable robots in manufacturing. Through laboratory experience students become familiar with hardware and software necessary for various industrial robot systems.

Mathematics

■ page 59

Courses

Revision: Course descriptions

Math 331
Introduction to Partial Differential Equations 3-0-3
Prerequisite: Math 220 or 330. Partial differential equations of physics and engineering. Initial, boundary value problems for the parabolic, hyperbolic and elliptic second order PDE. Stress on separation of variables techniques, special functions, transform methods, and numerical techniques. Fourier series, and wave, heat, and potential equations. Solutions include separation of variables, transform methods and numerical methods.

Math 332
Introduction to Functions of a Complex Variable 3-0-3
Prerequisite: Math 222 or 330. A first course in functions of a complex variable; Cauchy-Riemann equations, Cauchy-Goursat theories, integration, series, residues, poles, geometrical aspects. Emphasis is placed on techniques. Topics considered include the complex plane.

Course moved from Statistics to Mathematics section

Math 340
Applied Numerical Methods and Optimization 3-0-3

Mechanical Engineering

■ page 25

Mechanical Engineering Day Program

Revision: Course title

ME 403 Mechanical Systems I 2-2-3

■ pages 60, 61, 62

Courses

Revisions: Prerequisites

ME 308
Analysis and Synthesis of Mechanical Systems 2-1-2
Prerequisites: ME 303, 305.

ME 468
Noise Pollution and Abatement 3-0-3
Prerequisite: Math 222.

ME 490
Mechanical Engineering Project A 2-0-2
Prerequisites: Senior standing and approval of the chair of the department.

ME 491
Mechanical Engineering Project B 2-0-2
Prerequisites: ME 490 and approval of the chair of the department.

Organizational and Social Sciences

■ page 64

Courses

Additions

SS 203
Honors Economics 3-0-3
Prerequisite: Admission to the Institute Honors Program or permission of the instructor. An honors course parallel to SS 201. The course is designed for students who are admitted to the Institute Honors Program and whose proficiency and interest are greater than those of the average student.

SS 417
Mathematical Foundations of Economic Theory 3-0-3
Prerequisites: SS 301 and either Math 111 or 138. This course provides analytic insights into the theories of consumer demand, production, cost functions and market structure. Mathematical models of constrained optimization and displacement of equilibrium will be analyzed.

Physical Education

■ page 65

Revisions: Course descriptions

PE 105
Advanced Life Saving
An American Red Cross certification course. The purchase of textbooks will be required. Laboratory hours to be established at first lecture.

PE 106
Water Safety Instructor
Prerequisite: Valid Advanced Lifesaving certificate. An American Red Cross certification course. The purchase of textbooks will be required. Laboratory hours to be established at first lecture.

PE 110
Skiing
A course of instruction and practical experience in recreational skiing designed for the novice and intermediate skier. The course will include 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 will be responsible for costs of lift tickets and any equipment rentals. Transportation will be provided.

PE 119
Bicycling
A course of instruction and experience in biking designed to prepare the novice biker for a short tour. Students should supply their own bicycles. The class will include some weekend tours.

Additions

PE 113
Volleyball
Students in this class will have a chance to develop fitness and learn the techniques and tactics of volleyball.

continued on next page

PE 127
Sailing and Windsurfing
Learn the basics of small boat sailing and windsurfing. Course will include principles of sailing, rules of the road and boat maintenance with practical experience at Spruce Run Reservoir. Transportation will be provided.

PE 128
Hydrofitness (AEROBICS) — Women
A water fitness course designed to tone major muscle groups, strengthen the cardiovascular system and massage the body. Course includes excercises for all parts of the body, recipes for staying in shape, the aerobic way to a strong heart. Limited to twenty women. A bathing suit is needed.

PE 129
Individualized Fitness Program
The course will deal with specific training to meet the individual student's interests. Areas covered will include techniques of strength training, goal setting and record keeping.

PE 130
Body Building for Women
Getting stronger is not only important for athletes. If you are a woman of the 80's, developing muscular strength and sculpting a new shape for your body are exciting and fulfilling. For women only. Required clothing: tights, leotard, bathing suit and warm-up.

PE 131
Introduction to Power Tumbling
A class designed to introduce students to power tumbling. Course will include intermediate tumbling skills, spotting procedures, and competitive tumbling routines. Required clothing: men — shorts and T-shirts; women — tights, leotard.

Statistics and Actuarial Science

■ page 33

Curriculum — Actuarial Science

Revision: Course sequence

Math 242 taken first semester; Math 337 taken second semester

■ page 59–60

Courses

Revision: Course description

Math 342
Probabilistic and Statistical Analysis II 3-0-3
Prerequisite: Math 341. This course is a continuation of Math 341. Topics covered include: hypothesis testing, regression, analysis of variance, sampling techniques, design of experiments.

Additions

Math 344
Regression Analysis 4-0-4
Prerequisite: Math 333 or Math 341. In depth discussion of linear and multiple regression and analysis of variance incorporating the use of computer statistical packages and their applications to specific examples. The development will rely heavily upon the use of matrix algebra.

Math 346
Theory of Interest 3-0-3
Prerequisites: Math 108 or Math 111, Math 141. The main topics include: basic problems in interest, annuities certain, amortization and sinking funds, bonds and related securities.

Directory

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Campus Directory

Revision:
Mechanical Engineering
Room 204B

Addition:
Computer and Information Science
Room 200W

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Directory for Correspondence

Additions:
Residence Life/On-Campus Housing:
Contact the Office of residence life.
Telephone (201) 596-3039

Student Services:
Contact the dean of student services office.
Telephone (201) 596-3466

Veterans Benefits:
Contact the registrar.
Telephone (201) 596-3243

New Jersey
Institute of
Technology