C.I.L.C. Desk

NEWARK COLLEGE OF ENGINEERING
1881
NCE
NEW JERSEY

UNDERGRADUATE DAY AND EVENING COURSES

1964 1965

JANUARY, 1964

DIRECTORY FOR CORRESPONDENCE

MAILING ADDRESS: 323 High Street, Newark, N. J. 07102.

TELEPHONE: Area Code 201, 624-2424.

MATTERS OF GENERAL COLLEGE INTEREST:
Address the President.

ADMISSIONS (UNDERGRADUATE OR GRADUATE):
For everything concerned with admissions, including requests for publications, and information on scholarships and student aid, advanced standing, tuition, and fees, address Dean of Admissions. Telephone: Ext. 257.

REGISTRATION:
Address the Registrar. Telephone: Ext. 369.

ALUMNI ACTIVITIES:
Address Alumni Secretary. Telephone: Ext. 364.

FINANCIAL MATTERS:
Address the Business Manager. Telephone: Ext. 218.

GRADUATE PROGRAM:
Address the Dean of Admissions. Telephone: Ext. 257.

SPECIAL COURSES ADMISSION OR PROGRAM:
For all information concerning special courses programs and admissions, etc., address the Director of Special Courses. Telephone: Ext. 366.

EMPLOYMENT OF SENIORS AND GRADUATES:
Address the Director of Placement. Telephone: Ext. 363.

COUNSELING:
Address the Counseling Center. Telephone: Ext. 263.

TRANSCRIPTS:
For transcripts and student grades, address the Records Supervisor. Telephone: Ext. 246 (Day records), Ext. 229 (Evening records).

VETERANS:
For information on veteran status, address the Veterans' Coordinator. Telephone: Ext. 379.

RESEARCH FOUNDATION:
Address the Secretary. Telephone: Ext. 243.

PLANT, EQUIPMENT, AND UTILITIES:
Address the Director of Physical Plant. Telephone: Ext. 270.

The business and administrative offices of the College are open between the hours of 9:00 A.M. and 5:00 P.M. Monday through Friday during the school year. The Registrar's Office and the Finance Office are also open evenings between the hours of 6:00 P.M. and 9:00 P.M. daily except Saturdays. During the summer program, the business and administrative offices remain open until 4:00 P.M., Monday through Friday, while the Registrar's Office and the Finance Office are open between the hours of 6:00 P.M. and 9:00 P.M., Monday through Thursday.

NEWARK COLLEGE OF ENGINEERING

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The BULLETIN
PUBLISHED BY
THE BOARD OF TRUSTEES
OF SCHOOLS FOR INDUSTRIAL EDUCATION
OF NEWARK, N. J.

GENERAL INFORMATION

Newark College of Engineering, instituted in 1919, is a development of the Newark Technical School founded in 1881 by the Board of Trade of Newark and civic-minded citizens. The College is a public institution supported by both the City of Newark and the State of New Jersey and is governed by a Board of Trustees appointed by the Governor of the State of New Jersey. The Governor and the Mayor of Newark are ex officio members.

The College is organized under four divisions: the Day Undergraduate Division, the Evening Undergraduate Division, the Graduate Division and the Special Courses Division. The first two offer courses leading to the degree of Bachelor of Science. The Graduate Division offers the degree of Master of Science in all fields of major study, and the degree of Doctor of Engineering Science in Chemical and Electrical Engineering only. The Special Courses Division offers a wide list of courses for the upgrading of industrial personnel, and cooperates with Newark Technical School in presenting certain of these courses tuition-free to residents of the City of Newark. The College also maintains a Counseling Center which cooperates with industry, with individuals requesting counseling, and with high school guidance departments.

The College is accredited by the Middle States Association of Colleges and Secondary Schools and the Engineers' Council for Professional Development.

The College's administrative offices are located at 323 High Street in the City of Newark, convenient to all transportation lines. The College has a predominantly commuting population.

Current enrollment figures show 3600 students enrolled in the undergraduate day and evening divisions of the College, and 887 students taking work leading to the Master of Science and Doctor of Engineering Science degrees. The Special Courses Division numbers 1450 students.

CONTENTS

COLLEGE CALENDAR: 1964-1965

The College reserves the right to make changes in this calendar.

1964

Registration — Fall Semester.....In accordance with instructions to be issued.

Fall Semester Begins.....September 23

Midpoint of Semester.....November 17

Thanksgiving Holidays.....November 25 to 28 inclusive

Christmas Holidays .....December 21 to January 2 inclusive

1965

Fall Semester Ends.....January 30

Registration — Spring Semester.....In accordance with instructions to be issued.

Spring Semester Begins.....February 15

Washington's Birthday Holiday.....February 22

Midpoint of Semester, except for February Freshmen.....April 10

Spring Vacation.....April 12 to 17 inclusive

Memorial Day Holiday.....May 31

Spring Semester Ends for February Freshmen.....June 4

Last Day of Attendance for Seniors.....June 7

Commencement (tentative) .....June 10

Registration for Summer Semester
—February Freshmen.....June 11

Spring Semester Ends for all students except February Freshmen and Seniors .....June 12

Summer Semester Begins for February Freshmen.....June 14

*Registration — Evening Undergraduate Summer Session.....June 18

Evening Undergraduate Summer Session Begins.....June 21

Independence Day Holiday.....July 5

Summer Semester Ends
for February Evening Freshmen....August 26
for February Day Freshmen.....August 27

Evening Undergraduate Summer Session Ends.....September 3

*The Evening Undergraduate Summer Session Announcement will be available at the Office of the Registrar on or about April 1.

1964

SEPTEMBER

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1965

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JULY

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AUGUST

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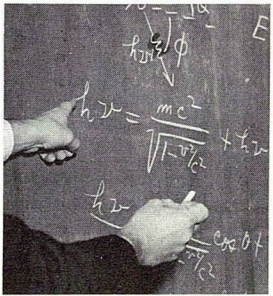

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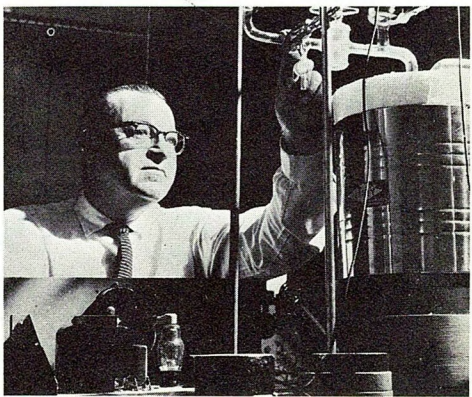

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HISTORY OF NEWARK COLLEGE OF ENGINEERING

The years between 1878 and 1885 are historic ones for the Newark Technical School and Newark College of Engineering. During that period prominent citizens and public officials first discussed the establishment of a technical school and actually got it under way. Before the Civil War the Newark Mechanics' Institute had been in operation. As its name indicates, apprentices and mechanics from local concerns were given some theoretical and practical training in their own trades to help them in their everyday work, but the drain on manpower during the Civil War presumably forced the Institute to close.

By 1878 Newark had grown tremendously as a manufacturing center, and a definite need for a technical school had again risen. The Governor and other influential leaders and organizations, including the Newark Board of Trade, by committee work and investigation, looked into the matter. A bill sponsored by the Board of Trade passed the state legislature in 1881 and $5,000 per year was appropriated for the upkeep of a technical school in Newark, provided citizens would raise a similar amount by subscription or contributions. The citizens raised their share, and a building was secured at 21 West Park Street in Newark. Professor Charles A. Colton of Rose Polytechnic Institute, Terre Haute, Indiana, was named Director.

The first class, numbering 100 students, started courses of evening study which included work in drawing, mathematics, physics, and chemistry. Director Colton, a mining engineer, brought a wide educational vision to the newly formed institution, and constantly made changes and improvements in the courses to meet changing needs.

At this time all the students studied during the evening and were employees of local industries. Director Colton felt by 1912 that the time had come when work of college grade should be given during the daytime, and he took steps to initiate such work. The First World War delayed this procedure somewhat, and it was not until September, 1919 that the first day class matriculated for a degree program. This period also saw hundreds of disabled war veterans assigned to the School by the Veterans' Bureau for study and rehabilitation.

Allan R. Cullimore was appointed Director of the School and head of the College in 1920. Coming from the University of Delaware, the new Director brought with him many forthright ideas, and soon both Evening School and College were flourishing in numbers and in prestige.

There was evidence that a great many men engaged in industry during the daytime needed to further their education beyond the night technical school level, and in the middle

twenties the college instituted an evening program leading to the bachelor of science degree. The evening division of the college has continued to grow and is now an important factor in the industrial and professional advancement of many hundreds of young men and women in the New Jersey industrial areas. Side by side with the growth of the evening school has been the advancement of the Graduate Division of the College which offers both master of science and doctoral degrees.

The Second World War brought a number of changes in the operation of the college. An Engineering, Science and Management War Training program was instituted, and Newark College of Engineering became a leader among the professional colleges training men and women for essential positions in war industries. Approximately 10,000 residents of the area received training in critical war production work. So successful was the upgrading of this type of personnel that the College broadened this effort under the direction of the Special Courses Division, which now offers a wide field of technical subjects in a program of continuing education for men and women in industry.

Several of the teaching personnel of the College were called into the Armed Forces in their specialized capacities, while others served on scientific and industrial projects of secret nature. The student personnel through enlistments or selective service was cut sharply and this enabled the College to instruct assigned army personnel under the Army Specialized Training Program.

At the conclusion of the war, as in the case of World War I, the College played a leading part in the rehabilitation and retraining of men under the Veterans' Administration, and a Testing and Guidance Center was established, with highly trained personnel, which has now, as the NCE Counseling Center, become an integral part of the college.

Dr. Cullimore retired from the presidency in 1949, and was succeeded by Dr. Robert W. Van Houten, a graduate of the College, who continues as president today.

In reviewing the growth of Newark College of Engineering since its development from the original Newark Technical School, beginning in 1920, it is important to stress the major contributions made by Dr. Cullimore to the field of engineering education.

During the twenty-nine years of his presidency, he established the enviable record in opening new frontiers of engineering education that led, in 1951, to his receiving the Lamme Award of the American Society for Engineering Education, the highest national honor which that Society bestows.

He established the study of the humanities on an equal level with technical studies. He made major contributions to the field of guidance, particularly as they apply to engineering students, and was responsible for the excellent Counseling Center which exists at the College today. He based the ruling philosophy of the College on two principles: that engineering is a discipline, requiring the highest ideals of work and ethics, and that the engineer has a duty as a citizen perhaps even greater than do the members of other professions, because of his specialized training in both logical and creative thinking.

The latter emphasis finds expression today in the College's four-year program of orientation to industry and society, particularly, but not exclusively, within the curricula of the departments of English and Humanistic Studies, Industrial Relations, and Industrial and Management Engineering.

In partial recognition of this record, the trustees of the College, shortly after his death in 1956, decided to name NCE's new 41-room classroom building Cullimore Hall. The dedicatory plaque at the building's entrance reads, "In honor of Allan Reginald Cullimore, President, 1920-1949. Engineer, soldier, teacher, administrator, citizen, constructive statesman in engineering education, consecrated to the cause of young engineers. He gave of himself without stint that this college might grow great and strong in the service of the community and the engineering profession."

FACILITIES

BUILDINGS

From its original modest building on West Park Street, Newark College of Engineering has now expanded to six edifices along High Street, Summit Street, Summit Place and Bleeker Street in the heart of Newark. The first of the buildings to be erected at the present site was a combination administration and classroom building, designated Weston Hall in honor of Dr. Edward Weston, one of the founders of the institution, which was torn down in 1958 to be replaced by a new Weston Hall, completed in 1960. The College soon outgrew the facilities of the original building and there was built on adjoining property a four story laboratory building now known as Colton Hall, which contained equipment used in the courses, and also provided classroom, lecture and drafting room space. The continued expansion of the College necessitated the construction of Campbell Hall in 1926 and a five story Campbell Hall annex in 1930.

Still greater work areas were found necessary immediately following the Second World War, and plans were formulated and construction started for a five story extension to Colton Hall which would house departmental offices as well as more modern scientific and technological equipment. The expansion of administrative and student facilities also occasioned the purchase of the former Newark Orphan Asylum property at the corner of Bleeker Street. This century old building was rehabilitated and named Eberhardt Hall in honor of Frederick L. Eberhardt, former chairman of the Board of Trustees of the College.

Additional facilities were completed in the Spring of 1958 with the opening of Cullimore Hall, a six story building at the rear of Eberhardt Hall, containing a new cafeteria, student commons, and 37 classrooms, as well as other offices and college services. With the completion of the new Weston Hall, a seven story building, 15 laboratory areas, an enlarged Library, and a 400-seat lecture hall were added to the College plant.

The College has also acquired a building situated at 240-250 High Street through the philanthropy of Mr. Martin F. Tiernan, which after extensive remodeling has been occupied by the departments of Chemical and Civil Engineering for laboratories, offices, and classrooms. This is the Martin F. Tiernan Laboratory Building.

As one of New Jersey's eight State-supported higher educational institutions, Newark College of Engineering has received $7,000,000 from a recent bond issue which will enable the College further to expand its facilities between now and 1965 in order to take care of the greatly increased need for opportunities in engineering education created by the State's expanding college-age population.

The present buildings house well-allocated classroom, lecture room, laboratory, and drawing room space, with modern equipment in the engineering and technological departments. There is also a well equipped bookstore for students' books and supplies. The Dining Hall is open from 8:00 a.m. until 7:00 p.m. Two gymnasiums, which are used for intramural sports as well as varsity games, and a well rounded physical education program, are an integral part of the College's educational plan. Administrative offices of the College and of the individual departments are located close to their major work areas.

COUNSELING CENTER

The Counseling Center exists primarily to assist students in two ways: first, to help them understand and deal with problems which may be interfering with their satisfactory scholastic progress; and secondly, to help them plan thoughtful and responsible action regarding their educational and career choices. Noteworthy services of the latter kind are the pre-employment career counseling of seniors and of students who, for any reason, may have to leave the College. These confidential services are free to undergraduate students of the College.

Students may themselves request counseling whenever the Center is open. Students may be referred for counseling by the Dean of Students, the Assistant Dean of Students, and members of the faculty.

The Center is located in especially designed rooms on the third floor of Eberhardt Hall. In addition to experienced professional counselors, its staff includes a trained psychometrist who administers standard psychological and other tests, and scoring and stenographic assistants. Its facilities provide privacy for counseling and for individual or group testing, including the testing of vision.

The Center dates from 1943, when the first of over 14,000 veterans were counseled for the Veterans Administration. Since 1943, over 28,000 persons and many business and industrial firms have used the services of the Center.

The Center's community services, all by appointment (see inside front cover), include: (a) the educational and career counseling of 11th and 12th grade students, college students and out-of-school adults; (b) the evaluation for business and industry of applicants for employment and of employees for promotion, training, or transfer; (c) educational counseling for the parents of 8th, 9th, and 10th grade students who are too young for career counseling; and (d) individual testing and score reporting for applicants to graduate schools which require the Miller Analogies Test, the Minnesota Engineering Analogies Test, or the

Doppelt Mathematics Reasoning Test. Counseling and testing fees reflect the cost of providing each service.

The Center is open from 9 a.m. to 5 p.m. Monday through Friday, as well as one evening each week (for evening students) and by appointment on occasional Saturday dates.

LIBRARY

The College Library occupies the third floor of Weston Hall. The reading room has seating accommodations for two hundred students and provides an environment suitable for serious study. Display cases exhibiting the late Dr. Edward Weston's early electric equipment and inventions occupy a small portion of the room.

The book collection consists of over 40,300 bound volumes and a considerable number of unbound periodicals, government bulletins, and miscellaneous booklets. Over five hundred periodical titles are received regularly on subscription. Books and magazines are selected with special emphasis on the fields of study offered by the College; in addition, books and magazines are constantly being acquired in literary and cultural subjects. Students are encouraged to expand their scope of knowledge through extensive reading in all areas.

To augment the resources of the College Library, students have access to other excellent libraries: The Newark Public Library grants book-borrowing privileges to students attending the College; the Public Service Corporation Library is available for limited use; the libraries of the Engineering Societies and the Chemists' Club, and the New York Public Library all permit students to use their facilities.

Country-wide interlibrary loan relationships, together with the availability of microfilm and copying services further extend the volume of printed information for research and study.

Memorial gifts from the personal libraries of men formerly associated with the College have been received. Foremost among these gifts are books and periodicals from the collections of former Trustee Dr. Edward Weston and State Senator Roy V. Wright. During the past five years the Society of Plastics Engineers has purchased and presented to the Library approximately 50 current books and several periodical subscriptions in the field of plastics.

The Library is open for service on all days when classes are in session, between the hours 8:30 a.m. and 9:00 p.m. and on Saturday mornings from 9:00 a.m. to 12:00 noon. Holiday and recess period hours are posted on the bulletin board located at the Library entrance.

OBJECTIVES

The philosophy of Newark College of Engineering is simple and involves training along scientific, technological, and humanistic lines those young men and women who have interest and ability irrespective of financial situation. The College is in effect a community project. As a result, there has been developed here an institution which enjoys a well earned reputation for academic excellence. It has conceived that its function lies in the development of sound, well trained engineers and citizens at the lowest cost consistent with high technological quality.

The factors involving this democratic education available to young men and women of capacity are the simple American concepts of:

1. Character
2. Initiative
3. Hard work
4. Understanding human relations
5. A knowledge of fundamentals of applied science

The vision and foresight of its founders such as Edward Weston, George Phillips, ex-Governor Marcus Ward, ex-Senator William D. Kirk, Thomas B. Peddie and others have been amply evidenced in the service that the College has performed to supply the needs of ever-expanding industry for engineering personnel.

The College maintains close contact with industry in the area and passes on to each student the important and fundamental objectives of the industries and their attitudes toward modern engineering techniques. This is accomplished by lecturers from industry, by the Professional Development program and placement service which arranges to have qualified students placed in plants during their summer vacations for practical experience, and by the use of professors and instructors who in addition to their academic background have had extensive professional experience.

The College feels that the development of a sensitivity in the students on the importance of dress and good grooming is a part of the social, technical and professional disciplines which constitute engineering education. The College therefore requires that all male students shall wear the customary items of dress, including shirt, tie and coat in all places of assembly such as corridors, dining halls, and formal classes and that women students shall also be suitably attired. Certain concessions can be made during continuous warm weather and in laboratories, drafting rooms, and on field trips.

The College requires that every student shall conduct himself with decorum and shall constantly adhere to ethical and professional behavior. No student may use or give any unauthorized aid in any test, report, or assigned paper. All work offered as the student's own must be the work of the individual student. Instances of alleged unethical or unprofessional conduct will be brought to the attention of the appropriate College authorities for investigation and action.

PROGRAMS

DAY AND EVENING UNDERGRADUATE DIVISIONS

The College offers four-year undergraduate curriculums in Chemical, Civil, Electrical, Industrial and Mechanical Engineering.

Much of the subject matter in the undergraduate programs of study is common to all of them (although course titles may be different). These common courses represent the unity in all branches of engineering of basic sciences, mathematics, humanities, and engineering science.

The work of the first two years of the Day Division has been designated as the Junior Division. The work of the third and fourth years, being predominantly in the departments of Chemical, Civil, Electrical, Industrial and Mechanical Engineering, is known as the Senior Division.

The evening program of Newark College of Engineering is also divided into two sections. The first four years of work come under the heading of the Junior Division (Evening). This division has the same entrance standards and requirements as the day program, and the work taken during the evening hours parallels the subjects studied in the first two years of the undergraduate day division. The program of the Senior Division is five years in length if taken on a full evening schedule, and completion of these courses under the same standards as in the day third and fourth year programs will lead to the bachelor of science degree.

Courses for which less than fifteen students are enrolled may not be given. Students may not register for part of a subject.

For information concerning programs consult or write the Dean of Admissions.

HONORS PROGRAM

An Honors Program at Newark College of Engineering has been established in the Day Undergraduate Division in all four years and all five curriculums. Students in the freshman and sophomore years may participate in Honors courses in Mathematics and in English and Humanistic Studies with the recommendation of members of the faculty; aptitude tests and high school records are used as corroborative selective criteria. Such Honors courses, appropriately designated, are described under the offerings of their respective departments. Students in the junior and senior years may participate in a program involving concentrated course work, summer honors reading and course work, special lectures, and individual course or laboratory work,

with the recommendation of members of the faculty; college records are used as corroborative selective criteria. In certain cases, students in the Program may, with the approval of the department concerned, substitute graduate courses for courses in the regular undergraduate curriculum. The Honors Program is guided by a faculty committee and special advisers within each department involved.

GRADUATE DIVISION

Newark College of Engineering offers courses at the graduate level leading to the degree of Master of Science in the fields of Chemical, Civil, Electrical, Management, and Mechanical Engineering, and the degree of Master of Science without designation. A program of courses and the opportunity for research, leading to the degree of Doctor of Engineering Science, are also offered in the fields of Chemical and Electrical Engineering.

Graduates of accredited institutions who wish to enroll in programs of advanced study may obtain further information by requesting the Division's *Catalog of Graduate Courses.* (See inside front cover.)

Specially qualified seniors at Newark College of Engineering may take courses in the Graduate Division before graduation under certain specified conditions. Information as to these conditions may be obtained from the Director of the Graduate Division.

Specially qualified seniors at Newark College of Engineering may take courses in the Graduate Division before graduation under certain specified conditions. Information as to these conditions may be obtained from the Chairman, Graduate Division.

Through the College and its Research Foundation, fellowships are available to graduate students to enable them to pursue a combined program of research, teaching and study leading to the master's degree. It normally takes two years to earn the degree under the fellowship program, and the fellowships are renewable for the second year. Inquiries and applications should be directed to the Vice-President.

THE NEWARK COLLEGE OF ENGINEERING RESEARCH FOUNDATION

The Newark College of Engineering Research Foundation, a privately incorporated and financed organization, serves as a coordinating agency for research activities at the College. One of the Foundation's major objectives is to offer the opportunity for professional development to graduate students and members of the teaching staff by providing for or obtaining support for research activities. The staff of the Foundation assists with the preparation of research proposals, solicitation of financial support, and administrative details involved in research programs.

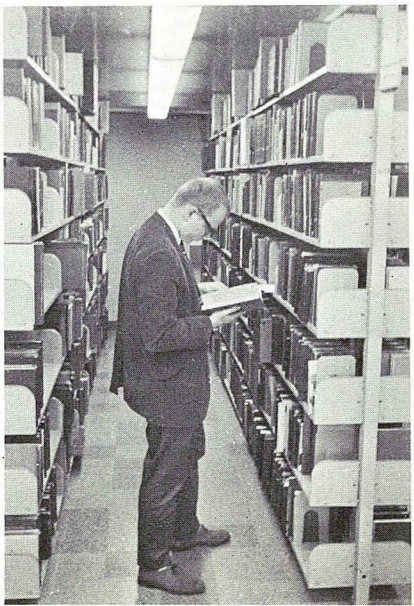
COMPUTING CENTER

The Computing Center is an inter-departmental laboratory for the use of students and staff of all divisions of the College. The equipment consists of an analog computer and a modern high-speed digital computer with peripheral card-handling devices. The computers are capable of obtaining numerical solutions to a wide range of engineering and scientific problems as well as the processing of data for general business operations.

Instructions in computer programming and operation are given at various times during the school year as an integral part of the college curriculum and also through a number of special courses. Those who have taken these courses may, through their instructors, reserve time on the computer for their problems. The staff of the Center is available for consultation in problems of programming and operation.

SPECIAL COURSES DIVISION

This Division offers terminal programs, individual courses, conferences and seminars in technical subject matter for men and women in industry who wish to further their scientific, technical, and mathematical training, but are not concerned with credits toward a degree. The Division operates on a quarter term basis with its major offerings in the fall, winter, and spring terms. Over 150 courses are offered under the supervision of the various departments of the College, and these are conducted during the evening hours or on Saturdays. They generally run 12 weeks, and a modest tuition charge is set on each course. Certain courses are tuition-free to residents of Newark, New Jersey. A list of all courses is published in brochure form and may be obtained from the Director of Special Courses. Eight certificate programs of two or three years duration in certain specific fields are available.



CRITERIA FOR GRADUATION

DEGREES

Newark College of Engineering reports to and receives the right to grant degrees from the New Jersey State Board of Education.

Candidates for graduation who satisfactorily complete a regular undergraduate course of study and the examinations required receive the degree of Bachelor of Science (B.S.) in the course pursued.

While passing marks are required as a minimum in all subjects undertaken, barely passing marks alone do not insure graduation.

To be eligible for graduation, a student must attain a grade point average of 2.00 in all the courses listed in the Bulletin as being required in the third and fourth years of the engineering department in which he desires to earn a Bachelor of Science degree.

The Bulletin of the Graduate Division states the requirements for the degrees of Master of Science (M.S.) and Doctor of Engineering Science (Engr. Sc. D.).

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

Each prospective candidate for any degree must file an Application for Candidacy prior to the opening of the spring semester of the year in which the candidate expects to graduate.

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

GRADES

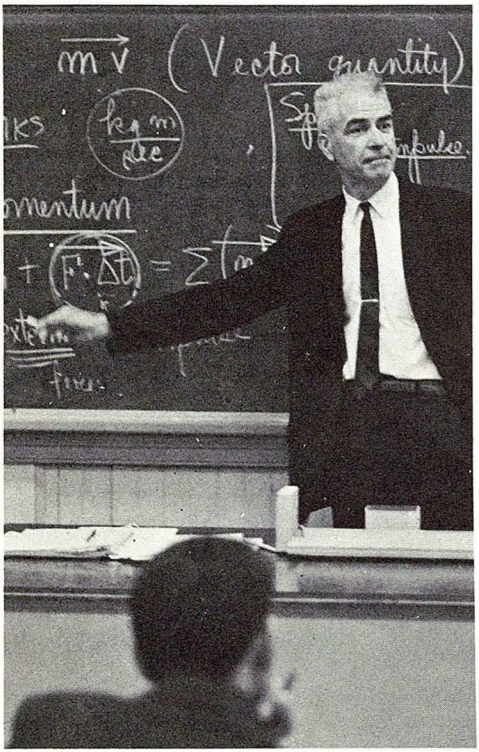
Grades used in the College and their general significance are as listed below:

GRADE	SIGNIFICANCE
4	Superior
3	Above average
2	Satisfactory
1	Minimum for credit
O	No credit

INC "Grade deferred"—given in *rare* instance for students who would normally complete work, but because of special circumstances *could* not. If this grade is not removed within the next regular semester, a grade of O will result.

R Resigned

W Withdrawn.



ADMISSIONS

APPLICATION

Candidates for the Freshman Class must submit an application for admission and a certified secondary school record on forms provided by the Office of Admissions. Forms normally employed for that purpose by the secondary school submitting the record may also be used for the scholastic record. A $5.00 application fee must accompany the application.

SCHOLASTIC RECORD

The certified record must include the date of graduation; or if the record is submitted prior to graduation, a certificate of graduation must be submitted before final acceptance can be granted.

Failure on the part of the applicant or the secondary school to provide complete information may delay consideration of the application.

In lieu of a certificate of graduation from an approved secondary school, a candidate may offer a high school equivalency certificate as issued by the New Jersey State Board of Education.

REQUIREMENTS

Engineering requires more than mere technical ability. Graduates of engineering colleges are expected to be well versed not only in mathematics and science but also in English and social studies. The curriculums in accredited engineering colleges are designed with this goal in mind, and experience has proved that applicants for admission need an all-inclusive secondary school background.

Candidates for admission must submit a minimum of 16 secondary school units:

Ten are required:

English	4 units
College preparatory mathematics, including algebra, geometry, and plane trigonometry	4 units
Physics	1 unit
Chemistry	1 unit

The remaining 6 may be submitted from among the following as indicated:

Foreign Language	2 to 5 units
Social Studies	1 to 5 units
Science and Mathematics in addition to required units	1 to 3 units
Any other subject having a value of one full unit	1 unit

In selecting applicants for admission from among those who meet the entrance requirements listed above, preference will be given to those who submit two or more units in one foreign language.

Candidates should plan to take the Scholastic Aptitude Test of the College Entrance Examination Board, the entrance examination required of all applicants, in December or January of their senior year. Applications and information on fees and dates of examinations can be obtained from the College Entrance Examination Board, Box 592, Princeton, New Jersey.

Since increasing enrollments are causing existing facilities to be used to the utmost, legal residents of the State of New Jersey will be given preference in acceptance. A limited number of non-residents of New Jersey may be accepted for admission.

ADMISSION BY TRANSFER

Students who have pursued studies at accredited colleges or universities offering comparable programs and who have demonstrated by their previous records that they are capable of doing academic work of the high caliber which would enable them to earn a degree at Newark College of Engineering may be admitted with advanced standing. Credit may be given for completed courses that are equivalent to those in the curriculum for which the applicant is accepted, and in which he has earned final grades higher than the lowest passing grade.

Candidates who have previously attended another institution giving courses above the secondary school level must comply with all the regulations set forth for candidates for the first year class, including the scores earned on the Scholastic Aptitude Test of the College Entrance Examination Board and, in addition, submit official transcripts and statements of honorable dismissal from all institutions which they have previously attended. Applicants in this category must submit a transcript evaluation fee of five dollars with their applications. This fee covers a service which is necessary to evaluate transcripts for studies completed at other institutions. This fee is not returnable regardless of whether or not the applicant is admitted to the College.

SPECIAL STUDENTS

NON-MATRICULATED STUDENTS

Although the College usually recommends a program of studies leading to a degree, applicants who fulfill all the admission requirements may, with the approval of the Admissions Office, choose courses without following a degree program. Official transcripts of record for non-matriculated students will list subjects completed, grades earned, and the credits which will be granted if the student matriculates.

AUDITOR

Permission to enroll as an auditor may be granted by the Admissions Office to mature students who cannot meet the admission

requirements but who can demonstrate that by virtue of their professional experience they are qualified to take and profit from the courses for which they desire to register. Auditors receive no grade or academic credit but may receive a statement of their attendance in the course.

ENROLLMENT

Those who wish to be considered for enrollment as Special Students may receive instructions as to the procedure to be followed by writing to the Office of Admissions.

Special Students approved for enrollment will be permitted to register for courses in which there is still room available after all degree candidates have completed their registration.

PRE-COLLEGE GUIDANCE

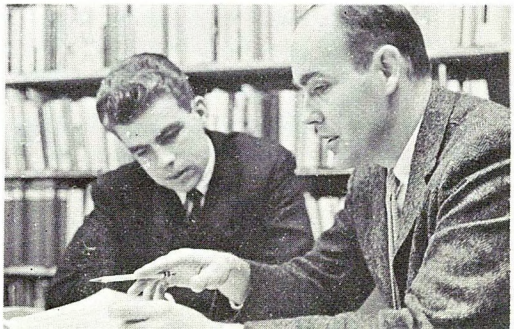
Since students of Newark College of Engineering are in the main graduates of secondary schools located in the northeastern part of New Jersey, personal communication with those likely to be candidates for admission is readily maintained. Members of the Admissions Staff make scheduled visits to all the schools in the area and in addition make every effort to accept invitations to participate in guidance programs or to talk informally with groups of students. A class characteristics study of the most recently admitted class and a follow-up report of their graduates already enrolled are sent annually to all high schools in the area.

High school and junior high school students are encouraged to visit the Admissions Office for an interview or to be escorted on tours of the buildings. Members of Alpha Phi Omega, national college service fraternity, act as guides for these tours. Arrangements can be made for guided tours by telephoning the Admissions Office, MA 4-2424, Ext. 257.

The Counseling Center also participates in pre-college guidance. For details, refer to the section "Facilities."

INTERVIEWS

An interview may be required of any candidate to assist in determining his probable fitness to do engineering college work. The date and time of the interview will be arranged by the Dean of Admissions.



EXPENSES

TUITION AND FEES

DAY DIVISION

As a public institution receiving support from the State of New Jersey and the City of Newark, and having no general endowment funds, it is incumbent upon Newark College of Engineering to establish its tuition and fees at a level which will maintain the proper relationship between the responsibilities of the State, the City, and the direct beneficiary, the student.

To preserve the equities of all interested parties, it is necessary for the College to adjust its tuition charges from time to time as educational costs become affected by changing economic conditions.

	Charges per Semester	
	New Jersey Residents	*Non-Residents*
Tuition*	$193.00	$386.00
Regular Fees		
Registration	7.50	7.50
Student Activities & Facilities Fee	15.00	15.00
Total Tuition and Regular Fees per Semester	$215.50	$408.50

*Tuition includes charges for services other than instruction, such as library, publications, counseling, placement, etc., but does not cover the breakage or loss of College property.

Tuition charges are somewhat higher for special programs of study differing from those shown in this catalog.

APPLICATION, MATRICULATION AND SPECIAL FEES

DAY DIVISION

Each candidate for admission to the College must pay an APPLICATION FEE of $5.00 at the time the application for admission is submitted. The fee is not returnable, regardless of whether or not the applicant is admitted to the College. This fee covers service which is necessary to evaluate applications for admission.

Any applicant for readmission to Newark College of Engineering must pay an APPLICATION FEE of $5.00 at the time the Application for Readmission form is submitted. (See section "Readmission," page 44.) This fee is not returnable, regardless of whether or not the student is readmitted to the College. This fee covers service which is necessary to evaluate applications for readmission.

A fee of $5.00 will be charged for the EVALUATION of official college transcripts submitted in accordance with the instructions set forth on page 40 of this catalog under the heading "Admission by Transfer." This fee is *in addition* to the application fee of $5.00 which *all* applicants must pay and covers service which is necessary to evaluate transcripts of study completed at other institutions of higher education. It is not returnable, regardless of whether or not the applicant is admitted to the College.

Prospective students are charged a fee of $7.00 if they are required to take ADMISSION TESTS other than the required College Entrance Examination Board tests.

All students entering the College for the first time as candidates for a degree are charged a MATRICULATION FEE of $5.00.

Registration is required for each semester. An extra REGISTRATION FEE of $5.00 is required of those who register late.

A fee of $2.00 is charged if, at the discretion of the College, it seems advisable for the student to be given a PHYSICAL EXAMINATION.

Students registering for the professional work of any semester in the Chemical Engineering Department are charged a special LABORATORY FEE of $10.00 a semester if residents of New Jersey, or $20.00 a semester if non-residents.

A fee of $1.00 is charged for the REMOVAL OF A GRADE of "INC."

For SPECIAL EXAMINATIONS, taken at times other than those regularly scheduled, a fee of $5.00 is charged.

A GRADUATION FEE of $25.00 is required of all candidates for the Bachelor's degree; and a graduation fee of $25.00 for advanced degrees. The graduation fee includes cost of rental of academic dress.

Health and accident insurance is made available to full time day students at a reasonable cost. See page 52.

Students are advised to defer expenditures for books until the official list of textbooks has been posted at the College Bookstore.

For the first semester of the freshman year, books cost approximately $80.00 with an additional $50.00 covering the cost of a slide rule, drawing instruments and general supplies for that semester. Books and supplies for the second semester of the freshman year will cost approximately $35.00.

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

EVENING DIVISION

Information concerning expenses for the Evening Division will be found on pages 72-74.

PROCEDURES

REGISTRATION

Prospective students will be informed of registration procedures by the Registrar, after the latter has received certification of acceptance from the Dean of Admissions.

Students entering the College for the first time are required to submit before registration a *completed physical examination form* which will be furnished by the Registrar. The form must be prepared by a physician within a thirty-day period preceding registration for the first semester. Each examination will be reviewed by the College physician.

Currently enrolled students will be informed of registration procedures (during July for the Fall Semester and during January for the Spring Semester) by the Registrar.

Former students (not currently enrolled), after being readmitted by the Dean of Students, will be informed of registration procedures by the Registrar.

Failure to complete registration by the close of the registration period will make the student subject to payment of a late fee. (See page 43.)

CHANGE OF PROGRAM

A student who adds a course, or courses, to his program will be charged the full tuition and fee for the course, or courses, added, regardless of the date on which the addition takes place. If, *within the first two weeks of the semester,* a student changes his schedule, he must fill out a set of schedule change forms and see to it that they are properly authorized. His charges will then be recalculated and, if he is entitled to a refund or financial credit, such refund or credit will be made.

If the dropping of a course, or courses, causes the change to be classified as a withdrawal from College, the student should follow the procedures stipulated in the section "Withdrawals from College—General," below.

READMISSION

Students of any of the groups listed below who wish to resume their studies at the College must apply for readmission:

1. Students who withdraw from the College during any semester and wish to return for the next or any succeeding semester,
2. Former students who have not been in attendance for one or more semesters, and

3. Students who have been dismissed for academic reasons.

Students who have been dismissed for academic reasons are not eligible to apply for readmission until one semester has elapsed since the time of their dismissal. The results of a recent series of aptitude tests (which can be arranged at no cost to the applicant) must be on file at the Counseling Center. This is mandatory for both Day and Evening students.

To initiate readmission, students must obtain an Application for Readmission at the offices of either the Dean of Students or Registrar and then complete and submit this form with the required readmission application fee of $5.00 to the Dean of Students. Deadline dates for the receipt of applications for readmissions are as follows:

For the Fall Semester ..... August 15
For the Spring Semester ..... January 15
For the Summer Session ..... May 15

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

TRANSCRIPT OF GRADES

A transcript of grades is issued to the student by the Registrar at the end of each semester. Students who wish to have a Transcript of Record issued on their behalf must submit a request in writing to the Registrar. Transcript requests must be accompanied by a payment fee of $1.00 for each copy issued subsequent to the first, which is issued at no charge. Grades are discussed fully in the section "Criteria for Graduation."

WITHDRAWALS AND REFUNDS

WITHDRAWAL PROCEDURE

Registration for a course places a definite responsibility upon the student to carry the course through to conclusion and to receive the grade he has earned. However, it is recognized that in exceptional cases it may be impossible for the student to continue in attendance. If a student wishes to withdraw from a course, or courses, or from college, he should notify the Dean of Students in writing, using a form to be obtained from his office or from the Registrar.

A student may resign from any subject during the first eight weeks of the term, or equivalent, and receive an "R" in any subject from which he resigns. After the first eight weeks, or equivalent, when an instructor has reason to believe that a student is no longer in attendance and if the student's class standing at the time of last attendance is 2 or better, the instructor will report a grade of "W"; if below a 2, the instructor will report a grade of "O," except that if the withdrawal comes within the last four weeks, or equivalent, of the semester, the

student will be given the grade earned as of the end of the semester.

Should a student be forced to withdraw due to causes beyond his control, the matter should be promptly referred to the Dean of Students for consideration.

The receipt of the notice by the Dean of Students will be considered as the date of the withdrawal.

Students withdrawing from a course, or courses, or from college, should adhere strictly to the general regulations as stated above.

WITHDRAWALS FROM COLLEGE—SELECTIVE SERVICE

Any student who is forced to withdraw from college because of induction by selective service is entitled to a pro rata refund as of the date of his induction. If his induction occurs after the middle of a semester, certain options are available to the student, and he is advised to confer with the Dean of Students concerning particulars. In order to obtain a refund in a case of induction, a student should submit a copy of his notice of induction with the notice of withdrawal.

WITHDRAWALS FROM COLLEGE—GENERAL

A student who is forced to withdraw from college for reasons other than induction by selective service may, if the reasons are beyond his control, apply to the Business Manager for a refund. The application should state fully the reasons for the withdrawal and should include necessary verification such as, in the case of illness, a doctor's certificate. Refunds are based on the date on which the application is received. If the Committee on Refunds, to which the Business Manager will refer the application, approves it, a refund will be recommended to the Board of Trustees for consideration.

Matriculation fees, registration fees, and all other fees except laboratory and general fees, are under no condition returnable.

REFUNDS

If a refund is approved by the Board of Trustees, the percentage of tuition and general fee refunded will be based on the following table:

Date of Receipt of Application	*Percentage Refund*
During the first week of the term	80%
During the second week of the term	80%
During the third week of the term	60%
During the fourth week of the term	40%
During the fifth week of the term	20%
During the remainder of the term	0%

The above schedule applies only to the regular fall and spring semesters but will also be used as a guide to compute comparable percentage refunds for short terms, such as during a summer session.

SCHOLARSHIPS, AWARDS AND STUDENT AID

SCHOLARSHIPS AND AWARDS

Through the years the College has received applications from students who have shown a definite need for financial assistance in meeting their college expenses. For such needy young men who also possess the ability to carry on engineering study satisfactorily, certain scholarships are available.

Most of the following scholarships are available to full time students registered in the Day Division. It is expected that since evening students will be engaged during the day in income-producing occupations, there will be few cases where scholarship assistance is actually required.

Alcoa Foundation Scholarships

Four scholarships of $250 a year have been established by the Aluminum Company of America for junior and senior students who stand high scholastically in their class and show a potential of becoming successful engineers in their particular field.

American Society of Tool Engineers Scholarship

A scholarship is awarded by Chapter 14, A.S.T.E. every four years to a freshman student of sound scholastic ability who has a need for financial assistance. The payment of $150 will be made each year for four years, provided the recipient maintains his scholastic average. The student must elect those courses in the Mechanical Engineering curriculum which are specific to the Tool Engineering field. In addition to the monetary award, there will be provided a free student membership in A.S.T.E. for the four year period.

Board of Trustees Scholarships

A limited number of scholarships in the amount of $100 each are made available each fall and spring semester by the College Board of Trustees.

Blonder-Tongue Foundation Award

A scholarship of $250 has been established for award to a senior in electrical engineering in recognition of high scholastic attainment and the demonstration of outstanding potential in the fields of radio and television (electronics).

Boy Scout Scholarships

The Board of Trustees has granted two scholarships, the recipients of which are to be chosen from scouts in Newark, Belleville and Irvington by the Robert Treat Council of Boy Scouts of America.

Business and Professional Women's Club of Newark Scholarship

The Business and Professional Women's Club of Newark awards a two-year scholarship to an outstanding woman student who has completed her first year at NCE.

Eva Cohn Scholarships

By the will of Eva Cohn a few scholarships are available for worthy and capable students in financial need.

Colton Memorial Scholarship

A Colton Memorial Scholarship, established in memory of Dr. Charles A. Colton, first director of the Newark Technical School, is awarded each year by the Scholarship Fund Trustees of the Newark College of Engineering Alumni Association, in the amount of $400, to a member of the Freshman class. Applicants will be considered on the basis of high school record, College Board scores, and need.

Allan R. Cullimore Memorial Scholarship

A scholarship in memory of the late Dr. Allan R. Cullimore, former president of the College, is awarded annually by the Scholarship Fund Trustees of the Newark College of Engineering Alumni Association. This scholarship, in the amount of $400, will be awarded in the Spring semester to the Junior class member having the highest grade-point average in the Class during the first five semesters at NCE.

John Christopher Denman Scholarship Fund

This fund has been established to provide a scholarship for an evening school student who wishes to take professional work at NCE.

Essex County Engineering Society Scholarships

The Society will provide one or more scholarships in the amount of $200.00 annually, divided equally between

two successive semesters. The student must have maintained a satisfactory academic record through one or more years at this institution and must need financial assistance.

Other things being equal, the son or daughter of a professional engineer will be given preference. The student must be willing to take such tests as may be requested by the college committee appointed to select the recipient. The recipient will automatically become the nominee for the same award for the next year unless he no longer requires financial assistance, in which case the award will be made to another qualified student. The final selection of each candidate will be made by a committee of the faculty of the college.

General Motors Corporation Scholarships

One General Motors Corporation Scholarship to Newark College of Engineering is awarded each year to an entering freshman. The amount of the award is flexible, depending upon the need of the individual for financial assistance, and ranges from an honorary award of $200 up to $2000 per year. The scholarship is renewable for four years providing the recipient maintains a high academic record.

Herbert P. Gleason Scholarships

By the will of Herbert P. Gleason several scholarships are available from time to time for young men of character and ability.

The Irvington Optimist Club Scholarship

The Optimist Club of Irvington offers annually a $350 scholarship at Newark College of Engineering to a senior boy in one of the high schools in Irvington, New Jersey.

A committee of school personnel determines the winner and an alternate on the basis of need, scholarship, College Board scores, marks, especially in English, mathematics, and science, personality ratings, and extra curricular activities. The winner must already have been accepted at Newark College of Engineering and determination made that he will definitely attend Newark College of Engineering.

Junior Achievement Scholarship

The college Board of Trustees annually awards a scholarship of $200.00 to be used to pay part of the first year's tuition expenses for a Junior Achiever. Candidates are selected by the National Scholarship Committee of Junior Achievement.

Odon S. Knight Memorial Award

Each year a scholarship is awarded by the North Jersey Section, American Institute of Chemical Engineers to a senior chemical engineering student. The award will be announced upon completion of the student's junior year. The recipient must be of outstanding scholarship, good character, and in need of financial assistance.

New Jersey Society of Professional Engineers Scholarship Awards

Each year the New Jersey Society of Professional Engineers awards one or more scholarships to regular daytime students who are in the last year of candidacy for the Bachelor's Degree in a curriculum accredited by the Engineers Council for Professional Development. Students of Newark College of Engineering and three other engineering colleges in New Jersey are eligible for consideration. Each scholarship is in the amount of $500.00 with final selection determined by the scholarship committee of the college.

John A. Schieck Memorial Fund

By the will of Caroline D. Schieck, a scholarship fund has been established in the name of her brother, John A. Schieck. From time to time several scholarships will be available from this fund.

William L. Schoonover Scholarships

By the will of William L. Schoonover several scholarships are available from time to time for worthy and capable students in financial need.

Arthur Silverman Scholarship

Arthur Silverman, Class of 1939, makes available to NCE a yearly scholarship covering tuition and fees which is awarded to a student upon the recommendation of the scholarship committee.

Union Carbide Engineering Scholarship

One scholarship is awarded each year to an entering freshman who intends to specialize in either Chemical or Mechanical Engineering. The scholarship is renewable each year, provided the student maintains a high grade point average.

United States Rubber Company Foundation Scholarships

Funds for a limited number of annual scholarships have been granted to Newark College of Engineering to assist junior and senior year students of proven ability who lack personal financial resources.

Western Electric Fund Scholarships

These scholarships are awarded annually by the Western Electric Co., Inc. to third and fourth year students who exhibit high academic performance. Awards are made by the scholarship committee and cover tuition, books, and fees.

Materials Handling Prize

The Silent Hoist and Crane Company Materials Handling Award is presented annually for the best papers on the subject of materials handling. The award is made from proceeds from a trust established by the Wunsch Foundation, Inc., of Brooklyn.

STUDENT AID

The College participates in the National Defense Student Loan Program of the Federal Government whereby outstanding full-time students at the College may secure loans to meet the cost of attending the College and make repayment after graduation or leaving the College.

The College also administers several loan funds from which loans may be made to a limited number of students. These funds include the Continental Electric Company Student Loan Fund, the Sanford L. Kahn Loan Fund, Morris County Association of Professional Engineers and Land Surveyors Loan Fund, Newark College of Engineering Scholarship Fund, the Abraham Rothschild Loan Fund, the David Steinman Foundation Loan Fund, Senior Loan Fund, and Mechanical Engineers' Loan Fund.

Some part time positions in the college during hours when classes are not in session, or in the evening or during holiday periods, are also available to students who can qualify for such positions. Students interested in obtaining such part-time positions should consult the Dean of Students.

Applications for any form of student aid should be made to the Dean of Students.

HEALTH AND ACCIDENT INSURANCE

Health and accident insurance protection is available at low rates to all day students on a group basis. Coverage extends 24 hours per day throughout the 12 month period or until a student ceases to be enrolled as a day undergraduate.

Subscription to the insurance coverage is voluntary, although each student is required at registration to submit a statement declaring whether or not he desires to enroll in the Student Medical Reimbursement Insurance Plan.

INFORMATION FOR VETERANS

All of the programs of the College are available under Public Law 550.

A newly-accepted student who is eligible for, and wishes to take his college program under V.A. benefits should, without delay, apply to the Veterans Administration Regional Office, Newark, N. J., for a Certificate for Education and Training. Once certified by the Veterans Administration, it is the responsibility of each veteran to see the Veterans' Coordinator of the College at each registration.

Veterans' Administration regulations state that any course which has been completed satisfactorily may be repeated only at the veteran's own expense.

Veterans eligible for training under Public Law 550 should be prepared to meet their financial obligations to the College at each registration.

Public Law 87-815 provides educational assistance for veterans who sustained a 30% minimum service-connected disability in peacetime military duty. All such veterans have until October 15, 1971 to file for benefits with the Veterans Administration.

WAR ORPHANS ACT

Public Law 634 provides education and training at higher institutions to all children of servicemen who died as a result of a disability or disease incurred in line of duty during World War I, II, or the Korean War. Any applicant or student between the ages of 18 and 23 who believes he is eligible under this bill should contact the Veterans Administration Regional Office, Newark, New Jersey.

PLACEMENT

RELATIONS WITH INDUSTRY

The aims and purposes of the college program are directed toward properly preparing the student for his place in industry. Under the guidance and supervision of the professional departments he has been trained in the fundamentals of engineering principles. He has further received instruction in the human relations problems of industry in the courses of the Department of Industrial Relations. It is the function of the Department to culminate that training by helping place the individual student in the type of work for which he has demonstrated interest and ability.

PROFESSIONAL DEVELOPMENT PROGRAM

The Professional Development Program is intended to supply the opportunity for qualified students to take on the challenge of more advanced work assignments offered through a cooperative plan with industry for the summer months.

Each year a number of industrial firms and governmental agencies are solicited for the purpose of identifying a list of selected pre-engineering positions demanding students of above average academic achievement.

The program is open to Sophomore and Junior students in the Day Division who achieve a minimum G.P.A. of 3.00. The students so qualified will receive priority placement in the job opportunities made available through this program. A student who meets the requirements of high academic excellence and who achieves satisfactory job progress reports from industry will receive a certificate of distinction at the conclusion of the year's program. Furthermore, those students who successfully maintain this class rank for the Sophomore and Junior academic years and attain satisfactory work performance records in industry for two summers will receive a special citation on their diplomas at graduation in recognition of this outstanding achievement.

PLACEMENT

Modern industry, with its activity in research, design, development, production, and management, recognizes academic achievement as only one of its criteria for selection. The criteria for advancement, in addition to the academic, are initiative, industry, and leadership. It is for this reason that the Department coordinates its efforts in placement with the Counseling Center and the professional departments with the single aim of making the recruiting period as efficient as possible for both the students and company representatives.

Each candidate for graduation is provided with a printed schedule of company recruiting dates, and arrangements may be made through the Placement Office for interviews with representatives of companies who regularly recruit at the college. An up-to-date Relations With Industry file of company information is available to make the students' preparation a thorough one.

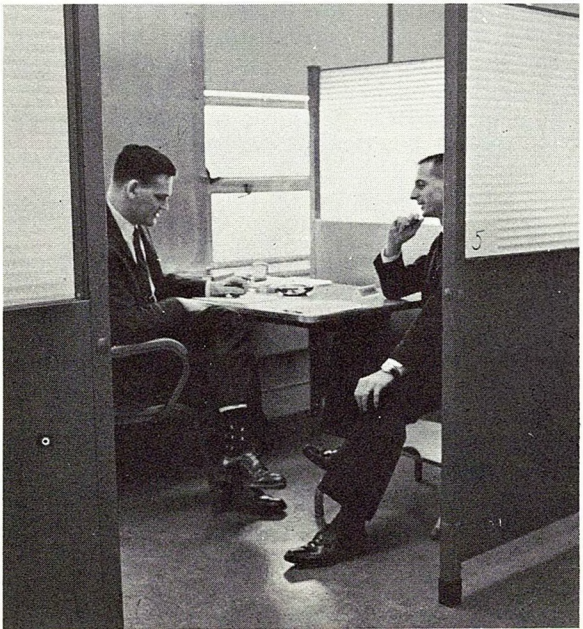
Recognizing the importance of the placement interview, both to the student and the company representatives, the College has made available modern and comfortable interviewing facilities.

For use during his stay at the College, each company representative is supplied a folder on each student he will see which contains a transcript, grade point averages, and a personal summary which has been prepared by the student for this purpose.

The Summer Employment Work Evaluation Forms of students participating in the Professional Development Program will also be included.

The department maintains a file of all job openings received for candidates for graduation as well as for alumni. The Placement Office is open all year during business hours and on designated evenings as a service to students and to industry.

The Placement Office provides information on part-time off-campus employment for students throughout the year. Part-time positions in the various areas of the College are listed with the office of the Dean of Students. Assistance in obtaining summer employment is available to all undergraduate and graduate students. Since the best interest of the student requires unqualified attention to his course of study, the Placement Office supervises such placements and feels that outside activity should be limited to the ability of the individual student.



STUDENT LIFE

Student life, through its guidance, counseling, and extracurricular programs, plays an important role in preparing NCE students for their eventual careers in industry, education and government. Membership in the College's various clubs and athletic organizations, in professional and honor societies, and in student government councils provides excellent training for eventual participation in similar activities beyond college. The guidance resources of NCE provide additional aids for students in academic, vocational and personal decision-making.

GUIDANCE AND COUNSELING

The guidance and counseling services of the College are coordinated by the Dean of Student's office and are available to all students through their Freshman Adviser, the Dean of Students, and the Counseling Center. During their Orientation Program, freshmen learn about the engineering education they will be offered. At this time the Counseling Center administers a comprehensive battery of tests, and the freshmen are introduced to the total counseling and guidance program. As freshmen, they utilize the services of the Freshman Adviser for problems of a vocational, academic, social or personal nature. When they become upperclassmen, the Dean of Students acts as their adviser. When a problem requires intensive counseling, the students are referred to the Counseling Center. The Counseling Center also provides valuable pre-employment counseling for all seniors.

STUDENT GOVERNMENT

A Student Council, acting with the Assistant Dean of Students as the adviser, constitutes the basic form of student government. This group is composed of officers who are elected by the student body and of representatives from various special-interest areas. The Council also coordinates the overall Student Activity Program. The Freshman, Sophomore, Junior and Senior classes are organized further to meet the needs of these student groups.

SOCIAL ACTIVITIES

Social gatherings range from dinner meetings and lectures conducted by student professional societies to class or fraternity-sponsored dances and outings. In all cases, the group sponsoring a social event is responsible for the conduct of those attending, including that of members and guests. Further, each student is expected always to conduct himself on the basis of high professional standards.

Ten social fraternities offer the student desiring this type of affiliation a choice of the fraternity in which he may wish to

participate. Representatives of these fraternities to the Interfraternity Council coordinate various unified programs of the group.

SPECIAL INTEREST ORGANIZATIONS

The development of individual interests is fostered by the opportunity for participation in a number of organizations. Those students wishing to develop spiritually may participate in the Christian Fellowship or in Newman Club activities. In addition, there are club activities in physical recreation, such as skiing, rod and gun, yachting and golf. The Audio, Bridge, Chess, Dance, Motor, Photo and Radio Clubs, and a number of others, offer additional opportunities for students with special interests.

COEDUCATIONAL ACTIVITIES

The coeds of the College participate actively in student government, clubs and social organizations, and in professional and honor societies. Sigma Chi Epsilon, a College sorority open to all coeds, promotes social and intellectual activities of special significance to women students.

STUDENT PUBLICATIONS

A newspaper, *The Vector,* is operated and published entirely by student staff members. There is a yearbook, *Nucleus,* published by each Senior class. *Log NCE,* the handbook for freshmen, as well as professional, departmental, and other publications, are also edited by students.

HONOR SOCIETIES

Freshmen who rank in the upper 20 percent of their class are considered for membership in Phi Eta Sigma, national scholarship society for freshmen. The College is also among the leading engineering colleges of the United States having a chapter of Tau Beta Pi, the honorary engineering society. Membership in this distinguished organization is open, by election, to junior and senior students of high scholarship and exemplary character, of unselfish activity and breadth of interest in technical and nontechnical fields.

There are also several other national honor societies. Omicron Delta Kappa, leadership society, recognizes students on the basis of character and specific eligibility in scholarship and extracurricular activity. Faculty and alumni members are chosen for similar qualities. Four national honor societies are associated with particular professional departments, all of them open only to juniors and seniors: Omega Chi Epsilon, Chemical Engineering; Pi Tau Sigma, Mechanical Engineering; Eta Kappa Nu, Electrical Engineering; and Chi Epsilon, Civil Engineering.

The Arnold Air Society is the honor society of the Air Force Reserve Officers Training Corps. Its purpose is to further the mission, tradition, and concept of the Air Force as a means of defense, to promote American citizenship, and to create a closer and more efficient relationship among the students. Membership is limited to advanced students who qualify academically, show an interest in the Air Force ROTC program, and are considered favorably in voting sessions of the active members of the squadron.

PROFESSIONAL SOCIETIES

National professional engineering societies sponsor student branches at the College. The societies represented are the American Chemical Society, American Institute of Chemical Engineers, American Society of Civil Engineers, American Institute of Industrial Engineers, American Society of Mechanical Engineers, Institute of Electrical and Electronics Engineers, and Society for the Advancement of Management.

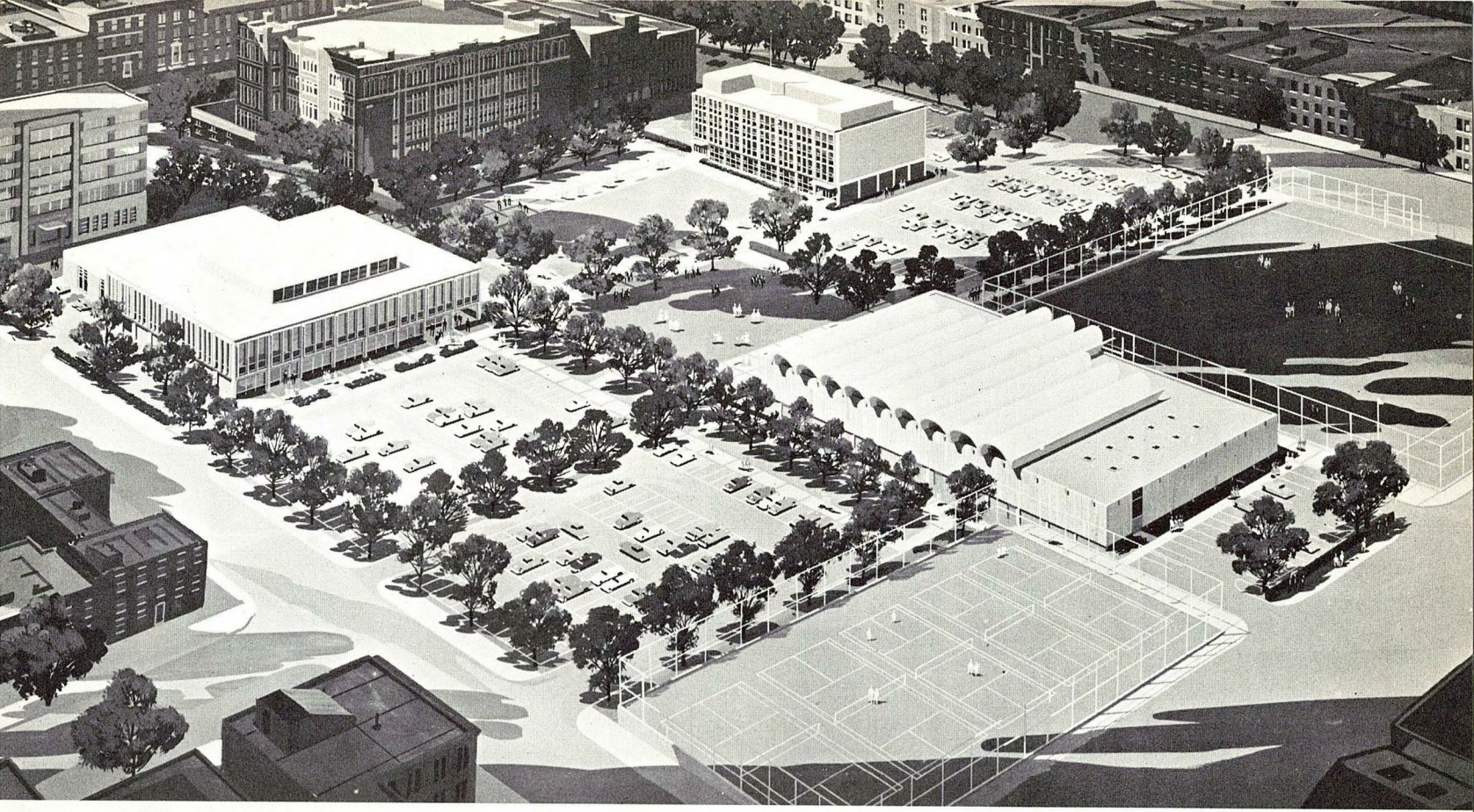
The faculty encourages student participation in the activities of the student branches of these societies as an important phase of their engineering education.

ATHLETICS

The Director of Health, Physical Education, and Athletics, assisted by the joint Student-Faculty Athletic Committee and the Student Athletic Association directs an extensive and varied program in athletic activities which reflects the interests and capabilities of the engineering student and provides him with opportunities for participation.

Intercollegiate competition is usually provided in soccer, basketball, baseball, bowling, tennis, golf, fencing, and riflery. On an intramural level, competition is college-wide in the form of tournaments in basketball, bowling, softball, table tennis, volleyball, and badminton.

Students are encouraged to participate in a wide range of activities on a purely amateur basis. Interested members of the faculty participate in the capacity of coach or adviser.



ARTIST'S RENDERING OF EXPANDED NCE CAMPUS,
SCHEDULED FOR COMPLETION IN 1965.

CURRICULUMS

DAY DIVISION

The Freshman Year is common to all curriculums. Note that the Sophomore Year requires a choice of department of major study. Much of the Sophomore curriculum is common to all departments; but to provide the proper sequence of courses, certain differences appear in each departmental program. The courses common to all departments are listed first, followed by those peculiar to each department.

Students taking the Air Force ROTC program will find the necessary course requirements listed for each year under the heading "Air Science Option." These courses are to be taken *in addition* to regular courses in the Freshman and Sophomore Years and *in lieu of* courses indicated by an asterisk in the Junior and Senior Years.

The numbers following the course title under the headings "1st Semester" and "2nd Semester" represent, in order: class hours per week, laboratory hours per week, and credits for the semester. All courses are one-semester courses.

FIRST YEAR
COMMON TO ALL CURRICULUMS

COURSE NUMBER		TITLE	1ST SEMESTER		2ND SEMESTER	
(Chem 15)	(Chem 16)	General Chemistry	4-3	4½	4-3	4½
(EG 1)	(EG 2)	Engineering Graphics	1-3	2½	1-3	2½
(Eng 11)	(Eng 12)	Composition and Literature	3-0	3	3-0	3
(Math 10)		Mathematics	4-0	4	-	
	(Math 15)	Differential Calculus	-		4-0	4
(Phys 1)	(Phys 2)	Physics I & II	3-2	3½	3-2	3½
(IR 31)		Psychology of Personal Adjustment	2-0	1	-	
		Physical Education	0-1	0	0-1	0
AIR SCIENCE OPTION						
(AS 1)	(AS 1)	First Year Basic Course	†0-1	½	2-1	1½

† A six-hour orientation program will be given.

CHEMICAL ENGINEERING

B.S. (Ch. E.)

FIRST YEAR

The courses offered in the First Year will be found on page 59.

SECOND YEAR

Course Number		Title	1st Semester		2nd Semester	
(Eng 21)		English and American Literature to 1850	3-0	2		
	(Eng 22)	English and American Literature after 1850	-		3-0	2
(Math 20)		Integral Calculus	4-0	4	-	
	(Math 25)	Intermediate Analysis	-		4-0	4
(Phys 3)	(Phys 4)	Physics III & IV	3-2	3½	3-2	3½
(Mech 1)		Statics	3-0	2	-	
	(Mech 2)	Dynamics	-		3-0	2
(IE 23)		Economics	3-0	2½	-	
	(IR 34)	Elements of Industrial Growth	-		3-0	2
(Hist 21)	(Hist 22)	Development of the Modern World	3-0	2½	3-0	2½
(Chem 28)		Quantitative Analysis	1-4	2		
	(ChE 27)	Chemical Engineering Problems	-		3-0	2
AIR SCIENCE OPTION						
(AS 2)	(AS 2)	World Military Systems	2-1	1½	0-1	0

THIRD YEAR
(1964-65 only)

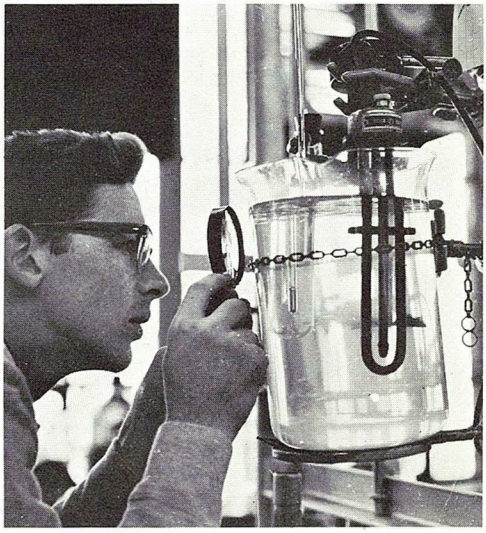
(ChE 27)		Chemical Engineering Problems	3-0	2	-	
	(ChE 28)	Reaction Equilibria & Kinetics	-		3-0	2
(ChE 32)	(ChE 35)	Physical Chemistry I & II	3-0	2	3-3	4
(ChE 41)	(ChE 42)	Organic Chemistry I & II	3-3	3½	3-3	3
(ChE 43)	(ChE 44)	Unit Operations I & II	3-0	3½	3-0	3
	(Math 30)	Mathematics for Engineers I	-		3-0	2½
(EE 92)		Electrical Engineering	3-3	3	-	
	(IR 25)*	Human Relations	-		2-0	1½
(IR 27)*		Labor Relations	3-0	2	-	
		Elective (Humanities)†	3-0	2½	3-0	2½
*AIR SCIENCE OPTION						
(AS 3)	(AS 3)	Growth and Development of Aerospace Power	4-1	2½	4-1	2½

† The humanities elective program is outlined on page 70.

FOURTH YEAR
(1964-65 only)

Course Number		Title	1st Semester		2nd Semester	
(ChE 45)	(ChE 46)	Chemical Engineering Thermodynamics	3-0	2½	3-0	2½
(ChE 47)		Process Kinetics	3-0	3	-	
(ChE 55)		Chemical Engineering Measurements	0-3	2	-	
	(ChE 56)	Instrumental Analysis	-		0-3	2
(ChE 57)	(ChE 58)	Unit Operations III & IV	3-3	4	3-3	5
(ChE 59)	(ChE 60)	Process & Plant Design I & II	1-2†	2½	1-3†	3½
	(Mech 5)	Mechanics of Deformable Bodies	-		4½-1½	4
(IR 26)*		Personnel Administration	2-0	1½	-	
	(IR 28)*	Contemporary Issues	-		3-0	2
		Elective (Technical)	2-0	2	-	
*AIR SCIENCE OPTION						
(IR 38)		Industrial Relations	2-0	1½	-	
	(IR 29)	Contemporary Issues	-		2-0	1½
(AS 4)	(AS 4)	The Professional Officer	4-1	2½	4-1	2½
TECHNICAL ELECTIVES						
(ChE 61)		Chemical Engineering Metallurgy	2-0	2	-	
(ChE 62)		Chemical Engineering Problems II	2-0	2	-	

† In this course, the laboratory hours refer to hours of design.



CIVIL ENGINEERING

B.S. (C.E.)

FIRST YEAR

The courses offered in the First Year will be found on page 59.

SECOND YEAR

Course Number		Title	1st Semester		2nd Semester	
(Eng 21)		English and American Literature to 1850	3-0	2	-	
	(Eng 22)	English and American Literature after 1850	-		3-0	2
(Math 20)		Integral Calculus	4-0	4	-	
	(Math 25)	Intermediate Analysis	-		4-0	4
(Phys 3)	(Phys 4)	Physics III & IV	3-2	3½	3-2	3½
(Mech 1)		Statics	3-0	2	-	
	(Mech 2)	Dynamics	-		3-0	2
(IE 23)		Economics	3-0	2½	-	
	(IR 34)	Elements of Industrial Growth	-		3-0	2
(Chem 25)		Principles of Engineering Materials	3-0	2½	-	
	(CE 3)	Surveying	-		3-3	4
(CE 42)		Environmental Sanitation	2-0	2	-	
AIR SCIENCE OPTION						
(AS 2)	(AS 2)	World Military Systems	2-1	1½	0-1	0

THIRD YEAR

(CE 21)	(CE 22)	Strength of Materials I & II	3-3	3½	3-0	2½
(CE 40)		Fluid Mechanics I	5-0	4½	-	
(CE 61)		Electronic Computations	3-1	3	-	
	(EE 90)	Electrical Engineering	-		2-2	3
	(IE 93)	Enterprise Management	-		6-0	4½
	(ME 41)	Thermodynamics I	-		3-0	2½
(Hist 21)	(Hist 22)	Development of the Modern World	3-0	2½	3-0	2½
	(IR 25)*	Human Relations	-		2-0	1½
(IR 27)*		Labor Relations	3-0	2	-	
		Elective (Technical)	3-0	3	3-0	3
*AIR SCIENCE OPTION						
(AS 3)	(AS 3)	Growth and Development of Aerospace Power	4-1	2½	4-1	2½
TECHNICAL ELECTIVES						
(CE 5)	(CE 6)	Advanced Surveying I & II	3-0	3	3-0	3
(CE 17)		Engineering Geology	3-0	3	-	
	(CE 45)	Fluid Mechanics II	-		3-0	3
(CE 47)	(CE 48)	Hydr. & San. Engrg. I & II	3-0	3	3-0	3
(CE 51)		Urban Planning	3-0	3	-	
	(CE 52)	Transportation Engrg.	-		3-0	3

FOURTH YEAR

Course Number		Title	1st Semester		2nd Semester	
	(CE 12)	Soil Mechanics	-		3-3	4
(CE 25)	(CE 26)	Structures I & II	6-0	5	3-0	3
	(Eng 41)	Engineering Report Writing	-		3-0	1½
(ME 73)		Thermodynamics for C.E. II	3-0	2	-	
(ME 77)		Power & Fluids Laboratory	0-3	2	-	
(IR 26)*		Personnel Administration	2-0	1½	-	
	(IR 28)*	Contemporary Issues	-		3-0	2
		Elective (Humanities)†	3-0	2½	3-0	2½
		Electives (Technical)	6-0	6	6-0	6

*AIR SCIENCE OPTION

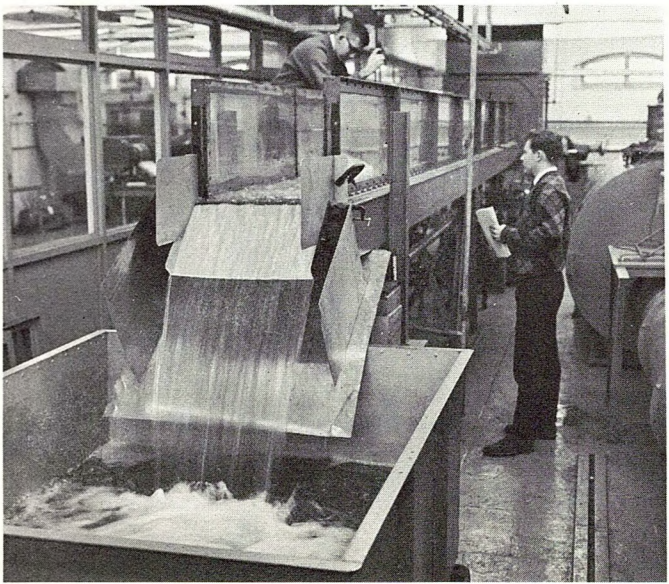
(IR 38)		Industrial Relations	2-0	1½	-	
	(IR 29)	Contemporary Issues	-		2-0	1½
(AS 4)	(AS 4)	The Professional Officer	4-1	2½	4-1	2½

TECHNICAL ELECTIVES

Students must take two courses per semester. Other graduate or undergraduate courses of 3 credits each may be elected with the approval of the student's adviser.

(CE 5)	(CE 6)	Advanced Surveying I & II	3-0	3	3-0	3
(CE 17)		Engineering Geology	3-0	3	-	
(CE 31)	(CE 32)	Constr. Management I & II	3-0	3	3-0	3
	(CE 45)	Fluid Mechanics II	-		3-0	3
(CE 47)	(CE 48)	Hydr. & San. Engrg. I & II	3-0	3	3-0	3
(CE 51)		Urban Planning	3-0	3	-	
	(CE 52)	Transportation Engrg.	-		3-0	3
(CE 63)	(CE 64)	Numerical Methods I & II	3-0	3	3-0	3
(CE 71)	(CE 72)	Civil Engrg. Projects I & II	3-0	3	3-0	3
(Chem 200)		Sanitary Microbiology‡	3-0	3	-	
	(Chem 201)	Sanitary Chemistry‡	-		3-0	3

† The humanities elective program is outlined on page 70.
‡ For a description of this course, refer to the 1964-65 catalog of *Graduate Courses*.



ELECTRICAL ENGINEERING
B.S. (E.E.)

FIRST YEAR

The courses offered in the First Year will be found on page 59.

SECOND YEAR

Course Number		Title	1st Semester		2nd Semester	
(Eng 21)		English and American Literature to 1850	3-0	2	-	
	(Eng 22)	English and American Literature after 1850	-		3-0	2
(Math 20)		Integral Calculus	4-0	4	-	
	(Math 25)	Intermediate Analysis	-		4-0	4
(Phys 3)	(Phys 4)	Physics III & IV	3-2	3½	3-2	3½
(Mech 1)		Statics	3-0	2	-	
	(Mech 2)	Dynamics	-		3-0	2
(IE 23)		Economics	3-0	2½	-	
	(IR 34)	Elements of Industrial Growth	-		3-0	2
(Hist 21)	(Hist 22)	Development of the Modern World	3-0	2½	3-0	2½
(Chem 25)		Principles of Engineering Materials	3-0	2½	-	
	(EE 10)	Electric Circuits and Measurements	-		3-2	3
AIR SCIENCE OPTION						
(AS 2)	(AS 2)	World Military Systems	2-1	1½	0-1	0

THIRD YEAR

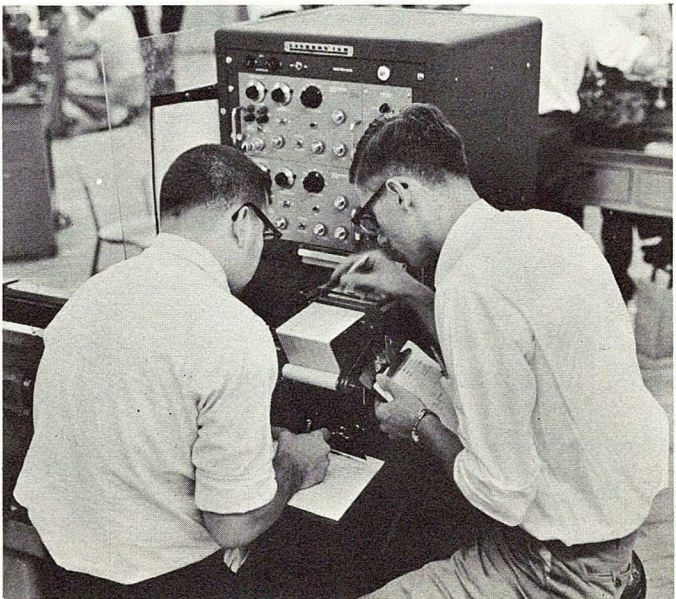
(EE 40)		Electronic Devices	3-0	2	-	
	(Mech 6)	Mechanics of Deformable Bodies	-		3-2†	4
(Math 30)	(Math 35)	Mathematics for Engineers I & II	3-0	2½	3-0	2½
(EE 20)		Passive Circuits	4-0	4	-	
	(EE 21)	Communications Networks	-		3-0	2
	(EE 42)	Active Circuits I	-		3-3	3½
(EE 60)		Electromagnetics	3-3	4	-	
	(EE 62)	Electrokinetics I	-		3-0	2½
(ME 41)		Thermodynamics I	3-0	2½	-	
	(ME 78)	Thermodynamics for E.E. II	-		3-0	2
	(IR 25)*	Human Relations	-		2-0	1½
(IR 27)*		Labor Relations	3-0	2	-	
		Elective (Humanities)‡	3-0	2½	-	
*AIR SCIENCE OPTION						
(AS 3)	(AS 3)	Growth and Development of Aerospace Power	4-1	2½	4-1	2½

† 5-0 on alternate weeks.
‡ The humanities elective program is outlined on page 70.

FOURTH YEAR

(1964-65 only)

Course Number		Title	1st Semester		2nd Semester	
(EE 22)		Transmission Circuits	4-0	3	-	
(EE 25)		Electromagnetic Fields	3-0	2½	-	
(EE 44)		Active Circuits II	3-3	4	-	
(EE 64)		Electrokinetics II	3-3	4	-	
	(EE 80)	Advanced Measurements	-		4-3	4½
		Elect. Engrg. Elective	-		3-0	2½
	(EE 86)	Elect. Engrg. Project	-		0-4	2½
	(IE 91)	Enterprise Management	-		4-0	3
(IR 26)*		Personnel Administration	2-0	1½	-	
	(IR 28)*	Contemporary Issues	-		3-0	2
(Math 33)		Probability and Statistics	3-0	2½	-	
		Elective (Technical)	-		3-0	2½
*AIR SCIENCE OPTION						
(IR 38)		Industrial Relations	2-0	1½	-	
	(IR 29)	Contemporary Issues	-		2-0	1½
(AS 4)	(AS 4)	The Professional Officer	4-1	2½	4-1	2½
TECHNICAL ELECTIVES						
	(Phys 5)	Electronic Physics	-		3-0	2½
	(Phys 6)	Engineering Physics	-		3-0	2½
	(Phys 7)	Nuclear Engineering	-		3-0	2½
ELECTRICAL ENGINEERING ELECTIVES						
	(EE 70)	Transistor Circuits	-		3-0	2½
	(EE 71)	Control Systems	-		3-0	2½
	(EE 74)	Analog Computation in Analysis and Design	-		3-0	2½
	(EE 75)	Digital Computer Circuits	-		3-0	2½
	(EE 76)	Microwaves	-		3-0	2½



INDUSTRIAL ENGINEERING

B.S. (I.E.)

FIRST YEAR

The courses offered in the First Year will be found on page 59.

SECOND YEAR

Course Number		Title	1st Semester		2nd Semester	
(Eng 21)		English and American Literature to 1850	3-0	2	-	
	(Eng 22)	English and American Literature after 1850	-		3-0	2
(Math 20)		Integral Calculus	4-0	4	-	
	(Math 25)	Intermediate Analysis	-		4-0	4
(Phys 3)	(Phys 4)	Physics III & IV	3-2	3½	3-2	3½
(Mech 1)		Statics	3-0	2	-	
	(Mech 2)	Dynamics	-		3-0	2
(IE 23)		Economics	3-0	2½	-	
	(IR 34)	Elements of Industrial Growth	-		3-0	2
	(Chem 25)	Principles of Engineering Materials	-		3-0	2½
(IE 24)		Production Process Design	2-2	3	-	
(IE 25)		Logic and Scientific Method	2-0	2	-	
	(IE 27)	Digital Computer Programming	-		2-0	2
AIR SCIENCE OPTION						
(AS 2)	(AS 2)	World Military Systems	2-1	1½	0-1	0

THIRD YEAR

(Math 33)		Probability and Statistics	3-0	2½	-	
	(Math 34)	Mathematics for Management Science	-		3-0	2½
(Hist 21)	(Hist 22)	Development of the Modern World	3-0	2½	3-0	2½
(Mech 6)		Mechanics of Deformable Bodies	3-2†	4	-	
	(ME 39)	Machine Design Fundamentals	-		3-0	2½
(ME 41)		Thermodynamics I	3-0	2½	-	
	(ME 75)	Thermodynamics for I.E. II	-		3-0	2
(IE 37)	(IE 38)	Work Anaylsis I & II	3-2	4	3-1	3
	(IE 47)	Accounting for Engineers	-		3-1	3
(IE 96)		Engineering Economy	2-0	2	-	
	(IR 25)*	Human Relations	-		2-0	1½
(IR 27)*		Labor Relations	3-0	2	-	
AIR SCIENCE OPTION						
(AS 3)	(AS 3)	Growth and Development of Aerospace Power	4-1	2½	4-1	2½

† 5-0 on alternate weeks.

FOURTH YEAR
(1964-65 only)

Course Number		Title	1st Semester		2nd Semester	
(IE 39)	(IE 40)	Studies in Management Science I & II	3-2	3½	4-0	4
(IE 43)	(IE 44)	Systems & Control Design I & II	3-0	3	3-3	4½
(IE 95)		Engineering Economy	3-0	2	-	
(ME 39)		Machine Design Fundamentals	3-0	2½	-	
(ME 44)		Fluid Mechanics	3-0	2½	-	
	(IE 46)	Law	-		3-0	2
(IR 26)*		Personnel Administration	2-0	1½	-	
	(IR 28)*	Contemporary Issues	-		3-0	2
		Elective (Humanities)†	3-0	2½	3-0	2½
		Elective (Technical)	-		3-0	2½

*AIR SCIENCE OPTION

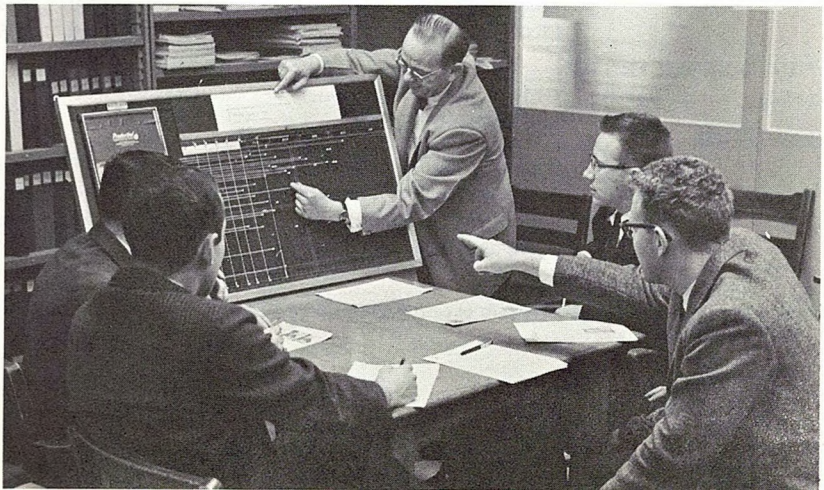
(IR 38)		Industrial Relations	2-0	1½	-	
	(IR 29)	Contemporary Issues	-		2-0	1½
(AS 4)	(AS 4)	The Professional Officer	4-1	2½	4-1	2½

TECHNICAL ELECTIVES

Students may elect one course in each semester of the Fourth Year. In areas where the student has the necessary prerequisites, he may choose electives of equivalent credit offered by other Engineering departments.

(IE 58)		Tool Engineering	3-0	2½	-	
	(IE 59)	Computerized Production Control	-		3-0	2½
(IE 60)		Inventory Models	3-0	2½	-	
(IE 61)		Statistical Quality Control	3-0	2½	-	
(IE 62)		Budgetary Planning and Control	3-0	2½	-	
	(IE 63)	Organization Planning and Control	-		3-0	2½
	(IE 64)	Product & Process Reliability	-		3-0	2½
	(IE 65)	Patent Law	-		3-0	2½

† The humanities elective program is outlined on page 70.



MECHANICAL ENGINEERING
B.S. (M.E.)

FIRST YEAR

The courses offered in the First Year will be found on page 59.

SECOND YEAR

Course Number		Title	1st Semester		2nd Semester	
(Eng 21)		English and American Literature to 1850	3-0	2	-	
	(Eng 22)	English and American Literature after 1850	-		3-0	2
(Math 20)		Integral Calculus	4-0	4	-	
	(Math 25)	Intermediate Analysis	-		4-0	4
(Phys 3)	(Phys 4)	Physics III & IV	3-2	3½	3-2	3½
(Mech 1)		Statics	3-0	2	-	
	(Mech 2)	Dynamics	-		3-0	2
(IE 23)		Economics	3-0	2½	-	
	(IR 34)	Elements of Industrial Growth	-		3-0	2
(Hist 21)	(Hist 22)	Development of the Modern World	3-0	2½	3-0	2½
	(Chem 25)	Principles of Engineering Materials	-		3-0	2½
AIR SCIENCE OPTION						
(AS 2)	(AS 2)	World Military Systems	2-1	1½	0-1	0

THIRD YEAR

(ME 10)§		Manufacturing Processes	0-3	2	-	
(ME 14)		Metallurgy	3-0	2½	-	
	(ME 15)	Metallography	-		0-3	1½
	(ME 31)§	Mechanisms	-		3-0	3
(ME 41)	(ME 42)	Thermodynamics I & II	3-0	2½	3-0	3
	(ME 43)	Mechanical Laboratory I	-		0-3	2
(ME 44)		Fluid Mechanics	3-0	2½	-	
(Math 30)		Mathematics for Engineers I	3-0	2½	-	
(Mech 6)		Mechanics of Deformable Bodies	3-2†	4	-	
	(IE 91)	Enterprise Management	-		4-0	3
	(IR 25)*	Human Relations	-		2-0	1½
(IR 27)*		Labor Relations	3-0	2	-	
		Elective (Humanities)‡	-		3-0	2½
		Elective	-		3-0	2½
*AIR SCIENCE OPTION						
(AS 3)	(AS 3)	Growth and Development of Aerospace Power	4-1	2½	4-1	2½
ELECTIVES						
	(Math 33)	Probability and Statistics	-		3-0	2½
	(Math 35)	Mathematics for Engineers II	-		3-0	2½
	(ME 55)	Automatic Controls	-		3-0	2½
	(ME 79)	Computer Solutions in M.E.	-		3-0	2½

† 5-0 on alternate weeks.
‡ The humanities elective program is outlined on page 70.
§ Offered each semester.

FOURTH YEAR

(1964-65 only)

Course Number		Title	1st Semester		2nd Semester	
(ME 33)		Vibration Analysis	3-0	2½	-	
(ME 34)	(ME 36)	Machine Design I & II	5-0	3	5-0	3
	(ME 37)	Structural Analysis	-		3-0	2
(ME 45)		Heat Transfer	3-0	3	-	
(ME 46)	(ME 48)	Mechanical Laboratory II & III	0-3	2½	0-3	2½
(EE 96)	(EE 97)	Electrical Engineering	3-2	3½	3-2	3½
	(IE 95)	Engineering Economy	-		3-0	2
(IR 26)*		Personnel Administration	2-0	1½	-	
	(IR 28)*	Contemporary Issues	-		3-0	2
		Elective (Technical)	3-0	2½	-	
		Elective†	-		3-0	2½

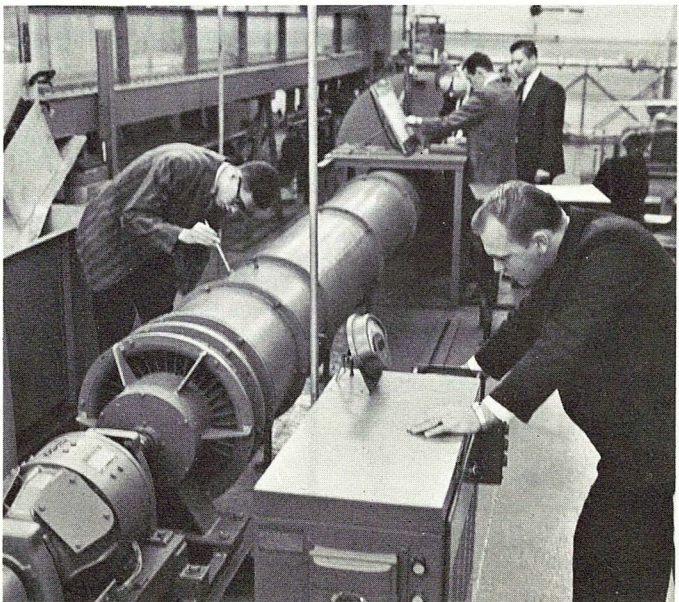
*AIR SCIENCE OPTION

(IR 38)		Industrial Relations	2-0	1½	-	
	(IR 29)	Contemporary Issues	-		2-0	1½
(AS 4)	(AS 4)	The Professional Officer	4-1	2½	4-1	2½

TECHNICAL ELECTIVES

(ME 53)	Energy Conversion	3-0	2½	-	
(ME 54)	Gas Dynamics	3-0	2½	-	
(ME 55)	Automatic Controls	3-0	2½	-	
(ME 56)	Fluid Machinery	3-0	2½	-	
(ME 79)	Computer Solutions in M.E.	3-0	2½	-	

† This course may be chosen from the field of mathematics, physics, or the humanities, or may be elected from departmental offerings.



HUMANITIES ELECTIVE PROGRAM

All courses in this program consist of 3 hours of lecture and offer 2½ credits. Under the heading "Course Number," 1st Semester courses stand to the left, 2nd Semester courses to the right. The program and courses are described in detail on page 105.

ARTS

Course Number		Title
(Arts 51)		Appreciation of Music
	(Arts 52)	Period, Style, and Genre in Music
(Arts 53)		Appreciation of Visual Arts
	(Arts 54)	Period, Style, and Medium in the Visual Arts

HISTORY

(Hist 51)		Aspects of Classical Civilization: The Legacy
	(Hist 51A)	Aspects of Classical and Medieval Civilization: The West and the East
(Hist 52)		Aspects of British Civilization: Modern British Society
(Hist 53)		Aspects of American Civilization: Political Economy
	(Hist 53A)	Aspects of American Civilization: The City
(Hist 54)		Special Areas: Modern Russian
	(Hist 54A)	Special Areas: Modern Germany
	(Hist 54B)	Special Areas: Contemporary Europe
(Hist 55)		Problems in Modern History: Political and Social Movements
(Hist 55B)		Problems in Modern History: Underdeveloped Areas

LITERATURE

(Lit 51)		An Era of Literature: The Renaissance
(Lit 51A)		An Era of Literature: Twentieth Century
	(Lit 51B)	An Era of Literature: Twentieth Century European Fiction
	(Lit 51C)	An Era of Literature: Modern Drama
(Lit 52)		A Form of Literature: Growth of European Fiction
(Lit 52A)		A Form of Literature: The English Novel
	(Lit 52C)	A Form of Literature: Forms of Modern Drama, Fiction, and Poetry
(Lit 53A)		A Recurrent Subject of Literature: The Good Life
	(Lit 54)	Principal Works of One Writer: Shakespeare

PHILOSOPHY

(Phil 51)		Principles of Philosophy: Philosophical Problems
	(Phil 51A)	Principles of Philosophy: Representative Philosophers
	(Phil 52)	Historical Developments in Philosophy: Development of Modern Thought
	(Phil 52A)	Historical Developments in Philosophy: Psychological Theories and Systems
	(Phil 52B)	Historical Developments in Philosophy: History of Economic Thought
(Phil 53)		Philosophical Foundations: Science
(Phil 53A)		Philosophical Foundations: Comparative Economic Thought
(Phil 53B)		Philosophical Foundations: Philosophy of Language

EVENING DIVISION

OBJECTIVES

The objectives of Newark College of Engineering, as described on page 33, do not vary with the time of day at which courses are given. For students in the Evening Division, however, time is an important consideration.

The available evening hours per week, when related to the curriculums as taken by Day students provides a ready means to determine the length of time necessary for the Evening curriculums if the two are to be identical. Time also affects slightly the sequence of courses.

The overall time necessary to complete the work required for a degree may be reduced by summer study. A list of courses available for summer study is published each Spring.

FACILITIES

The facilities and services of the College are available to students of both the Day and Evening Division. The College recognizes, however, that limitations of time and circumstances sometimes prevent evening students from taking full advantage of all areas of activity. The College has therefore provided evening hour coverage for those areas that are most important to the academic advancement of Evening students. A complete description of College facilities appears on pages 30-32.

STUDENT ACTIVITIES

Activities concerned with student life, while usually scheduled during the daytime period, are also available to Evening Division students. Students interested in these extracurricular activities, which are described in the section "Student Life," are advised to consult the Dean of Students for additional information.

Inquiries regarding information about scholarships and loan funds available to Evening students should be directed to the Dean of Students.

The Air Force ROTC program is not available to students registered in the Evening Division.

EXPENSES

TUITION AND FEES

JUNOR DIVISION (EVENING)

During 1964-1965, the tuition and regular fees per semester for students taking regular programs of study in the Junior Division (Evening) and Newark Technical School will be as follows:

	Charges per Semester	
	New Jersey Residents	*Non-Residents*
Tuition*	$ 95.00	$140.00
Regular Fees		
Registration	5.00	5.00
Student Facilities Fee	5.00	5.00
Total Tuition and Regular Fees per Semester	$105.00	$150.00

* Tuition includes charges for services other than instruction, such as library, publications, counseling, placement, etc., but does not cover the breakage or loss of College property.

Tuition charges are somewhat higher for special programs of study differing from those shown in this catalog.

TUITION AND FEES

SENIOR DIVISION (EVENING)

It is necessary for the College to adjust its tuition charges in the Senior Division (Evening) in accordance with the individual Block programs contained therein. These charges vary somewhat in accordance with the number of hours offered under each Block. There are certain fixed fees due and payable at each registration period in addition to these tuition fees. As in the case of the Junior Division (Evening) and the Day Division, every effort has been made to establish these fees at a level which will maintain the proper relation between the State, the City, and the direct beneficiary, the student.

Students taking complete Block programs exactly as published in this catalog are charged tuition at the rate of $11.00 *per contact hour per semester* if residents of the State of New Jersey, and $16.00 *per contact hour per semester* if non-residents. Students taking programs which differ from the Block schedule are charged at the rate of $14.00 *per contact hour per semester* if residents of the State of New Jersey, and $21.00 *per contact hour per semester* if non-residents.

Tuition includes charges for services other than instruction, such as library, publications, counseling, placement, etc., but does not cover the breakage or loss of College property.

APPLICATION, MATRICULATION AND SPECIAL FEES

JUNOR DIVISION (EVENING)

Registration is required for each semester. An extra REGISTRATION FEE *of $5.00 is required of those who register late.*

For the first semester of the first year, books cost approximately $45.00 with an additional $40.00 covering the cost of a slide rule and general supplies for that semester. Books and supplies for the second semester of the first year cost approximately $25.00.

SENIOR DIVISION (EVENING)

A REGISTRATION FEE *of $5.00 per semester is charged for each semester. An extra* REGISTRATION FEE *of $5.00 is required of those who register late.*

Each evening student is charged a STUDENT FACILITIES FEE of $5.00 per semester.

Students registering for the professional work of any semester in the Chemical Engineering Department, are charged a special LABORATORY FEE of $10.00 a semester, if residents of New Jersey, or $20.00 a semester if non-residents.

A GRADUATION FEE of $25.00 is required of all candidates for the Bachelor's Degree. The graduation fee includes the cost of rental of academic dress.

JUNIOR AND SENIOR DIVISIONS (EVENING)

Each candidate for admission to the College must pay an APPLICATION FEE of $5.00 at the time the application for admission is submitted. The fee is not returnable, regardless of whether or not the applicant is admitted to the College. This fee covers service which is necessary to evaluate applications for admission.

Any applicant for readmission to Newark College of Engineering must pay an APPLICATION FEE of $5.00 at the time the Application for Readmission form is submitted. (See section "Readmission," page 44.) This fee is not returnable, regardless of whether or not the student is readmitted to the College. This fee covers service which is necessary to evaluate applications for readmission.

A fee of $5.00 will be charged for the EVALUATION of official college transcripts submitted in accordance with the instructions set forth on page 40 of this catalog under the heading "Admission by Transfer." This is *in addition* to the application fee of $5.00 which all applicants must pay and covers service which is neces-

sary to evaluate transcripts of study completed at other institutions of higher education. It is not returnable, regardless of whether or not the applicant is admitted to the College.

Prospective students are charged a fee of $7.00 if they are required to take ADMISSION TESTS other than the required College Entrance Examination Board tests.

All students entering the College for the first time as candidates for a degree are charged a MATRICULATION FEE of $5.00.

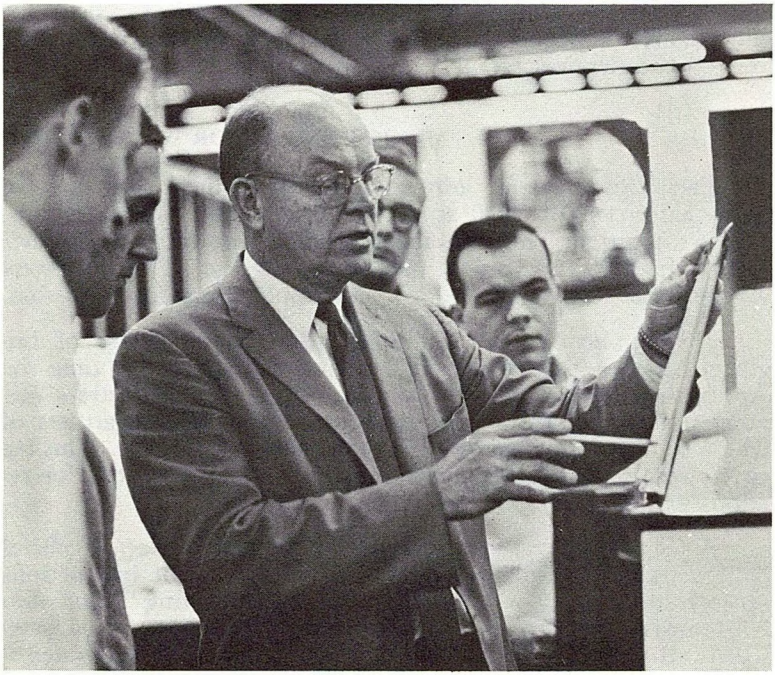
A fee of $2.00 is charged if, at the discretion of the College, it seems advisable for the student to be given a PHYSICAL EXAMINATION.

A fee of $1.00 is charged for the REMOVAL OF A GRADE of "INC."

For SPECIAL EXAMINATIONS, taken at times other than those regularly scheduled, a fee of $5.00 is charged.

Students are advised to defer expenditures for books until the official list of text books has been posted at the College Bookstore.

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



CURRICULUMS
EVENING DIVISION

The curriculums of the Evening Division have been undergoing revision. The first four years are common to all curriculums. Revisions are still being made in transition in the years 5-8 inclusive.

The numbers following the course title under the heading "1st Semester" and "2nd Semester" represent, in order: class hours per week, laboratory hours per week, and credits for the semester.

FIRST YEAR

COMMON TO ALL CURRICULUMS

COURSE NUMBER		TITLE	1ST SEMESTER		2ND SEMESTER	
(Eng 11)	(Eng 12)	Composition and Literature	3-0	3	3-0	3
(Math 10A)		Basic Mathematics	3-0	2½	-	
	(Math 10B)	Analytic Geometry	-		3-0	2½
(EG 1A)	(EG 2A)	Engineering Graphics	2-3	2½	2-3	2½
(IR 21)		Psychology	1-0	½	-	
	(IR 22)	Preface to the Engineering Profession	-		1-0	½

SECOND YEAR

COMMON TO ALL CURRICULUMS

(Eng 21A)	(Eng 21B)	English and American Literature to 1850	2-0	1½	2-0	1½
(Math 15A)	(Math 15B)	Calculus I & II	3-0	2½	3-0	2½
(Chem 15)	(Chem 16)	General Chemistry	4-3	4½	4-3	4½

THIRD YEAR

COMMON TO ALL CURRICULUMS

(Eng 22A)	(Eng 22B)	English and American Literature after 1850	2-0	1½	2-0	1½
(Math 25A)	(Math 25B)	Calculus III & IV	3-0	3	3-0	3
(Phys 1)	(Phys 2)	Physics I & II	3-2	3½	3-2	3½
(IR 23)	(IR 24)	Elements of Industrial Growth	2-0	1	2-0	1

FOURTH YEAR

COMMON TO ALL CURRICULUMS

(Phys 3)	(Phys 4)	Physics III & IV	3-2	3½	3-2	3½
(Mech 1)		Statics	3-0	2	-	
	(Mech 2)	Dynamics	-		3-0	2
(Hist 21)	(Hist 22)	Development of the Modern World	3-0	2½	3-0	2½

CHEMICAL ENGINEERING
B.S. (Ch.E.)

FIRST, SECOND, THIRD AND FOURTH YEARS

The courses offered in the first four years will be found on page 75.

FIFTH YEAR (Block 41 ChE)

Course Number		Title	1st Semester		2nd Semester	
	(Chem 25)	Principles of Engineering Materials	-		3-0	2½
(Chem 28-A)		Quantitative Analysis	1-3	2	-	
	(ChE 27)	Chemical Engineering Problems	-		3-0	2
(Che 32)	(ChE 35)	Physical Chemistry I & II	3-0	2	3-3	4
(Math 30)		Mathematics for Engineers I	3-0	2½	-	
(IE 23)		Economics	3-0	2½	-	

SUMMER SESSION§

(Mech 6)		Mechanics of Deformable Bodies	3-2†	4	-	

SIXTH YEAR (Block 42 ChE)*

(ChE 27)		Chemical Engineering Problems	3-0	2	-	
	(ChE 28)	Reaction Equilibria and Kinetics	-		3-0	2
(ChE 41)	(ChE 42)	Organic Chemistry I & II	3-3	3½	3-3	3
(ChE 57)		Chemical Engineering Measurements	0-3	2	-	
	(Mech 6)	Mechanics of Deformable Bodies	-		3-2†	4

SEVENTH YEAR (Block 43 ChE)*

(ChE 48)		Industrial Organic Chemistry	3-3	3	-	
(ChE 50)	(ChE 50)	Physical Chemistry Laboratory	0-3	2	0-3	2½
	(ChE 51-1B)	Chemical Engineering	-		4-0	4
(Eng 20)	(Eng 20)	English and American Literature	3-0	1½	3-0	1½
(IR 46)		Personnel Relations	3-0	3	-	
	(IR 48)	Industrial Relations	-		3-0	3

EIGHTH YEAR (Block 44 ChE)

(ChE 45)	(ChE 46)	Chemical Engineering Thermodynamics	3-0	2½	3-0	2½
(ChE 51-2B)	(ChE 51-2B)	Chemical Engineering	3-3	4	3-3	4
(ChE 59)	(ChE 60)	Process and Plant Design	1-2	2½	1-3	3½

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* 1964-65 only. Revised program will be published in the 1965-66 edition of this catalog.

§ To complete the program within an eight-year period, a student must take the course indicated during the summer session.

† 5-0 on alternate weeks.

CIVIL ENGINEERING
B.S. (C.E.)

FIRST, SECOND, THIRD AND FOURTH YEARS

The courses offered in the first four years will be found on page 75.

FIFTH YEAR (Block 41 CE-A)

To be taken in 1964-65 by students who completed the Fourth Year in 1963-64.

Course Number		Title	1st Semester		2nd Semester	
(CE 3)*		Surveying	3-3	4	-	
(EE 90)		Electrical Engineering	2-2	3	-	
	(CE 42)	Environmental Sanitation	-		2-0	2
	(CE 61)	Electronic Computations	-		3-1	3
	(Eng 41)	Engineering Report Writing	-		3-0	1½
		Elective (Humanities)†	3-0	2½	3-0	2½

* Eight six-hour Saturday field or laboratory periods to be arranged. No field work will be scheduled on the first Saturday of the semester.

FIFTH YEAR (Block 41 CE-B)

To be taken in 1964-65 by students who completed Block 42 CE in 1963-64. These students must take Dynamics (Mech 2) in lieu of a technical elective in Block 43 CE in 1966-67.

(CE 42)		Environmental Sanitation	2-0	2	-	
	(CE 61)‡	Electronic Computations	-		3-1	3
(Eng 20)	(Eng 20)	English and American Literature	3-0	1½	3-0	1½
	(Eng 41)	Engineering Report Writing	-		3-0	1½
(Eng 71)		History of Industrial Civilization	2-0	1	-	
(IR 34)		Elements of Industrial Growth	3-0	2	-	
		Elective (Humanities)†	3-0	2½	3-0	2½

† The evening elective program is outlined on page 82.
‡ Five three-hour Saturday laboratory periods will be arranged.

SIXTH YEAR (Block 42 CE)

Not offered in 1964-65. To be given in 1965-66.

(Chem 25)		Principles of Engineering Materials	3-0	2½	-	
(IE 23)		Economics	3-0	2½	-	
(CE 21)	(CE 22)	Strength of Materials I & II	3-3	3½	3-0	2½
	(CE 40)	Fluid Mechanics I	-		5-0	4½
	(IE 93A)	Enterprise Management	-		4-0	3

SEVENTH YEAR (Block 43 CE-A)‡

To be given in 1964-65.

Course Number		Title	1st Semester		2nd Semester	
(ME 41)		Thermodynamics I	3-0	2½	-	
	(ME 73)	Thermodynamics for C.E. II	-		3-0	2
(ME 77)		Power & Fluids Laboratory	0-3	2	-	
		Electives (Technical)†	6-0	6	9-0†	9

TECHNICAL ELECTIVES

Students must take two electives in the 1st Semester and three in the 2nd Semester. Only a limited number of technical electives will be offered each year.

(CE 5)*	(CE 6)	Advanced Surveying I & II	3-0	3	3-0	3
(CE 17)		Engineering Geology	3-0	3	-	
(CE 31)	(CE 32)	Construction Management I & II	3-0	3	3-0	3
	(CE 45)	Fluid Mechanics II	-		3-0	3
(CE 47)	(CE 48)	Hydr. & San. Engrg. I & II	3-0	3	3-0	3
(CE 51)		Urban Planning	3-0	3	-	
	(CE 52)	Transportation Engrg.	-		3-0	3
(CE 63)	(CE 64)	Numerical Methods I & II	3-0	3	3-0	3
(CE 71)	(CE 72)	Civil Engrg. Projects I & II	3-0	3	3-0	3
(Chem 200)		Sanitary Microbiology**	3-0	3	-	
	(Chem 201)	Sanitary Chemistry**	-		3-0	3

† 1964-65 only. Students who completed Block 41 CE in 1962-63 will substitute Engineering Report Writing (Eng 41) for one technical elective.
Students taking Block 41 CE-B in 1964-65 must take Dynamics (Mech 2) in lieu of one technical elective in 1966-67.

* Not available to students who have completed Engineering Surveys (140).

** For a description of this course, refer to the 1964-65 catalog of *Graduate Courses*.

SEVENTH YEAR (Block 43 CE-B)‡

To be given in 1964-65.

(CE 47)	(CE 48)	Hydr. & San. Engrg. I & II	3-0	3	3-0	3
(Eng 20)	(Eng 20)	English & American Literature	3-0	1½	3-0	1½
(IR 46)		Personnel Relations	3-0	3	-	
	(IR 48)	Industrial Relations	-		3-0	3
		Elective (Technical)	3-0	3	-	
		Elective (Humanities)§	-		3-0	2½

‡ Prior to registration, the student shall consult with his adviser relative to the program to be followed. Registration will be completed for Block 43 CE-A, Block 43 CE-B, or for certain subjects in each block, whichever will permit the student to fulfill the requirements for graduation most expeditiously.

§ The evening elective program is outlined on page 82.

EIGHTH YEAR (Block 44 CE)

Not offered in 1964-65. To be given in 1965-66.

	(CE 12)	Soil Mechanics	-		3-3	4
(CE 25)	(CE 26)	Structures I & II	6-0	5	3-0	3
(IR 46)		Personnel Relations	3-0	3	-	
	(IR 48)	Industrial Relations	-		3-0	3
		Elective (Technical)	3-0	3	-	

ELECTRICAL ENGINEERING
B.S. (E.E.)

FIRST, SECOND, THIRD AND FOURTH YEARS

The courses offered in the first four years will be found on page 75.

FOURTH YEAR SUMMER SESSION§

Course Number		Title	1st Semester		2nd Semester	
	(EE 10)	Electric Circuits and Measurements	-		3-2	3

FIFTH YEAR (Block 41E)

(Math 30)	(Math 35)	Math. for Engrs. I & II	3-0	2½	3-0	2½
(EE 20)		Passive Circuits	4-0	4	-	
(EE 40)		Electronic Devices	3-0	2	-	
	(EE 60)	Electromagnetics	-		3-3	4
	(ME 41)	Thermodynamics I	-		3-0	2½

SUMMER SESSION§

(Mech 6)		Mechanics of Deformable Bodies	3-2†	4	-	

SIXTH YEAR (Block 42E)*

(EE 40)		Electronic Devices	3-0	2	-	
	(EE 42)	Active Circuits I	-		3-3	3½
(EE 60)		Electromagnetics	3-3	4	-	
(IR 46)		Personnel Relations	3-0	3	-	
	(ME 78)	Thermodynamics for E.E. II	-		3-0	2
	(Eng 21)	English Literature	-		3-0	2

SEVENTH YEAR (Block 43E)*

(EE 22)		Transmission Circuits	4-0	3	-	
	(EE 44)	Active Circuits II	-		3-3	4
(Eng 22)		American Literature	3-0	2	-	
(EE 62)	(EE 64)	Electrokinetics I & II	3-0	2½	3-3	4
(IR 48)		Industrial Relations	3-0	3	-	

EIGHTH YEAR (Block 44E)*

(EE 25)		Electromagnetic Fields	3-0	2½	-	
	(IE 91)	Enterprise Management	-		4-0	3
(EE 80)		Advanced Measurements	3-3	4½	-	
		Electrical Engrg. Elective**	-		3-0	2½
		Physics Elective	3-0	2	-	
	(EE 86)	Electrical Engrg. Project	-		0-4	2½

§ To complete the program within an eight-year period, a student must take the course indicated during the summer session. A nine-year program is available from E.E. advisers.

* 1964-65 only. Revised program will be published in the 1965-66 edition of this catalog.

** Electives are listed on page 65.

† 5-0 on alternate weeks.

INDUSTRIAL ENGINEERING
B.S. (I.E.)

FIRST, SECOND, THIRD AND FOURTH YEARS

The courses offered in the first four years will be found on page 75.

FIFTH YEAR (Block 41 IE)

Course Number		Title	1st Semester		2nd Semester	
(Math 33)		Probability and Statistics	3-0	2½	-	
	(Math 34)	Mathematics for Management Science	-		3-0	2½
(IE 23)		Economics	3-0	2½	-	
(IE 25)		Logic and Scientific Method	2-0	2	-	
	(IE 27)	Digital Computer Programming	-		2-0	2
(ME 41)		Thermodynamics I	3-0	2½	-	
	(ME 75)	Thermodynamics for I.E. II	-		3-0	2
	(Chem 25)	Principles of Engineering Materials	-		3-0	2½

SUMMER SESSION§

(Mech 6)		Mechanics of Deformable Bodies	3-2‡	4	-	

MECHANICAL ENGINEERING
ENGINEERING MANAGEMENT OPTION
B.S. (M.E.)

SIXTH YEAR (Block 42 MO)

(Mech 6)		Mechanics of Deformable Bodies	3-2‡	4	-	
	(Eng 71)	History of Industrial Civilization	-		2-0	1
(EM 59)		Industrial Relations Legislation Seminar	3-0	3	-	
	(EM 74A)	Engineering Economy	-		3-0	3
(EM 75A)	(EM 75A)	Industrial Statistical Methods	2-0	1½	2-0	1½
		Elective (Humanities)†	-		3-0	2½

SEVENTH YEAR (Block 43 MO)

(EE 88A)	(EE 89A)	Applied Electricity I & II	2-3	3½	3-3	4½
	(ME 39)	Machine Design Fundamentals	-		3-0	2½
(EM 55A)	(EM 55A)	Selection, Supervision and Control of Staff I	2-0	2	2-0	2
(EM 62A)		Engineering Management & Operation	2-0	1½	-	

§ To complete the program within an eight-year period, a student must take the course indicated during a summer session.

† The evening elective program is outlined on page 82.

‡ 5-0 on alternate weeks.

EIGHTH YEAR (Block 44 MO)

Course Number		Title	1st Semester		2nd Semester	
(EM 56A)	(EM 56A)	Selection, Supervision & Control of Staff II	3-0	2	3-0	2
(EM 64A)	(EM 64A)	Motion and Time Study	1-2	2½	1-2	2½
(EM 68)	(EM 68)	Management of Production and Distribution	3-0	2	3-0	2
(EM 71A)	(EM 71A)	Accounting and Cost Accounting	3-0	2	3-0	2½

MECHANICAL ENGINEERING

B.S. (M.E.)

FIRST, SECOND, THIRD AND FOURTH YEARS

The courses offered in the first four years will be found on page 75.

FIFTH YEAR (Block 41M)

(Chem 25)		Principles of Engineering Materials	3-0	2½	-	
(IE 23)		Economics	3-0	2½	-	
(IR 46)		Personnel Relations	3-0	3	-	
	(IR 48)	Industrial Relations	-		3-0	3
	(Math 30)	Math. for Engrs. I	-		3-0	2½
	(ME 10)	Manufacturing Processes	-		0-3	2
(ME 41)	(ME 42)	Thermodynamics I & II	3-0	2½	3-0	3

SUMMER SESSION§

		Elective (Humanities)†	3-0	2½	-	

SIXTH YEAR (Block 42M)

Offered 1964-65 only.

	(IE 92)	Enterprise Management	-		4-0	3
	(Mech 6)	Mechanics of Deformable Bodies	-		3-2‡	4
(ME 14)		Metallurgy	3-0	2½	-	
(ME 15)		Metallography	0-3	1½	-	
(ME 45)		Heat Transfer	3-0	3	-	
		Elective (Technical)	3-0	2½	-	
		Elective	-		3-0	2½

SEVENTH YEAR (Block 43M)

Offered through 1965-66 only.

(EE 96)	(EE 97)	Electrical Engineering I & II	3-2	3½	3-2	3½
(Eng 20)	(Eng 20)	English & American Literature	3-0	1½	3-0	1½
(ME 46)	(ME 48)	Mechanical Lab. II & III	0-3	2½	0-3	2½

EIGHTH YEAR (Block 44M)

Offered through 1966-67 only.

(IR 46)		Personnel Relations	3-0	3	-	
	(IR 48)	Industrial Relations	-		3-0	3
(ME 33)		Vibration Analysis	3-0	2½	-	
(ME 34)	(ME 36)	Machine Design I & II	6-0	3	6-0	3
	(ME 37)	Structural Analysis	-		3-0	2

§ To complete the program within an eight-year period, a student must take the course indicated during the summer session.

† The evening elective program is outlined on page 82.

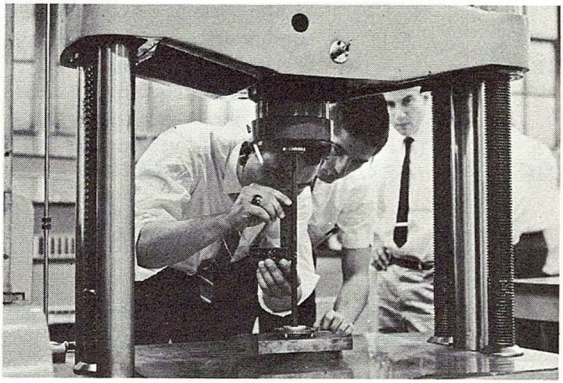
‡ 5-0 on alternate weeks.

TECHNICAL ELECTIVES

Course Number	Title	1st Semester		2nd Semester	
(ME 53)	Energy Conversion	3-0	2½	-	
(ME 54)	Gas Dynamics	3-0	2½	-	
(ME 55)	Automatic Controls	3-0	2½	-	
(ME 56)	Fluid Machinery	3-0	2½	-	
(ME 79)	Computer Solutions in M.E.	3-0	2½	-	

ELECTIVES

(Math 33)	Probability and Statistics	-		3-0	2½
(Math 35)	Mathematics for Engineers II	-		3-0	2½
(ME 55)	Automatic Controls	-		3-0	2½
(ME 79)	Computer Solutions in M.E.	-		3-0	2½



EVENING ELECTIVE PROGRAM*

Course Number	Title	1st Semester		2nd Semester	
(Arts 51)	Appreciation of Music	-		3-0	2½
(Arts 53)	Appreciation of Visual Arts	3-0	2½	-	
(Hist 53A)	Aspects of American Civilization: The City	-		3-0	2½
(Hist 54)	Special Areas: Modern Russian Civilization	3-0	2½	-	
(Lit 51A)	An Era of Literature: Twentieth Century British and American Literature	3-0	2½	-	
(Lit 51B)	An Era of Literature: Twentieth Century European Fiction	-		3-0	2½
(Phil 51A)	Representative Philosophers	-		3-0	2½
(Phil 53A)	Philosophic Foundations: Comparative Economic Thought	3-0	2½	-	

* The elective program for the Evening Undergraduate Summer Session will be listed in the Announcement.

DEPARTMENTS AND COURSES OF INSTRUCTION

DEPARTMENTS OF ENGINEERING

Departments granting degrees at Newark College of Engineering include the fields of Chemical Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering, and Industrial and Management Engineering. The last named department offers the B. S. in Industrial Engineering and the M. S. in Management Engineering.

The Department of Air Science offers Day Undergraduate students the opportunity to take the Air Force ROTC program leading to a commission as a Second Lieutenant in the U. S. Air Force Reserve.

BASIC SCIENCE DEPARTMENTS

Departments providing NCE students with a common background in mathematics and science, especially in the early years of their training are the departments of Chemistry, Engineering Graphics, Mathematics, and Physics and Mechanics. Known as the Technological Group, they also conduct advanced courses on both the undergraduate and graduate level.

HUMANISTIC-SOCIAL DEPARTMENTS

Since engineering education also requires that students receive a thorough grounding in the humanities, two additional departments have a prominent place in the curriculum: the Department of English and Humanistic Studies and the Department of Industrial Relations. Beside basic courses in English, Psychology, and Personnel Relations, these two departments offer a series of elective courses designed to provide students with opportunities for specialized studies in Arts, History, Literature, Philosophy, Sociology and other courses typical of the liberal arts tradition.

DIVISION OF HEALTH, PHYSICAL EDUCATION AND ATHLETICS

Common to the education of all Day Undergraduate students at NCE is a strong emphasis on health and physical activity. For this reason, Health, Physical Education and Athletics has been established as a separate, functional division of the College, gearing its programs to the needs and abilities of all students, and supervising a wide range of activities from formal gymnasium instruction to intramural and informal sports.

DEPARTMENT OF AIR SCIENCE

Chairman: COLONEL MAURICE A. BERRY
Associate Chairman: MAJOR ROBERT L. FRUTH

Professor: BERRY; *Assistant Professors:* DAHL, FRUTH, LUCAS, PROCTOR, RAFF, STOLLE; *Instructors:* KENNEDY, PERRY, SCHULZ, WILLIAMS, P., WILLIAMS, R.

The Department of Air Science offers qualified students a four year course leading to a commission as a Second Lieutenant, United States Air Force. The course includes sufficient practical and theoretical instruction so that the student can be quickly integrated into the Air Force organization. Emphasis is placed upon leadership training and in preparing the student to serve as an officer in the United States Air Force.

The first two years are devoted to the basic course and the last two years are devoted to the advanced course.

Classes in Air Science are not offered, other than six Introduction to AFROTC lectures, in the first term of the first year or the second term of the second year. In lieu thereof the satisfactory completion during these two terms of appropriate courses, of two or more semester credits, in the areas of mathematics, physical or natural sciences, the humanities or social sciences, will be accepted as satisfying the first and fourth term academic requirements of AFROTC. At registration, students will be advised as to specific courses which may be designated for this purpose.

Enrollment is voluntary. It is open to all regularly enrolled day session students who are citizens of the United States, possess good moral character, are physically qualified, are not less than fourteen years of age, and are approved by the President of the College and the Professor of Air Science. Entrance into the advanced course is on a selective basis. Selection is based upon composite scores derived from Air Force Officer Qualifying Tests, Air Force ROTC grades, academic grades, and instructors' and Advanced Course Selection Committee Members' estimate of the cadet's potential officer qualities and leadership ability. In addition, an applicant for enrollment in the advanced course will not be eligible unless he will be less than 28 years of age at the time of graduation, if enrolling in Categories II, III, or IV, or less than 26½ years of age at time of graduation, if enrolling in Categories IP or IN. Choice of category is made at time of application for enrollment in the advanced course. The categories to choose from are as follows:

CATEGORY IP. Included are those cadets who desire to enter pilot training after graduation and who meet the mental and physical standards for this type of training. The active duty obligation is five years.

CATEGORY IN. Included are those cadets who desire to enter navigation training after graduation and who meet the mental and physical standards for this type of training. The active duty obligation is five years.

CATEGORY II. Included are those cadets who are pursuing Electrical, Mechanical, or Civil Engineering or other scientific and technical fields, and who meet the mental and physical standards for an Air Force commission. The active duty obligation is four years.

CATEGORY II (Meteorology). Included are those cadets who meet certain academic prerequisites in physics and mathematics and who desire to serve as weather officers. The active duty obligation is four years.

CATEGORY III (Any Degree). Included are those cadets who are pursuing courses leading to degrees in the liberal arts, and who meet the mental and physical standards for an Air Force commission. The active duty obligation is four years.

CATEGORY IV. Included are veterans of the armed forces who can meet the mental and physical standards for an Air Force commission. They have no mandatory active duty obligation.

The inclusion of Air Science courses in the student's program does not materially increase his workload, as these courses receive comparable credits and may be substituted for certain courses in the standard curriculum.

Uniforms and textbooks are furnished without cost by the United States Air Force and advanced students receive a subsistence allowance of 90 cents a day or approximately $27 per month. Each student enrolled in the freshman and sophomore year will be required to pay a $15.00 uniform deposit.

Advanced students will normally attend summer training between the Junior and Senior years. While attending summer training, students receive approximately $75.00 per month, transportation to and from training, medical attention, subsistence, quarters and uniforms.

Credit for Air Science 1 is granted only upon the successful completion of Air Science 2, unless approved by the Professor of Air Science and proper college officials. No partial credit for any work completed in Air Science 1 or 2 will be given without the consent of the Professor of Air Science and the Dean of the College.

COURSES OF INSTRUCTION

INTRODUCTION TO AFROTC. *No credit.*

An introduction to the Air Force ROTC program. Purposes, policies, curriculum content, and related activities of the program are presented. Required of all freshmen registered for AFROTC. One lecture per week for the first six weeks of the freshman year.

AS 1. FIRST YEAR BASIC COURSE. 2 *credits per year.*

An introduction to aerospace missiles and aircraft; propulsion and guidance systems; areospace defense; modern targeting and electronic warfare; high explosive, nuclear, chemical, and biological warheads; aerospace strategic and tactical organizations, and military implications of present and future space operations. One period of laboratory per week each semester, two lectures per week during the spring semester.

AS 2. OE 200, WORLD MILITARY SYSTEMS. 1½ *credits per year.*

Prerequisites: AS 1 or 6 months' active military service. A comparative study of world military forces to include Free World land and naval forces, Free World air forces, Communist military systems, and trends in the development and employment of military power. Two class hours per week and one hour of leadership laboratory.

AS 3. OE 300, GROWTH AND DEVELOPMENT OF AEROSPACE POWER. 5 *credits per year.*

Prerequisite: AS 2 or one year's active military service. A survey course about the nature of war; development of airpower in the United States; mission and organization of the Defense Department; Air Force concepts, doctrine, and employment; astronautics and space operations; and the future development of aerospace power. Includes the United States space programs, vehicles, systems, and problems in space exploration. Three class hours per week, one hour of supervised research, and one hour of leadership laboratory.

AS 4. OE 400, THE PROFESSIONAL OFFICER. 5 *credits per year.*

Prerequisite: AS 3. A study of professionalism, leadership, and management. Includes the meaning of professionalism, professional responsibilities, the Military Justice System; leadership theory, functions, and practices; management principles and function; problem solving; and management tools, practices, and controls. Three class hours per week, one hour of supervised research, and one hour of leadership laboratory.

DEPARTMENT OF CHEMICAL ENGINEERING

Chairman: JOSEPH JOFFE.
Associate Chairman: GEORGE C. KEEFFE.

Professors: ANDERSEN, CARLSON, FREDERICK, JOFFE, KEEFFE, KREPS, MANTELL, SALAMONE; *Assistant Professors:* CASCIANO, HANESIAN, MCCORMICK, SNYDER; *Assistant Instructors:* CZECH, DRUIN.

The Chemical Engineering curriculum is designed to give the student a thorough background in the fundamental sciences and engineering subjects. It prepares the student for a professional career in chemical engineering in the process industries involving the development of practices in chemical manufacture and related operations, the design and operation of plants, as well as chemical and engineering application in non-chemical organizations.

To this end, the organic, unit operations and specialized laboratories are so equipped that the student may follow a particular process from test tube scale to semi-commercial scale and allow estimation of large scale production. The equipment in the unit operations and process laboratories is, for the most part, of modern design. This equipment has been adapted to the teaching of basic scientific principles and for quantitative and economic evaluation. The Physical Chemistry Laboratory and Instrument Laboratories are equipped for control and instrumentation studies for general and fundamental training in the physicochemical field. The course in Process and Plant Design coordinates and utilizes all of the engineering work in the chemical engineering curriculum. All equipment with associated design rooms, research laboratories and specialized areas is located in the Tiernan laboratories at 240 High Street.

The department encourages active participation of its students in the Student Chapters of the American Institute of Chemical Engineers and of the American Chemical Society. These student groups arrange for guest speakers from industry and for plant trips, both of which are important in orienting professional interest and attitude.

In addition to the one day trips arranged by the student chapters, the chemical engineering students, with the cooperation of the department, visit industries outside the Newark area. These extended trips are usually taken during one of the regular college vacation periods.

COURSES OF INSTRUCTION

ChE 27. CHEMICAL ENGINEERING PROBLEMS. 2 *credits.*

Prerequisites: Math 15, Phys 2, Chem 16. A course in the application of the principles of physics and chemistry to, and the quantitative solution of industrial chemical process problems. Emphasis is placed on material and heat balance of complex chemical reactions.

ChE 28. REACTION EQUILIBRIA AND KINETICS. 2 *credits.*

Prerequisites: ChE 27, 32. A study of selected chemical processes emphasizing mass, energy and rate concepts. Thermodynamics of chemical processes and process kinetics will be emphasized.

ChE 32. PHYSICAL CHEMISTRY I. 2 *credits.*

Prerequisites: Math 25, Phys 4, Chem 28. The topics covered in lecture are the properties of ideal and non-ideal gases, liquids, solids and solutions, thermochemistry and elementary thermodynamics. Relationship between physical properties and molecular structure is shown.

ChE 35. PHYSICAL CHEMISTRY II. 4 *credits.*

Prerequisite: ChE 32. The topics covered in lecture are homogeneous and heterogeneous equilibria, phase rule, electrolytic transference and conductance, ionic equilibria, electromotive force and kinetics. Experiments are done which illustrate principles covered in lecture. Laboratory reports include an analysis of experimental errors and a quantitative calculation of the reliability of calculated results.

ChE 41. ORGANIC CHEMISTRY I. 3½ *credits.*

Prerequisite: Chem 28. Lectures, problems, and laboratory exercises in the principles and practice of organic chemistry presenting an integrated study of aliphatic, aromatic and heterocyclic compounds. Modern concepts of structure and mechanism are considered.

ChE 42. ORGANIC CHEMISTRY II. 3 *credits.*

Prerequisite: ChE 41. Continuation of the integrated study of organic chemistry. Laboratory work will emphasize more advanced analytic and synthetic procedures.

ChE 43. UNIT OPERATIONS I. 3½ *credits.*

Prerequisites: ChE 27, Math 25, Phys 4. A lecture problem course in fluid and particle mechanics. The emphasis will be on Newtonian fluids although some non-Newtonian systems will be dealt with. The unit operations covered will include fluid flow, size reduction, solids handling, mixing, and mechanical separations.

ChE 44. UNIT OPERATIONS II. 3 *credits.*

Prerequisite: ChE 43. A lecture problem course in heat transmission, including the unit operation of evaporation. Emphasis will be placed on empirical correlations for film coefficients of heat transfer.

ChE 45. CHEMICAL ENGINEERING THERMODYNAMICS I. 2½ *credits.*

Prerequisites: ChE 27, 35, Math 30. 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. Applications are made to batch and flow processes.

ChE 46. CHEMICAL ENGINEERING THERMODYNAMICS II. 2½ *credits.*

Prerequisite: ChE 45. The concepts and methods developed in ChE 45 are applied to the treatment of compressors, heat engines, refrigeration, and phase equilibria. The student is introduced to the thermodynamic analysis of practical processes as a method for the evaluation of energy utilization.

ChE 47. PROCESS KINETICS. 3 *credits.*

Prerequisites: ChE 28, 35. This course is a continuation of ChE 28. The kinetics of chemical processes, reactor design and economic optimization of processes will be considered.

ChE 48. INDUSTRIAL ORGANIC CHEMISTRY. 3 *credits.*

Prerequisite: ChE 41, 42 or equivalent. This course will include advanced and critical studies of organic synthesis with special emphasis on commercial methods. The laboratory work is intended to develop techniques preliminary to large scale laboratory operations.

ChE 50. PHYSICAL CHEMISTRY LABORATORY. 4½ *credits, two semesters.*

Prerequisite: ChE 31. This course consists of laboratory experimentation, in the course of which the student applies and extends the basic knowledge of physical chemistry acquired in the junior year. Laboratory reports are expected to include the analysis of experimental errors and a quantitative discussion of the reliability of calculated results.

ChE 51-1B. CHEMICAL ENGINEERING. 4 *credits.*

Prerequisites: 340, ChE 31. A lecture problem course in fluid mechanics and heat transfer. The Unit Operations covered will include fluid flow, heat flow, evaporation, size reduction and solids handling.

ChE 51-2B. CHEMICAL ENGINEERING. 8 *credits, two semesters.*

Prerequisite: ChE 51-1B. This course is a continuation of ChE 51-1B. The portion of the course devoted to lecture and recitation will cover Unit Operations such as size reduction, solids handling, mechanical separations, mixing, absorption, extraction, distillation, and drying. In the laboratory the student will attempt to correlate theoretical and actual performance in the various Unit Operations.

ChE 55. CHEMICAL ENGINEERING MEASUREMENTS. 2 *credits.*

Prerequisites: ChE 32, 35. This course consists of laboratory experimentation in which the student applies and extends the basic knowledge of physical chemical and chemical engineering principles acquired in the junior year.

ChE 56. INSTRUMENTAL ANALYSIS. 2 *credits.*

Prerequisites: ChE 32, 35, 55. In this course the student studies the theory and construction of instruments and applies these to the measurements of physical properties for purposes of control or chemical analysis. The instruments used for measurement are ultra-violet, visible and infrared and flame spectrophotometer, emission spectograph, dielectric apparatus, polarograph, pH and other electrometric apparatus.

ChE 57. CHEMICAL ENGINEERING UNIT OPERATIONS III. 4 *credits.*

Prerequisites: ChE 44, 35. A lecture-problem course in diffusional operations which will include molecular diffusion in fluids, analogy between heat, mass and momentum transfer and quantitative calculations in simultaneous heat and mass transfer. The laboratory will include experiments in fluid flow, heat transfer, evaporation, fluidization, mixing, crushing and grinding, filtration and sedimentation on a quantitative basis. Process instrumentation will be emphasized.

ChE 58. CHEMICAL ENGINEERING UNIT OPERATIONS IV. 5 *credits.*

Prerequisite: ChE 57. A lecture-problem course covering the unit operations of distillation, liquid extraction, drying and adsorption. The laboratory will include experiments in distillation, gas absorption, liquid extraction and drying. Process instrumentation will be emphasized.

ChE 59. PROCESS AND PLANT DESIGN I. 2½ *credits.*

Prerequisites: ChE 27, 28, 35, 42, 44. Co-ordination and application of knowledge gained in other courses is applied to the design of chemical engineering equipment, foundations, outer connection, material of construction, corrosion and preservation. An intensive study is made of economic factors. There will be a visitation during the period between semesters to process industry plants and chemical engineering industries over a three to four day period. All expenses are to be paid by the individual student. Required for all chemical engineering seniors.

ChE 60. PROCESS AND PLANT DESIGN II. 3½ *credits.*

Prerequisites: ChE 57, 59. Literature search, experimental work, design calculations, specifications, interconnection and selection of equipment for a coordinated process and plant, plant layout, cost studies, labor and management economics, codes and related factors.

ChE 61. CHEMICAL ENGINEERING METALLURGY. 2 *credits.*

Prerequisites: ChE 35, 44. Application of chemical engineering unit operations to pressure leaching of ores and slimes, benefication, to flotation, vaporization of metallic compounds and vapor phase separation, leaching, rare earth fractionation by adsorption, non-aqueous solvent extraction of minerals, liquid-liquid extraction applied to metallurgy, continuous recovery of by-products from recycling operations.

ChE 62. CHEMICAL ENGINEERING PROBLEMS II. 2 *credits.*

Prerequisite: Math 30. This is a course in applied mathematics. The subjects will include a short study of computer principles and programming. The elements of matrix algebra will be studied with application to computerized solutions of systems of differential equations. Applied work using Laplace Transforms, Bessel functions and Legendre polynomials will also be included.

DEPARTMENT OF CHEMISTRY

Chairman: M. LELYN BRANIN
Associate Chairman: JOSEPH M. FITZGERALD
Assistant Chairman: VINCENT N. CAGNATI

Professors: BAUDER, BISHOP, BRANIN; *Associate Professors:* FITZGERALD, RAM; *Assistant Professors:* CAGNATI, KWEI, PANDYA, POETZ, SHILMAN, WENISCH; *Instructors:* GURNEY, MYTELKA, REILLY, STEINBERG, ZEGEL; *Assistant Instructors:* BULSARA, SCHAFFER; *Adjunct Instructing Staff:* COOPER, LI.

The increasing awareness of the importance of science and engineering in our national economy has been taken cognizance of in planning the various courses presently being offered by the Department of Chemistry. Since the responsibility of establishing a solid foundation for the student's engineering education rests largely with those departments teaching the physical sciences and mathematics, the chemistry courses have been designed to develop the student's understanding of fundamentals by placing maximum emphasis on the principles and the methods of science. Both in the classroom and in the laboratory, the emphasis generally is directed to the quantitative more than to the qualitative aspects of the subject. Frequent references also are made to the relationships existing between fundamental principles and their application to the solution of engineering problems.

A second important objective is the establishment of an adequate scientific foundation upon which the student may build after graduation from college and during the course of his subsequent professional career.

The Department of Chemistry offers courses in general college chemistry, including some analytical chemistry, quantitative analysis, and principles of engineering materials. In addition to these, certain special courses, such as sanitary chemistry and sanitary microbiology, are offered as technical options for students majoring in Chemical or Civil Engineering.

COURSES OF INSTRUCTION

Chem 15. GENERAL CHEMISTRY. 4½ *credits.*

Fundamental chemistry, including general inorganic, analytical, and some organic and nuclear chemistry, with particular emphasis on those concepts which are basic to an engineering education. Both the pace and content of the course presuppose a full year of high school chemistry prior to entering college.

Chem 15H. HONORS CHEMISTRY. 4½ *credits.*

This is an honors course in chemistry which follows in general the course content of Chem 15 but differs from it in that the fundamental theory is covered more comprehensively and in somewhat greater depth. Admission to the course is restricted.

Chem 16. General Chemistry. 4½ *credits.*

Prerequisite: Chem 15. A continuation of Chem 15.

Chem 16H. Honors Chemistry. 4½ *credits.*

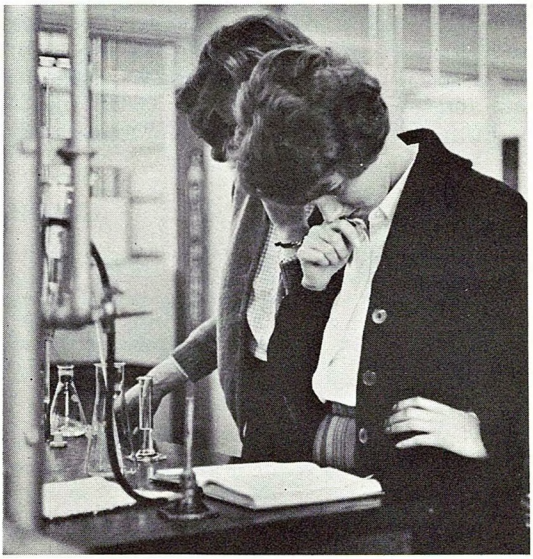
Prerequisite: Chem 15. This is a continuation of Chem 15H. Admission to the course is restricted.

Chem 25. Principles of Engineering Materials. 2½ *credits.*

Prerequisites: Chem 15, 16. A study of the basic principles which underlie the behavior of materials. The influence of structure and bonding forces on properties is emphasized.

Chem 28. Introduction to Quantitative Analysis. 2 *credits.*

Prerequisites: Chem 15, 16. A brief course in which the student is introduced to the methods of volumetric and gravimetric analysis. Emphasis is placed upon errors which are common to all types of analysis.



DEPARTMENT OF CIVIL ENGINEERING

Chairman: WILLIAM S. LA LONDE, JR.
Associate Chairman: JAMES M. ROBBINS.

Professors: LA LONDE, LEHMAN, MANGASARIAN, ROBBINS; *Associate Professor:* RAAMOT; *Assistant Professor:* LAW; *Instructors:* DISKO, GALANDAK; *Assistant Instructor:* OLSEN.

Modern civil engineering includes within its scope the economic planning, design, construction, operation, and maintenance of the fixed structures and works required by our present industrial civilization. Its coordinated subdivisions comprise: structural engineering, which provides bridges, dams, industrial plants, foundations, buildings, tunnels, and other important stationary structures; transportation engineering, which provides highways, railroads, airways, inland waterways and the terminal facilities requisite thereto; hydraulic engineering, covering the development of water supplies, irrigation, drainage, hydro-electric power, flood control and shore protection; sanitary engineering, which provides potable water supplies, treatment and disposal facilities for sewage and industrial wastes, and measures incident to the engineering control of communicable disease; surveying, which furnishes the engineering surveys required by all construction operations, the proper delineation of property, and the base maps of the nation; and construction management, which provides the planning and direction required to get things built.

A field so varied requires that the academic training of those who enter it have breadth as well as depth. Rigorous education in the basic sciences is fundamental. A knowledge of numerical methods is necessary to enable the practicing engineer to program his long and complex problems for solutions by electronic computers. Economics and finance are of the essence in this field. Knowledge of the properties of engineering materials is essential not only in design but in research. A rational approach to personnel problems is vital. Chemistry, biology and bacteriology are required by the sanitarian. The operation of highly mechanized construction plants requires basic training in mechanical and electrical engineering. The ability to write clearly and to speak convincingly must be inculcated. Liberal training must be provided in the humanities if the student is to develop to take his proper part, as engineer and citizen, in the community. Integrated with, and built upon, this broad foundation we have the applications of the engineering method to the professional work of the field.

To provide for breadth of training in a four-year undergraduate program, the hours devoted to courses which are primarily vocational in character have been reduced to a minimum. Depth of training is obtained by permitting the student to select

approximately one full semester of technical electives best suited to his graduate professional or academic interests. Highly specialized instruction of an advanced character has been definitely placed in the graduate program.

COURSES OF INSTRUCTION

CE 3. SURVEYING. 4 *credits.*

Prerequisite: Math 10. Theory, fieldwork, drafting and computations dealing with plane, cadastral, topographic, hydrographic and route surveys.

CE 5. ADVANCED SURVEYING I. 3 *credits.*

Prerequisite: CE 3. The theory of engineering astronomy, of satellite and space vehicle tracking and of geodetic surveying will be considered in class. An occasional day or evening field period will be held in lieu of classes to permit the student to make field observations on the sun, stars or other heavenly bodies for the determination of latitude, longitude, time and azimuth.

CE 6. ADVANCED SURVEYING II. 3 *credits.*

Prerequisite: CE 3. The theory of photogrammetric methods and surveys will be considered in class. Occasional visits to a consulting engineer's office will give on-the-job acquaintance with many items of equipment and will be in lieu of equivalent class time.

CE 12. SOIL MECHANICS AND FOUNDATIONS. 4 *credits.*

Prerequisite: CE 22. A study of all soil types and properties; the significance of soil tests; the methods of compaction, consolidation and settlement; bearing capacity and pile tests and formulas; lateral pressures; frost heaving; soil stabilization; and problems relating to the proper design of soil supported foundations for engineering structures. The theoretical study is supplemented by experimental work in the soil mechanics laboratory.

CE 17. ENGINEERING GEOLOGY. 3 *credits.*

A study of physical geology and physiography with particular emphasis placed on the applications of the material considered in Civil Engineering work.

CE 21. STRENGTH OF MATERIALS I. 3½ *credits.*

Prerequisites: Mech 1, Math 20. A consideration of the relations between external forces acting on engineering structures and the resulting internal forces and stresses, and the relations between external forces and strains. Many practical problems are worked out illustrating the use of the derived principles. In the laboratory, tests are conducted to investigate some of the physical characteristics of materials and to verify the assumptions used in theoretical analysis. The results of each test are summarized in an engineering report.

CE 22. STRENGTH OF MATERIALS II. 2½ *credits.*

Prerequisite: CE 21. A continuation of the stress-strain relations begun in CE 21. There is no laboratory verification.

CE 25. STRUCTURES I. 5 *credits.*

Prerequisites: Mech 1, CE 22. A course in statically determinate and indeterminate structural theory with just enough introduction into design to make the structural theory meaningful. The practical design considerations will be carried out by those interested in the Civil Engineering Projects courses.

CE 26. STRUCTURES II. 3 *credits.*

Prerequisites: Mech 1, CE 22. This course is one covering the elements of reinforced concrete theory and design involving indeterminate structural applications. The practical design considerations will be carried out by those interested in the Civil Engineering Projects courses.

CE 31. CONSTRUCTION MANAGEMENT I. 3 *credits.*

Prerequisite: IE 93. A study of engineered construction with emphasis on planning and management. Organization of projects with special attention to critical path analysis for control. Detailed discussion of contract documents, construction methods, materials handling and expedition of projects.

CE 32. CONSTRUCTION MANAGEMENT II. 3 *credits.*

Prerequisite: CE 31. A study of the economic feasibility and financing of various construction projects. Detailed analysis of bid procedures and methods used in estimating cost including the use of critical path scheduling with programming for computer solutions.

CE 40. FLUID MECHANICS I. 4½ *credits.*

Prerequisites: Math 20, Mech 1, 2. A problem course treating the static and dynamic behavior of fluids with a majority of applications dealing with the flow of water and other incompressible fluids. Emphasis is placed on the understanding of fundamental laws and the equations derived from them. Problems of compressible fluids and of similitude are also studied as well as the means for measuring fluid flow by theoretical and semi-empirical methods.

CE 42. ENVIRONMENTAL SANITATION. 2 *credits.*

Prerequisite: Chem 16. A study of the engineering control of man's environment through: the proper collection, treatment, and disposal of domestic and industrial wastes; the provision of potable water supplies; milk and food sanitation; the control of rodents and insects; the sanitation of public buildings; swimming pool sanitation; the construction of proper housing; air pollution control; radiological sanitation; and industrial hygiene. Water purification and waste water treatment, are dealt with in detail.

CE 45. FLUID MECHANICS II. 3 *credits.*

Prerequisite: CE 40. A problem course treating with fluid flow in pipe networks, flow in open channels, backwater curves, hydraulic jump, and some dynamic problems.

CE 47. HYDRAULIC AND SANITARY ENGINEERING I. 3 *credits.*

Prerequisite: CE 40. A study of the occurrence, distribution and utilization of water and of the analyses required for the design of regulatory works for water supplies, hydro-electric developments, irrigation, flood control, erosion control and inland navigation. Design problems deal with the development of the water resources of a river basin, the determination of the safe yield of a reservoir, flood routing and the design of hydrologic structures.

CE 48. HYDRAULIC AND SANITARY ENGINEERING II. 3 *credits.*

Prerequisites: CE 42, 47. A course covering the principles of the design, construction and operation of water supplies, distribution systems and treatment works, of storm drains and sanitary sewers, and of waste water treatment and disposal structures. Design problems deal with water distribution lines, storm drains and sanitary sewers.

CE 51. URBAN PLANNING. 3 *credits.*

Topics will include the interrelated concept of planning, politics, and the public interest; land use and its interaction with traffic and transportation; and the problems of the older city including urban renewal and rehabilitation. Practical applications will be presented in the form of case studies. Assignments will consist of readings from the available literature and a number of short problems.

CE 52. TRANSPORTATION ENGINEERING. 3 *credits*

A study of the principal modes of transportation, with emphasis on the planning, design, and construction of facilities for modern transportation systems. The practical design considerations will be carried out by those interested in the Civil Engineering Projects courses.

CE 61. ELECTRONIC COMPUTATIONS AND DATA PROCESSING. 3 *credits.*

Prerequisite: Math 25. Digital and analog systems are studied from the viewpoint of their use in solving engineering problems and processing data. Both computer oriented and problem oriented languages are studied. Coding is treated from a logical basis. Problem solutions are tested at the Computing Center.

CE 63. NUMERICAL METHODS IN ENGINEERING ANALYSIS I. 3 *credits.*

Prerequisite: Math 25. Modern powerful methods of analysis will be introduced through a number of simplified engineering problems of current interest. Students will use the College Computing Center for some of the solutions. Topics will include matrix methods, iteration and relaxation, methods of finite calculus, and polynomial approximations.

CE 64. NUMERICAL METHODS IN ENGINEERING ANALYSIS II. 3 *credits.*

Prerequisite: Math 25. The method of approach is the same as in CE 63. Topics will include simulation and mathematical models, principles of linear programming, and the application of probability and random processes to quality control, treatment of data, and the waiting line problem.

CE 71. CIVIL ENGINEERING PROJECTS I. 3 *credits.*

Prerequisite: Satisfactory Senior Standing. Upon the completion of a common project in structural design, the student works on one or more individually selected projects, guided by the Civil Engineering Department staff. The 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 or projects 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 the student will present his work to other students having similar interests.

CE 72. CIVIL ENGINEERING PROJECTS II. 3 *credits.*

Prerequisite. Satisfactory Senior Standing. One or more individually selected projects conforming to the specifications given in the description for CE 71.

DEPARTMENT OF ELECTRICAL ENGINEERING

Chairman: FREDERICK A. RUSSELL.
Associate Chairman: ROBERT E. ANDERSON.

Professors: ANDERSON, FISHMAN, JORDAN, MISRA, PADALINO, RUSSELL, ZAMBUTO; *Associate Professors:* DICKEY, MEOLA, REDMON, RIPS, ROSE, WINSTON; *Assistant Professors:* AYOUB, CARLUCCIO, CHOW, CLEMENTS, ROSENSTEIN, STRANO, YEH; *Instructors:* BHATT, EISENBERG, ITTLESON, RICCI; *Assistant Instructors:* COHEN, D'ADDARIO, JONES, LURIE, SALVATORE, STELZENMULLER, TIKIJIAN, TROOP; *Adjunct Instructing Staff:* ALBANESE, HOLLINGSWORTH, KURLAND, MAGID, RANSOM, SCHRAMM, SMITH, WOERNER, YAWORSKY.

The Electrical Engineering curriculum provides a broad, basic engineering education. A student will have completed his preparatory education in mathematics, the physical sciences, English, and the humanities during the first half of his college curriculum. During the final years his education is broadened into associated fields of engineering and includes increased specialization in his chosen field, electrical engineering.

The electrical engineering courses emphasize basic principles, concepts, and their interrelations upon which the design and operation of electrical devices of our present electrical age depend.

The aim is to educate an electrical engineer who can think analytically and creatively, work efficiently, and convey the results of his work effectively to others. He is prepared for responsibilities as a professional engineer and citizen in a democracy by his experiences within the group of fellow students and laboratory co-workers.

His electrical engineering education is as broad as possible so that employment opportunities upon graduation will not be restricted. His education is adequate for further advanced study in his chosen field if his interest lies in research or development. However, the curriculum can serve as a terminal engineering program leading to industrial work or activity as an engineer dealing with production, operation, or service.

Branches of the Institute of Electrical and Electronic Engineers and Eta Kappa Nu are active and stimulate interest in the practical and professional aspects of electrical engineering.

COURSES OF INSTRUCTION

EE 10. ELECTRIC CIRCUITS AND MEASUREMENTS. 3 *credits.*

Prerequisites: Phys 3, Math 20. A class and laboratory introductory course in Electrical Engineering. Definitions of electric circuit parameters, Kirchhoff's rules for instantaneous values in differential equation form, and special solutions to these using complex quantities. Mesh and nodal analysis, resonance, and balanced polyphase circuits. The laboratory work covers electrical measurements over a wide range of frequencies. The class work features problem solving, and the laboratory work will stress the correct use of a laboratory notebook.

EE 20. PASSIVE CIRCUITS. 4 *credits.*

Prerequisites: EE 10 and approval by EE department; corequisite: Math analysis from the pole-zero viewpoint. Laplace transform, transfer functions, real and complex frequencies, transient and steady state frequency response. Network analysis, circuit theorems, matrix manipulation. Unbalanced three-phase systems at power frequencies are included in this course.

EE 20H. PASSIVE CIRCUITS FOR HONORS STUDENTS. 4 *credits.*

Prerequisites: EE 10 and approval by EE department; corequisite: Math 30. Students enrolled in this course cover the regular passive circuits material. In addition, analog computation and selected topics in advanced network theory are discussed. Class hours to be arranged.

EE 21. COMMUNICATION NETWORKS. 2 *credits.*

Prerequisite: EE 20. This course consists of a pole-zero approach to steady-state analysis of Foster and Cauer networks, parallel resonance, amplifier coupling networks (shunt peaked, stagger tuned, Butterworth, Chebychev), and feedback networks.

EE 22. TRANSMISSION CIRCUITS. 3 *credits.*

Prerequisite: EE 21. A course in four-terminal networks with linear passive circuit elements. General theorems, tuned circuits, image impedance parameter analysis of inductance-capacitance filters including propagation, insertion loss, and hyperbolic trigonometry. Transmission lines at power, audio, and radio frequencies. Derivation of distributed parameters for conductors in simple configurations. Circle diagrams, including Smith chart. Introduction to transient response of uniform transmission lines.

EE 25. ELECTROMAGNETIC FIELDS. 2½ *credits.*

Prerequisite: Math 35. This is a foundation course, designed to lay a basis for advanced work in television, radar, and ultra-high frequency techniques. The basic principles of electromagnetic field theory, including Maxwell's field equations, are developed. The modern engineering point of view is maintained throughout, and advanced methods of analysis are introduced as needed.

EE 40. ELECTRONIC DEVICES. 2 *credits.*

Prerequisites: Phys 3, 4. This course is a study of the conduction of current in vacuum, gas, and semiconductors, as applied to diodes, triodes and multiterminal electronic devices. Also included is a study of the applications of these devices in elementary circuits.

EE 42. ACTIVE CIRCUITS I. 3½ *credits.*

Prerequisites: EE 20, 40. This class and laboratory course covers four areas of communication theory. Two-terminal nonlinear circuit elements, with continuous and discontinuous signals: vacuum, gas, and semiconductor diode circuits. Basic theorems of transconductance circuits: transistor, vacuum triode and pentode equivalent circuits. Active linear circuits: transistor and vacuum-tube small-signal amplifiers. Active quasi-linear circuits: audio power single-ended and push-pull amplifiers.

EE 44. ACTIVE CIRCUITS II. 4 *credits.*

Prerequisite: EE 42. This course extends the work of the preceding course into the area of active nonlinear circuits, including class B and C amplifiers and oscillators; coding, transmission, and decoding of information, including amplitude, frequency, and pulse modulation and demodulation. The course includes class and laboratory work in the above areas.

EE 60. ELECTROMAGNETICS. 4 *credits.*

Prerequisites: EE 10, Math 25. This course consists of a class and laboratory study of the theory of magnetic circuits, magnetic materials, and electromagnetic devices. It includes magnetic circuit calculations, losses, saturable reactors, transformers at all frequencies, frequency characteristic of inductively coupled circuits, three-phase transformer connections, phase transformation, effects of harmonics. Theory of force, torque and voltage generation, in relays, loudspeakers, meters and rotating machines.

EE 62. ELECTROKINETICS I. 2½ *credits.*

Prerequisite: EE 60. A course in the theory of rotating electromechanical energy converting devices. Basic concepts of rotating electrical machine analysis and performance. Analysis and applications of direct-current machines.

EE 64. ELECTROKINETICS II. 4 *credits.*

Prerequisite: EE 62. A continuation of the material of course EE 62, with laboratory work covering the material of this and the preceding course. The study of electromechanical energy conversion is extended to polyphase machines, including synchronous machines and induction machines.

EE 70. TRANSISTOR CIRCUITS. 2½ *credits.*

Prerequisite. EE 44. Topics to be covered include low frequency parameters and equivalent circuits, circuit characteristics of various configurations, biasing and bias stability; design of R-C coupled amplifiers and power amplifiers; high frequency parameters and equivalent circuits; design of wide-band amplifiers, feedback amplifiers and oscillators; and other selected topics.

EE 71. CONTROL SYSTEMS. 2½ *credits.*

Prerequisite: EE 44. A lecture course in the electronic control of rotating machinery designed to bring into focus the student's previous experience in electronics and electromechanical energy conversion. Analysis of electromechanical servomechanisms, study of stability and methods of design for linear systems will be part of the course.

EE 74. ANALOG COMPUTATION IN ANALYSIS AND DESIGN. 2½ *credits.*

Prerequisite: EE 44. This course will introduce the analog computer as a tool in engineering analysis and design. Emphasis will be placed on programming procedures for the study of linear and nonlinear systems. Electrical engineering applications will be stressed. The use of the computer in the laboratory will be required to complete several extensive analysis and design problems.

EE 75. DIGITAL COMPUTER CIRCUITS. 2½ *credits.*

Prerequisite: EE 44. The design of rudimentary solid state logic circuits used in digital computers. Applications will be made of switching algebra, truth tables, mapping techniques and other minimization techniques. Circuits will be constructed where feasible.

EE 76. MICROWAVES. 2½ *credits.*

Prerequisite: EE 25. This course is concerned with a study of guided electromagnetic waves and radiation from antennas. The topics to be covered include plane waves, waves between parallel plates, waves in rectangular and circular guides, radiation from dipole antennas, and characteristics of antenna arrays.

EE 80. ADVANCED MEASUREMENTS. 4½ *credits.*

Prerequisites: EE 22, 24, 44, Math 33 or 40. Advanced techniques in circuit measurements with multiple-frequency signals are studied in this class and laboratory course. Included are a-c bridge measurements, filters, harmonic analysis, resonance measurements and square-wave testing, transients in circuits, very-high and ultra-high frequency measurements, and field plotting.

EE 86. ELECTRICAL ENGINEERING PROJECT. 2½ *credits.*

Prerequisites: EE 44, 64. A synthesis and focusing of the student's previous experience, in college and out, upon one or more electrical engineering projects selected by the student. Library research, design, cost analysis, construction, and testing are usually involved. Class members are in touch with all projects through seminar discussions. Projects are available in optional fields of power and communications.

EE 88A. APPLIED ELECTRICITY I. 3½ *credits.*

Prerequisites: 948, Math 25 or equivalents. For Mechanical Engineering students. A study of the application of the fundamental principles of electricity to direct-current and alternating-current circuits, machines, and electronic appliances.

EE 89A. APPLIED ELECTRICITY II. 4½ *credits.*

Prerequisite: EE 88A. A continuation of EE 88A, involving study and operation of various alternating-current motors commonly used in industry.

EE 90. ELECTRICAL ENGINEERING FOR CIVIL ENGINEERS. 3 *credits.*

Prerequisites: Phys 4, Math 25. A class and laboratory course in the basic principles of electrical engineering theory and practice. The course begins with the study of a-c circuits, including polyphase circuits. Magnetics, transformers, direct-current and alternating-current machines are covered with an emphasis on significant operating characteristics and ratings. Basic electronics is included, with applications of electron tubes and transistors to rectification and amplification. Measurement techniques, including the use of vacuum-tube voltmeters and the oscilloscope, is part of the laboratory work.

EE 92. ELECTRICAL ENGINEERING FOR CHEMICAL ENGINEERS. 3 *credits.*

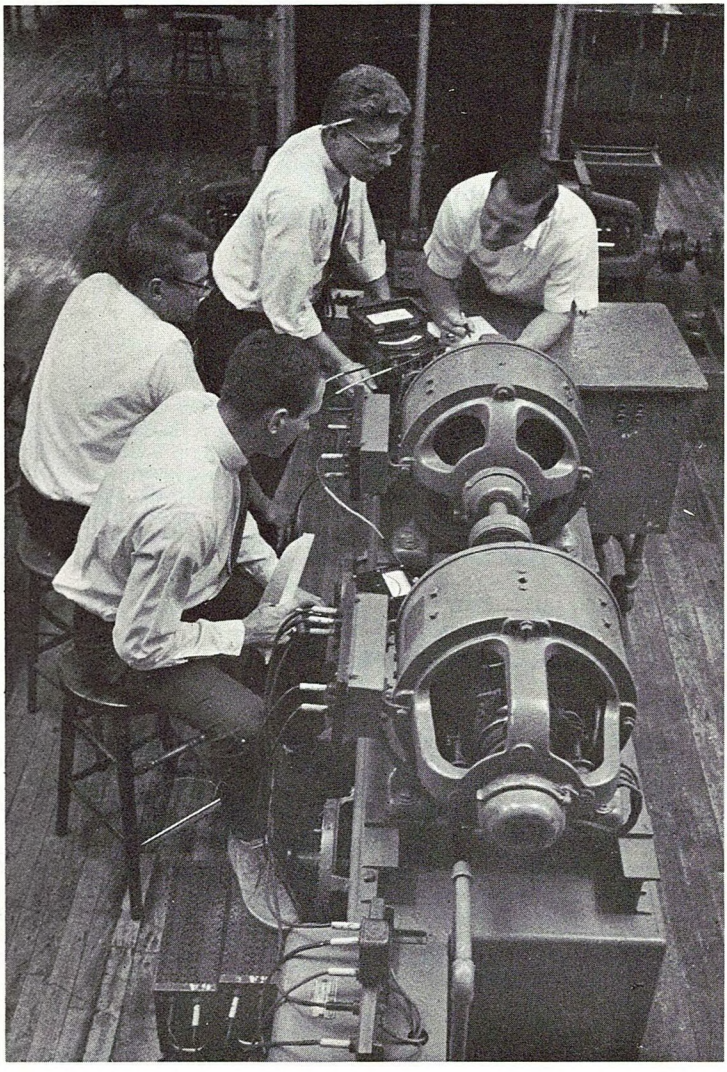
Prerequisites: Phys 4, Math 25. A class and laboratory course for chemical engineers, similar to EE 90, above.

EE 96. ELECTRICAL ENGINEERING FOR MECHANICAL AND INDUSTRIAL ENGINEERS I. 3½ *credits.*

Prerequisites: Phys 3, Math 25. This is a comprehensive laboratory and class course surveying broadly the fields of electrical engineering. Basic a-c circuits, three-phase circuits, power and reactive power, resonance, steady-state frequency-response, and elementary transients. Included are basic principles of thermionic vacuum tubes, transistors, gas-filled thermionic tubes; and applications to rectifier and amplifier circuits, cathode-ray, photoelectronic and other special electronic devices and their applications are considered.

EE 97. Electrical Engineering for Mechanical and Industrial Engineers II. 3½ *credits.*

Prerequisite: EE 96. A continuation of EE 96, above, this course considers the theory and applications of transformers and goes then into the area of rotating machines, stressing applications of the various types. Introduction to the physical aspects of rotating machines, including the generation of voltage and torque follows. Performance and characteristics of d-c and a-c machines. The course concludes with an elementary study of electronic control of motors and processes, both open and closed-cycle systems, including servomechanisms.



DEPARTMENT OF ENGINEERING GRAPHICS

Chairman: FRANCIS J. BURNS.
Associate Chairman: ROBERT G. SALMON.

Professor: BURNS; *Associate Professors:* DUJETS, SALAMON; *Assistant Professors:* GOLDEN, HANUS, RIGHTS; *Instructors:* KETZNER, O'HARA.

The Graphics courses, through application of a carefully considered system of disciplines, aim at preparing our beginning students for those engineering experiences which are to follow. Chief among these lessons is a development of the abilities to read carefully and to follow instructions meticulously since the professional engineer cannot leave himself open to misinterpretation. We try to teach Graphics, then, as a professional addition to the students' verbal and mathematical languages and from the present point of view of the profession that engineers are less and less likely to be engaged in the actual production of detail drawings in the future. A wide understanding of the geometries of construction, plus extensive drill in freehand sketching, is stressed so as to lay a sound foundation for the professional design work to follow.

COURSES OF INSTRUCTION

EG 1. ENGINEERING GRAPHICS. 2½ *credits.*

This course consists chiefly of work in descriptive geometry, plus freehand sketching and lettering exercises. Studies cover basic orthographic theory, coordinate systems, planes, lines, orientations, auxiliaries, normals, axials, obliques, directed views, solids, rotations, spheres, convolutes, cylinders, cylindroids, helices, etc. Homework is minimal, requiring about two and one-half hours per week. It consists of a simple freehand sketch, a brief lettering exercise, and the reading of several assigned pages of text for each class. One hour of class contact each week is devoted to lecture.

EG 1A. ENGINEERING GRAPHICS. 2½ *credits.*

This course is similar in content to EG 1, above.

EG 2. ENGINEERING GRAPHICS. 2½ *credits.*

Prerequisite: EG 1. This course consists of combined drawing and problem solving. Standards of annotation and dimensioning, special scales, sections and conventions, limits, threads, etc., are briefly introduced; the balance of the term deals with engineering curves and graphs, steel truss details, concrete detailing, perspective, axonometrics, vectors and centros, areas (Simpson's rule or planimeter), templates, ASA standards, piping, circuits, topography, and others. Homework continues and, as in the first term, consists of a freehand sketch, a brief lettering exercise, and for each class the reading of certain assigned pages of text, except that in this term the complexities of the sketches are considerably increased. Lectures also are given in the classes by the individual instructors as each different phase of the program is arrived at.

EG 2A. ENGINEERING GRAPHICS. 2½ *credits.*

Prerequisite: EG 1A. This course is similar in content to EG 2, above.

DEPARTMENT OF ENGLISH AND HUMANISTIC STUDIES

Chairman: SAMUEL K. WORKMAN.
Assistant Chairman (English): JAMES J. NAPIER.
Assistant Chairman (History): STANLEY B. WINTERS.

Professors: CRATER, ESTRIN, FELMLY, WORKMAN; *Associate Professors:* FERNSLER, KEABLES, NAPIER; *Assistant Professors:* DRUKS, GIBB, JOHNSON, LYNGSTAD, OSBORNE, RICHARDSON, STEINBERG, WACKER, WINTERS, WISE, ZIRNITE; *Instructors:* BECKER, CAMP, EPSTEIN, GOLDBERG, GROVER, TOMASSI; *Special Instructing Staff:* ANGLE, KARMAN, PLOTKIN, THOMAS; *Adjunct Instructing Staff:* BENSON, CHABROWE, GRINBERG, HILL, MADARAS, ROSE, SIMMS, STRAUSS, TURCHICK, WEISS, WHITESIDE.

An engineering college makes special demands upon its English Department. An engineer has to write down his ideas and directives efficiently. In both technical and non-technical reading he must be rapid and accurate. In all areas of his professional activity he will want his speech not merely to be correct but to come from him easily and naturally. Calling on a less tangible skill, many of his professional judgments will involve imponderables for which his perception is best cultivated by experience with the imaginative verbal expression of others, usually writers.

His career and his personal desires will take him more and more often into areas outside his immediate profession. He will want a sympathetic understanding, and a sense of judgment and taste, for the varied interests and activities of widely various people. Literature and other arts do much to develop such faculties, and so does the study of cultural history, a study largely carried out through reading.

This department provides all these areas of study, and is a principal participant in the broader program of electives in humanistic-social studies.

The Department also provides honors courses in English for freshmen (Eng 11H and Eng 12H), and beginning in 1965-66 will provide honors courses in literature (Eng 21H and Eng 22H) and in history (Hist 21H and Hist 22H) for sophomores or juniors. These honors courses run parallel with the regular required courses but are adapted to the abilities and needs of superior students. Entrance is voluntary, subject to Department approval, and may be applied for in any semester; continuation also is voluntary, after any one semester.

Starting in 1964-65, qualified students may also earn the designation of "Distinction in English and Humanistic Studies" by meeting the following requirements:

1. Completion of at least the second semester of the freshman English honors course (Eng 12H); and completion of both semesters of honors courses *either* in literature (Eng

21H and Eng 22H *or* in history (Hist 21H and Hist 22H).

2. *Either* completion of two elective courses in literature for students who have taken Eng 21H and Eng 22H; *or* completion of two elective courses in historical studies for students who have taken Hist 21H and Hist 22H; *or,* for either group of students, completion of The College Seminar in the Humanities (Hu 59 and Hu 59A).

3. Maintenance of a high level of scholarship in college work generally as well as in English and humanistic studies. This shall ordinarily be construed as maintenance of a minimum grade-point average of "3," exception to be made at the discretion of the Department of English and Humanistic Studies.

COURSES OF INSTRUCTION

Eng 11. COMPOSITION AND LITERATURE. 3 *credits.*

A course to develop the skills of reading and writing. The writing is expository, of various types. The reading includes the principal literary forms.

Eng 11H. COMPOSITION AND LITERATURE. 3 *credits.*

While paralleling Eng 11 in nature and purpose, this honors course offers opportunity for training in other forms of writing besides expository. Special areas of study will be in the relation of language and structure to the particular purpose of an expository writing; in the relation between the literary forms and the purposes of literature; and in the criticism and evaluation of writing.

Eng 12. COMPOSITION AND LITERATURE. 3 *credits.*

Prerequisite: Eng 11. A continuation of Eng 11.

Eng 12H. COMPOSITION AND LITERATURE. 3 *credits.*

Prerequisite: Eng 11 and departmental approval, or Eng 11H. A continuation of Eng 11, at the honors level.

Eng 20. ENGLISH AND AMERICAN LITERATURE. 3 *credits, two semesters.*

Prerequisite: Eng 12. This course is similar to Eng 21 and Eng 22, below.

Eng 21. ENGLISH AND AMERICAN LITERATURE TO 1850. 2 *credits.*

Prerequisite: Eng 12. A study of significant literary figures of England and America which introduces these writers as individuals and as participants in historical and intellectual movements. The students will prepare oral and written assignments related to the reading.

Eng 21A. ENGLISH AND AMERICAN LITERATURE TO 1850. 1½ *credits.*

Prerequisite: Eng 12. This course is similar to the first part of Eng 21.

Eng 21B. ENGLISH AND AMERICAN LITERATURE TO 1850. 1½ *credits.*

Prerequisite: Eng 21A. Similar to the second part of Eng 21.

Eng 22. ENGLISH AND AMERICAN LITERATURE AFTER 1850. 2 *credits.*

Prerequisite: Eng 21. A continuation of Eng 21.

Eng 22A. ENGLISH AND AMERICAN LITERATURE AFTER 1850. 1½ *credits.*

Prerequisite: Eng 21B. This course is similar to the first part of Eng 22.

Eng 22B. ENGLISH AND AMERICAN LITERATURE AFTER 1850. 1½ *credits.*

Prerequisite: Eng 22A. Similar to the second part of Eng 22.

Eng 41. ENGINEERING REPORT WRITING. 1½ *credits.*

Prerequisite: Eng 12. The principles of report writing are studied, with careful attention to models of sound technical writing. Instead of preparing unmotivated practice reports, the student is guided in fulfilling actual assignments of reports for his professional department. Finished work is judged by professional standards. Required for Civil Engineering students.

Eng 71. HISTORY OF INDUSTRIAL CIVILIZATION. 1 *credit.*

This course for Engineering Management Option students is designed to provide students with a broad picture of both the social and political aspects of our cultural history and to lay particular stress upon science and technology. It is designed to be followed by Eng 70 or Eng 71.

Eng 80. MODERN FOREIGN LANGUAGE. 3 *credits, two semesters.*

Prerequisite: A minimum of 2 units of high school credit in the subject—except for Russian. A year of advanced study of French, German, Italian, Spanish, or Russian, or an introduction to Russian, as may be elected by the student. Sections will be instituted in those subjects for which a sufficient number of students register.

Hist 21. DEVELOPMENT OF THE MODERN WORLD. 2½ *credits.*

A study of significant ideas, institutions, and events in European and European-influenced civilizations from the Renaissance to the Congress of Vienna, using source readings to encourage critical thinking and illuminate various historical eras.

Hist 22. DEVELOPMENT OF THE MODERN WORLD. 2½ *credits.*

Prerequisite: Hist 21 or equivalent. A continuation of Hist 21, covering the era of Romantic Nationalism through the Second World War.

THE HUMANITIES ELECTIVE PROGRAM

Broadly understood, the humanities might include any interests growing out of the sensitivities and capacities that lie in the nature of human beings. Traditionally, they include only those interests that involve not only knowledge and logic but nontangible relationships, and interests that have been cultivated not for direct practical application but for the pleasure, the expressiveness, and the wisdom felt to be inherent in them. The most frequently developed of these interests are thought of as arts, literature, philosophy, and history.

While several courses are offered in each of these principal fields, all of them have certain broad purposes in common: to sharpen perceptiveness in a non-tangible area of interest and to increase the realization of how taste and discrimination are formed in such an area. From that, one can develop greater capacity to enjoy and to assimilate other things of a similar kind when they are later met, and greater confidence in one's own judgment.

The particular subject-matter of each course is to be thought of for its typicality as a humanistic interest, not for its absolute importance as a body of knowledge. No course offered in the first semester will be planned for a sequel in the same subject or field, and none in the second semester will be built on any preceding. A student may elect any course from any field in either semester. Prerequisites for all courses in this program are Eng 11, 12, 21, 22, and Hist 21, 22.

Arts

Arts 51. Appreciation of Music. 2½ *credits.*

The purpose of this course is to develop creative listening through perception and appreciation of the basic materials of melody, harmony, rhythm, dynamics, tonality, tone, color, form, style, texture, and design. The course is not concerned with the history of the art of music, but with the elements of its structure and content, and does not assume previous training in music.

Arts 52. Period, Style, and Genre in Music. 2½ *credits.*

Representative Music of the Main Eras of Western Music. The purpose of this course is to develop creative listening to carefully programmed representative forms, styles, and schools of all the main eras of the historical development of Western music down to and including the "New Music."

Arts 53. Appreciation of Visual Arts. 2½ *credits.*

Examples from historic and modern painting and sculpture, and from some actual design problems in class, illustrate visual fundamentals and the significance of the principal styles.

Arts 54. Period, Style, and Medium in the Visual Arts. 2½ *credits.*

New Concepts in Architecture. Examples of Twentieth Century building are used to illustrate, on the one hand, the place in architecture of fundamentals common to all visual arts, and, on the other hand, the relation between available materials and architectural expression. Buildings examined, from photographs or from visit to the site, include examples by Wright, Mies van der Rohe, Le Corbusier, Saarinen, Nervi, and many others.

History

Hist 51. Aspects of Classical Civilization. 2½ *credits.*

The Legacy of the Ancient World. A survey of the ancient world as it appears to great historians, writers, and artists. The aim is to provide a framework within which the legacy of ancient Greece and Rome can be realized.

Hist 51A. ASPECTS OF MEDIEVAL CIVILIZATION. 2½ *credits.*

The West and the East after Rome. This course first traces the transition from the late Roman Empire into the early period of feudalism in the Western World. It then turns to the Christian Byzantine and to the Muslim worlds of the East and describes their influence on the changing West.

Hist 52. ASPECTS OF BRITISH CIVILIZATION. 2½ *credits.*

The Emergence of Modern British Society. The evolution of the British people in the course of the economic, political, and impartial changes of the last one hundred and fifty years: the Industrial Revolution, the rise of democracy, and the shift from Empire to Commonwealth. Discussion will include the attendant changes in social patterns, in moral attitudes, and in philosophic and artistic expression.

Hist 53. ASPECTS OF AMERICAN CIVILIZATION. 2½ *credits.*

Twentieth Century Political Economy in the United States. A study of politico-economic developments of the Twentieth Century as they have affected social change in the United States: The Square Deal, the New Freedom, the New Deal, the Fair Deal, and their consequences. Readings in materials contemporary with the events, and interpretative lectures and discussions.

Hist 53A. ASPECTS OF AMERICAN CIVILIZATION. 2½ *credits.*

The City in American Life and Thought. The growth and transformation of the American city in the 19th and 20th centuries with industrialization and technological change; the impact of the Irish, the Italians and other immigrants and Negro and Puerto Rican in-migrants; and the reactions of sensitive observers to these social changes as expressed in novels and scholarly studies.

Hist 54. SPECIAL AREAS. 2½ *credits.*

Introduction to Modern Russian Civilization. A survey of Tsarist and Soviet Russian society in the 19th and 20th centuries. Readings in the novel, the drama, history, and philosophy. Lectures and discussions on such key topics as serfdom, industrialization, revolutionary movements, the 1917 revolutions, and Soviet governmental and foreign policies.

Hist 54A. SPECIAL AREAS. 2½ *credits.*

The Development of Modern Germany. This course, beginning about 1870, considers the economic and political foundations of Germany's world position, aspects of its literature, science, and philosophy, and such movements as liberalism, Pan-Germanism, Nazism, and democracy.

Hist 54B. SPECIAL AREAS. 2½ *credits.*

Contemporary Europe. European society in the twentieth century with an emphasis on major events and trends of lasting importance. Nationalism, imperialism, the growth of totalitarianism, movements toward European unity, and prominent cultural developments will be among the topics to be discussed.

Hist 55. PROBLEMS IN MODERN HISTORY. 2½ *credits.*

Political and Social Movements. The nature and impact of such seminal theories and movements as democracy, conservatism, liberalism, anarchism, communism, fascism, and non-violent resistance; as seen through the lives and works of their proponents: Jefferson and Paine, Burke and John Adams, Marx and Lenin, Bakunin, Mussolini and Hitler, and Thoreau, Gandhi, and Martin Luther King.

Hist 55B. PROBLEMS IN MODERN HISTORY. 2½ *credits.*

Underdeveloped Areas and the World Powers. Emphasis will be given to cultural material, and moral considerations between certain highly developed countries and the underdeveloped areas. The course will be divided into an examination of Latin America, Asia, and Africa and their relations with whatever world powers have exerted a dominating influence on them in recent times.

LITERATURE

Lit 51. AN ERA OF LITERATURE. 2½ *credits.*

The Renaissance. The cultural advancements of Europe during the fifteenth and sixteenth centuries in thought, religion, science, education, literature, art and music are examined. The "rebirth" of learning is seen through the works of such authors as Sir Thomas More, Niccolo Machiavelli, Francois Rabelais, Miguel de Cervantes, and Christopher Marlowe. Lectures, some illustrated by reproductions of the art of the period and by records, will develop the Renaissance concept of the well-educated man, the humanist whose province was the whole world of thought and whose aims predicated the reform of early modern times.

Lit 51A. AN ERA OF LITERATURE. 2½ *credits.*

Twentieth Century British and American Literature. An examination of some of the more provocative Twentieth Century British and American works in fiction, drama, and poetry. The student acquires critical criteria whereby he is able to distinguish between popular forms and literature.

Lit 51B. AN ERA OF LITERATURE. 2½ *credits.*

Twentieth Century European Fiction. An examination of significant stories and novels drawn from the literatures of four continental European countries—France, Germany, Sweden, and Russia. The individual works, representative of such figures as Gide, Malraux, Sartre, Camus, Kafka, Mann, Lagerkvist, and Pasternak, will be approached principally as literary formulations of intellectual problems and beliefs, with consideration of social and biographical factors as demanded by the nature of the materials.

Lit 51C. AN ERA OF LITERATURE. 2½ *credits.*

Modern Drama. An examination of some of the dramas from the latter part of the nineteenth and twentieth centuries with the purpose of gaining some understanding of how dramatists in both subject matter and technique reflect the spirit of the times. Representative playwrights include Ibsen, Shaw, Wilde, Strindberg, O'Neill, Chekhov, O'Casey, Pirandello, Williams, Miller, Brecht, and Ionesco.

Lit 52. A FORM OF LITERATURE. 2½ *credits.*

The Growth of European Fiction. A study of some outstanding novels and short stories, mostly of the nineteenth century. Major figures, including Balzac, Flaubert, Dostoyevsky and Tolstoy, are seen as contributors to the expanding art of modern fiction.

Lit 52A. A FORM OF LITERATURE. 2½ *credits.*

The English Novel. A study of selected English novels from the first masterpieces to the present day. The works will be approached primarily as distinctive achievements in the art of prose narrative, but some account will be taken of their place in a continuous and varied tradition and of their relation to the changing social and intellectual scene.

Lit 52C. A FORM OF LITERATURE. 2½ *credits.*

Forms of Modern Drama, Fiction, and Poetry. This course is not a survey of Twentieth Century literature. Its main purpose is to develop an understanding of the *forms* and the *modes* of literature which are new and peculiar to our time. Typical writings will be read closely and descriptively, often in comparison to older writing, and related to other developments of this century.

Lit 53A. A RECURRENT SUBJECT OF LITERATURE. 2½ *credits.*

The Good Life and the Search for Value. The course is to be a survey of various views of the Good Life as reflected in certain literary works of our culture. The course will begin with traditional values of Western Civilization derived from the ancient Greeks and the Judeo-Christian ethos. The second half of the course will deal with some of the more important challenges, and the conflicts of values in the modern world.

Lit 54. THE PRINCIPAL WORKS OF ONE WRITER. 2½ *credits.*

Shakespeare. The reading will include about ten plays from the histories, comedies, and tragedies, and some short poems, chosen to typify the various facets of this writer. There will be attention to Shakespeare's times and to the basis for his distinction among dramatists.

PHILOSOPHY

Phil 51. PRINCIPLES OF PHILOSOPHY. 2½ *credits.*

Philosophical Problems. An examination of problems of a social, ethical, aesthetic, religious, and scientific nature and a study of the related principles and methods of philosophy. Particular attention is given to the application of these principles in everyday living.

Phil 51A. PRINCIPLES OF PHILOSOPHY. 2½ *credits.*

Representative Philosophers. A study of the ideals of important philosophers from the time of the Greeks to the present day. This course does not attempt a survey of philosophy but concentrates on the work of a few great thinkers so that the student may perceive at first hand how these men once accelerated intellectual progress and how their work may still contribute to the solution of modern problems.

Phil 52. HISTORICAL DEVELOPMENTS IN PHILOSOPHY. 2½ *credits.*

The Development of Modern Thought. A survey, analysis, and evaluation of the basic concepts which have moulded man's view of nature, of the political and societal environment, and of the individual from ancient Egypt to the present, as they are a requisite for an understanding of the modern world. In brief: A history of the ideas which have affected modern thought in science, religion, political theory, and aesthetics.

Phil 52A. HISTORICAL DEVELOPMENTS IN PHILOSOPHY. 2½ *credits.*

The Evolution of Psychological Theories and Systems. This course traces the evolution of contemporary theoretical concepts in psychology from their historical origins in philosophy and the natural sciences. It stresses the relation between a theory and the general interests and beliefs of the cultural area in which it appears, with particular attention to the empirical tradition which gave rise to the dominant experimental psychology of the contemporary American scene.

Phil 52B. HISTORICAL DEVELOPMENTS IN PHILOSOPHY. 2½ *credits.*

The History of Economic Thought. The historical evolution of man's intellectual efforts to understand economic phenomena, and the effect of the particular cultural environments which influenced thought. Theories and schools thus considered include Mercantilist, Cameralist, Physiocrat, Classical, Historical, Austrian, Dissenter, and the present-day Keynesian.

Phil 53. PHILOSOPHICAL FOUNDATIONS. 2½ *credits.*

Science and First Principles. This course is a brief introduction to the philosophy of science: the impact of scientific theories and hypotheses on the subject matter of philosophy. After the nature, function, and scope of philosophy are examined, the concepts of science are introduced as providing a formulation of, and avenues of approach to, the basic problems of philosophy itself. The implications of this relationship are then extended to the problem of values, involving man's place in the universe about him.

Phil 53A. PHILOSOPHICAL FOUNDATIONS. 2½ *credits.*

Comparative Economic Thought. A consideration of the philosophical and ethical foundations of systems that man has devised to secure his livelihood. These systems range from a society placing an emphasis on individualism wherein the constituents are free to pursue their own self interest, to organizations wherein the "state" plays the dominant role.

Phil 53B. PHILOSOPHICAL FOUNDATIONS. 2½ *credits.*

The Philosophy of Language. After a survey of the history of language the course turns to theories of language—Richards, Casirer, Sapir, Skinner, and others—pointing to the nature and the philosophic significance of linguistic experience. There will be discussion of positive and of ethical problems of verbal expression and communication.

HUMANITIES

Although the traditional humanistic interests are usually separated for study into distinct fields, they can be followed in many other manners, including attention to their many interrelationships. Some of these manners are more natural than field-studies as responses to the original interest.

In order to provide an opportunity for able students to proceed in one of these less well-marked directions, the Program includes, each semester, a course entitled "College Seminar in the Humanities."

Since each such course involves intensive investigation and discussion, it is open to no more than twelve students. To be eligible, a student must have a grade-point average of 3.00 or higher and must be recommended by his former instructors in English, history, and social studies.

Hu 59. COLLEGE SEMINAR IN THE HUMANITIES. 2½ *credits.*

Investigation and discussion of the relationships between two or more areas, such as science and political philosophy or art and religion. The subjects for the seminar will be announced at the time for electing a course in the Humanities Program. Credit can be obtained for any one semester.

Hu 59A. COLLEGE SEMINAR IN THE HUMANITIES. 2½ *credits.*

A continuation of Hu 59.

DEPARTMENT OF INDUSTRIAL AND MANAGEMENT ENGINEERING

Chairman: OLIVER J. SIZELOVE.
Assistant Chairmen: ROBERT GORDAN, WILLIAM J. JAFFE.

Professors: JAFFE, RICH, SIZELOVE; *Associate Professors:* DUBLIN, GOLDSTEIN, LA VERDA, MIHALSKY, RIGASSIO; *Assistant Professors:* GORDAN, WOLF, ZIMMERMAN; *Instructor:* MLADINEO; *Adjunct Instructing Staff:* BASSOFF, BECHT, BENNETT, BLOU, KOPF, MATAS, O'CONNOR, RITTER, SMYKIL, TIERNEY.

The curriculums of the department meet the needs of industry for engineers who are not only competent in the areas of mathematics, the physical and engineering sciences, and engineering analysis and design, but who are equally well qualified to apply the fundamentals of these areas to the design, improvement, and installation of integrated systems of men, materials, and equipment. Individuals thus trained—Industrial Engineers—solve the problems that arise in the management of an enterprise and make these solutions available for administrative decision within the functional areas of research, design and development, manufacture, personnel, and distribution.

The Industrial Engineering curriculum combines three professional stems: production process design, work design, and management science. During the early years the student is primarily concerned with the mathematics, the physical sciences, and the engineering sciences, upon which depends the material presented in the later years. The courses stress fundamental principles and concepts, and culminate in a systems design which classifies either within or between the three professional stems of the curriculum.

The Day Division class of 1964 will be the first to complete the Bachelor of Science in Industrial Engineering curriculum. In the Evening Division, the class of 1968 will be the first to complete the Industrial Engineering curriculum. The predecessor curriculum, the Engineering Management Option in Mechanical Engineering, will phase out for the Evening Division in 1967. Hence, the Industrial Engineering Curriculum is shown on pages 66-67 and the Engineering Management curriculum is shown on page 80. In addition, service courses in Economics and Enterprise Management are in operation for the other engineering departments.

The new modern laboratories of the Department include a Work Methods and Measurement Laboratory and adjacent Experimental Shops, an Accounting and Statistics Laboratory, and a Plant Design Laboratory. In addition, the facilities of the new NCE Computing Center will replace current use of off-campus electronic computers in applicable courses.

For early indoctrination in professional development, Day and Evening Division students in the department become affiliated with the NCE student chapter of A.I.I.E. In addition to their local meetings at the College, the student members attend the meetings and conferences of the sponsoring North Jersey Chapter of A.I.I.E.

COURSES OF INSTRUCTION*

IE 23. ECONOMICS. 2½ *credits.*

This course is designed to combine the classical and contemporary approaches to economics and serves as a springboard for future study. It presents basic principles which form the groundwork for analysis and discussions of contemporary problems. The American economic system vs. communism, fascism, and socialism is also discussed.

IE 24. PRODUCTION PROCESS DESIGN. 3 *credits.*

Introduction to design and control of manufacturing processes. Study covers theory and practice of machine tool selection, production tooling, 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 operation in the laboratory and in plants which are visited. Where practical, films of special tooling research or materials processing and fabrication are shown. A student project is included in which the student determines manufacturing feasibility, prepares specifications and operation sheets, selects equipment and tooling, and prepares flow charts for the fabrication of a metal, plastic, ceramic, wood or rubber product.

IE 25. LOGIC AND THE SCIENTIFIC METHOD. 2 *credits.*

This course is designed as an introduction to decision theory. It includes the logical systems, basic rules of decision making, experimentation, and symbolic reasoning applied to modern management procedures. The basic concepts to be discussed are inductive and deductive logic, syllogistic reasoning, symbolism, logical operations, probability, measurement, statistical methods, experimentation, etc.

IE 27. DIGITAL COMPUTER PROGRAMMING. 2 *credits.*

Prerequisite: IE 25. The organization of a modern high speed electronic computer. Programming fundamentals. Flow-charting of typical problems. Actual hands-on experience with the IBM 1620 computer. Solution of data-processing and scientific problems with a computer.

IE 37. WORK ANALYSIS I. 4 *credits.*

Prerequisite: IE 24. Integration of plant flow, layout design, material handling systems, and work place layout and design. Emphasis is placed on the interrelationship of organization, production planning and control, service activities, work simplification, human factors, methods, and tool design. Included are the use of motion economy, jig and fixture design, and micromotion analysis techniques.

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* The courses prefixed by IE represent the offerings in the new curriculum. The courses prefixed by EM are offered in the Engineering Management Option.

IE 38. WORK ANALYSIS. 3 *credits.*

Prerequisite: IE 37. Quantitative analysis of manufacturing activities, man and machine systems, wage payment plans, line balancing problems, and plant location decisions. Involved is the use of standard data, method measurement systems, work sampling, time study, value analysis, predetermined time systems and simulation of production systems.

IE 39. STUDIES IN MANAGEMENT SCIENCE I. 3½ *credits.*

Prerequisites: Math 34, IE 23. Introduction to quantitative and analytical techniques useful in managerial decision making. Treated are such techniques as model formulation, linear and non-linear programming, queueing theory, game theory, statistical applications, Markov processes, Monte Carlo techniques, and multi-stage processes.

IE 40. STUDIES IN MANAGEMENT SCIENCE II. 4 *credits.*

Prerequisite: IE 39. Application of the quantitative and analytical techniques of IE 39 to selected topics such as organization, production and distribution management including plant location, layout, inventory control, transportation, scheduling and market research.

IE 43. SYSTEMS DESIGN AND CONTROL I. 3 *credits.*

Prerequisites: IE 24, 37, 38, Math 33, 34. The concepts of industrial engineering systems and sub-systems design; principles, procedures, and techniques of systems design; the management control as an integral system component. Selection of a specific system design for the project of IE 44, establishment of plant contacts, determination of the system specifications, preliminary collection, classification, and analysis of the system data.

IE 44. SYSTEMS DESIGN AND CONTROL II. 4½ *credits.*

Prerequisite: IE 43. A continuation of IE 43 with the project culminating in a system 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, or Management Science.

IE 46. LAW. 2 *credits.*

Prerequisite: IE 23. This course familiarizes the student with basic principles of common and statutory law applicable to business and professional relationships, emphasizing contracts, negotiable instruments, sales of goods, agency and business organization.

IE 47. ACCOUNTING FOR ENGINEERS. 3 *credits.*

Prerequisite: IE 23. This course covers both general and cost accounting. It includes a study of the accounting cycle, development and analysis of financial statements, costing methods and classifications, material and inventory costs, overhead accumulations and distribution, job order, process, and standard cost systems, and budgets.

IE 58. TOOL ENGINEERING. 2½ *credits.*

Prerequisite: IE 24. The planning and fabrication of production tools will be treated from an economic viewpoint as well as from the engineering aspects. Included are classifications of tools, make or buy decisions, and the use of mathematical models for optimum design.

IE 59. COMPUTERIZED PRODUCTION CONTROL. 2½ *credits.*

Prerequisite: IE 27. 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 60. INVENTORY MODELS. 2½ *credits.*

Prerequisites: Math 33, 34, IE 27. A scientific approach to inventory problems under conditions of known and probabilistic demand. Order quantities, order times, shortage considerations, and price breaks are some of the topics investigated. Cost minimization for both discrete and continuous cases are discussed.

IE 61. STATISTICAL QUALITY CONTROL. 2½ *credits.*

Prerequisites: Math 33, 34. This course is designed to present the application of statistics and probability to the control of product and process quality. The subject matter to be studied includes process and machine capability studies, statistical control charting, and sampling plans. The management and engineering associated with a quality control program will also be considered.

IE 62. BUDGETARY PLANNING AND CONTROL. 2½ *credits.*

Prerequisite: IE 47. Introduction of budgeting procedures as a tool for planning and control in the areas of production, sales, indirect expense, cash, inventory, and capital expenditures. Emphasis will be made on the application of industrial engineering principles in the preparation and execution of budgets for profit planning and management.

IE 63. ORGANIZATION PLANNING AND CONTROL. 2½ *credits.*

A study of classical and behavioral approaches to organization planning, this course integrates both functional and adoptive points of view in an applied atorgenics approach 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 64. PRODUCT AND PROCESS RELIABILITY. 2½ *credits.*

Prerequisites: Math 33, 34. Treated in this course will be the methods of planning, organizing, and control needed to assure the reliability of a product or process. Inherent in this treatment will be a study of the various statistical and non-statistical means of attaining and measuring this reliability.

IE 65. PATENT LAW. 2½ *credits.*

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 91. ENTERPRISE MANAGEMENT. 3 *credits.*

Prerequisite: IE 23. A survey course for electrical and mechanical engineering students which includes sources of investment funds; organizational structure; product development and distribution, production management; engineering economy analysis of alternatives; estimating collecting, analyzing and control of enterprise costs; and the legal aspects of contracts; agency, and patents. Emphasis is on the operational management problems with orientation to the overall planning, organization, and control of the enterprise.

IE 93. ENTERPRISE MANAGEMENT. 4½ *credits.*

Prerequisite: IE 23. A survey course for civil engineering students including sources of investment funds: organizational structure; administration of public projects; financing and evaluation of civil engineering projects; the legal aspects of contracts, agency, sales and bailment; and the operations management of private public works.

IE 95. ENGINEERING ECONOMY. 2 *credits.*

Treats the principles and practices of engineering economy. It specifically applies these principles and practices to various industries. Among topics discussed are: depreciation, replacement policy, valuation studies, break-even analysis, increment costs, minimum costs points and cost estimating.

IE 96. ENGINEERING ECONOMY. 2 *credits.*

A course similar in scope to IE 95, but specifically oriented to the application of industrial engineering principles.

EM 55A. SELECTION, SUPERVISION, AND CONTROL OF STAFF I. 4 *credits, two semesters.*

Prerequisite: 841. The elements of selection, supervision, and control are first considered individually and then collectively. Under selection, the techniques of interviewing, job description, job evaluation, methods of selection, and the follow-up of placement are considered. Under supervision, the modern techniques as they apply to the engineer-supervisor are stressed. The control aspect is stressed particularly in EM 56A.

EM 56A. SELECTION, SUPERVISION, AND CONTROL OF STAFF II. 4 *credits, two semesters.*

Prerequisite: EM 55A. A continuation of the Junior course of the same title, stressing the control aspect by the application of the previous treatment to practical situations, through student reports presented in seminar.

EM 59. INDUSTRIAL RELATIONS LEGISLATION SEMINAR. 3 *credits.*

Prerequisite: EM 57. In this course the theory and background material of Industrial Relations Legislation is applied to existing, specific management-labor-government problems. The facts of typical mangement-labor and management-government problems are placed before the student by men from business and industry who have encountered them. With his training as a background, the student will attempt solution. Discrepancies, if they exist, between the student's solution and the one found in industry will be thoroughly discussed.

EM 62A. ENGINEERING MANAGEMENT AND OPERATION. 1½ *credits.*

A survey course which considers the problems of the management of research, design and development, the management of production, and the management of distribution. The profit motive is used as the key to the integration of phases,

EM 64A. MOTION AND TIME STUDY. 5 *credits, two semesters.*

Prerequisites: EM 62A, 67; and EM 75A for Second Semester. The charting and micromotion techniques of the Gilbreths, project work including design and construction of improved methods. Stop watch techniques, element analysis, rating and leveling, practice studies of hand and machine operations, elemental times and standard data.

EM 68. MANAGEMENT OF PRODUCTION AND DISTRIBUTION. 4 *credits, two semesters.*

Prerequisites: EM 62A, 67. The objective of this course is to present the modern techniques of progressive management in the fields of production and distribution. It includes plant location and layout, material handling, production planning and control, standardization, wage plans, traffic control, warehousing, sales, and marketing. The lecture-project method is utilized to demonstrate existing management techniques.

EM 71A. ACCOUNTING AND COST ACCOUNTING. 4½ *credits, two semesters.*

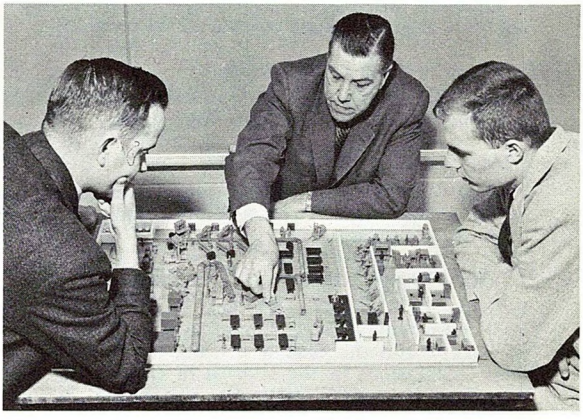
This course treats both general and cost accounting. It includes a study of the accounting cycle, basic books, worksheets, subsidiary ledgers, valuation, depreciation and depletion, development and analysis of financial statements, costing methods and classifications, material and inventory costs, overhead accumulations and distribution, job order, process, and standard cost systems, and budgets.

EM 74A. ENGINEERING ECONOMY. 3 *credits.*

Prerequisite: EM 67. "Hunch" decisions vs. decisions based upon costs, the time element in economy, capital recovery, prospective rate of returns, increment and sunk costs, replacement costs, depreciation, break-even and minimum-cost points, and cost estimating are the subjects covered.

EM 75A. INDUSTRIAL STATISTICAL METHODS. 3 *credits, two semesters.*

Prerequisite: Math 25. This course presents statistical methods together with their applications. The subjects treated include: selection, analysis, and interpretation of engineering and other data, charts, frequency distribution, central tendency, dispersion, skewness, curve fitting. Poisson distribution, significant differences, variance, correlation, and trend analysis. Special emphasis is placed on the application to industrial fields.



DEPARTMENT OF MATHEMATICS

Chairman: HENRY ZATZKIS.
Associate Chairman: POMPEY MAINARDI.
Assistant Chairman: CARL KONOVE.

Professors: BARKAN, FITHIAN, MAINARDI, ZATZKIS; *Adjunct Professor:* MOLINA; *Associate Professors:* FOSTER, FOX, KONOVE, KOREN, LIONE, WASSON; *Assistant Professor:* BROWER; *Instructors:* KATZEN, LIEB, MARX, SNYDER, WEISS; *Assistant Instructors:* BERLINER, HAZINSKI, LEVINE, TEKEL, VORONKA, YEE; *Special Instructing Staff:* FABRICIUS; *Adjunct Instructing Staff:* BUTEAU, GODDERZ, HAUBNER, KIZNER, MEGIBOW, MOSKOWITZ, ROCHE, TRACHTENBERG, VAN MEERBEKE.

The principal aim of the various courses offered by this department is to impart a knowledge of mathematics which will be useful to students during their study of science and which will also be of use to them later, in actual engineering practice. In keeping with the trend for greater emphasis on the humanities in engineering education, other aspects of mathematics relative to philosophical and cultural values are considered whenever opportunities arise.

COURSES OF INSTRUCTION

Math 10. MATHEMATICS. 4 *credits.*

This course includes certain topics in college algebra and a unit on the algebra of mathematical systems. It is primarily a course in analytic geometry.

Math 10A. BASIC MATHEMATICS. 2½ *credits.*

This course covers the algebra of the first part of Math 10, described above, and some trigonometry.

Math 10B. ANALYTIC GEOMETRY. 2½ *credits.*

Prerequisite: Math 10A. This course covers the subject matter included in the second part of Math 10 described above.

Math 15. DIFFERENTIAL CALCULUS. 4 *credits.*

Prerequisite: Math 10. The theories and techniques of the differential calculus are developed in this course. Applications to both physical and geometrical problems are considered throughout.

Math 15A. CALCULUS I. 2½ *credits.*

Prerequisite: Math 10B. This course covers the subject matter included in the first part of Math 15, described above.

Math 15B. CALCULUS II. 2½ *credits.*

Prerequisite: Math 15A. This course covers the subject matter included in the second part of Math 15, described above, and the first part of Math 20, described below.

Math 15H. HONORS MATHEMATICS I. 4 *credits.*

Prerequisite: Math 10. This is the first semester of a three-semester course in Honors Mathematics. Topics covered include rates of change, limits, continuity, and the theory of differentiation and integration along with their applications in the analysis of engineering problems. Admission to this course is restricted as described on page 34.

Math 20. INTEGRAL CALCULUS. 4 *credits.*

Prerequisite: Math 15. This is a course in integral calculus. Considerable emphasis is placed on physical applications of the theories and techniques in order to more fully develop the analytical power of the student.

Math 20H. HONORS MATHEMATICS II. 4 *credits.*

Prerequisite: Math 15H or Math 15. This is the second semester of a three-semester course in Honors Mathematics. Topics covered include methods of integration, determinants and linear equations, advanced analytic geometry, hyperbolic functions, polar coordinates and curves by the methods of analysis, introduction to vector analysis, and parametric equations. Admission to this course is restricted as described on page 34.

Math 25. INTERMEDIATE ANALYSIS. 4 *credits.*

Prerequisite: Math 20. This course consists of additional topics in calculus (multiple integrals, infinite series) and an introduction to differential equations through linear equations of first order. Fourier Series and hyperbolic functions are also introduced.

Math 25A. CALCULUS III. 3 *credits.*

Prerequisite: Math 15B. This course covers the subject matter included in the second part of Math 20 and the first part of Math 25, described above.

Math 25B. CALCULUS IV. 3 *credits.*

Prerequisite: Math 25A. This course covers the subject matter included in the second part of Math 25, described above.

Math 25H. HONORS MATHEMATICS III. 4 *credits.*

Prerequisite: Math 20H. This is the third semester of a three-semester course in Honors Mathematics and is a continuation of Math 20H. Topics covered include solid analytic geometry with vector analysis, partial differentitation, multiple integrals, infinite series, an introduction to the theory of complex variables, and differential equations.

Math 30. MATHEMATICS FOR ENGINEERS I. 2½ *credits.*

Prerequisite: Math 25. This course begins with the study of linear differential equations with constant coefficients and emphasizes engineering applications. Laplace Transforms are studied—also Fourier series and the Fourier integral. The course continues with other types of first and second order equations, systems of equations, and solutions by infinite series.

Math 33. PROBABILITY AND STATISTICS. 2½ *credits.*

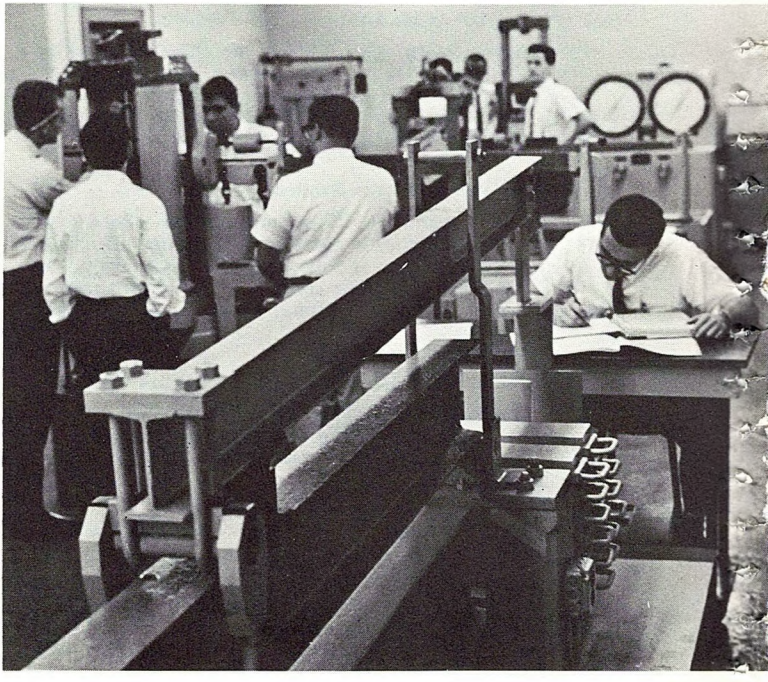
Prerequisite: Math 25. This is essentially a course in modern probability, statistics, and statistical inference. The specific topics include discrete and continuous distributions of random variables, probability models in science and statistical inference.

Math 34. MATHEMATICS FOR MANAGEMENT SCIENCE. 2½ *credits.*

Prerequisite: Math 33. This course is designed to acquaint the students with mathematical methods found especially useful in contemporary fields such as operations research and reliability engineering. Topics are selected from set theory, finite mathematics, difference equations, matrices and determinants, functions of several independent variables and special functions.

Math 35. MATHEMATICS FOR ENGINEERS II. 2½ *credits.*

Prerequisite: Math 25. This course includes the algebra and calculus of vectors; vector differential operators; line, surface, and volume integrals; and the integral theorems. Applications to differential geometry and physics will be treated. The course will conclude with an introduction to curvilinear coordinates.



DEPARTMENT OF MECHANICAL ENGINEERING

Chairman: GEORGE B. THOM.
Associate Chairman: EDWARD MILLER.
Assistant Chairmen: GERALD JAFFE, EUGENE H. SMITHBERG.

Professors: MILLER, POLANER, PREDALE, SMITHBERG, THOM; *Associate Professors:* BANNON, HSIEH, JACOBS, LEVY, MICHELS, SCHNEIDER, STAMPER; *Assistant Professors:* DEUTSCHMAN, GAAL, JAFFE, PEARCE, WILSON; *Instructors:* DROUGHTON, SCHRAM, TSCHANG; *Assistant Instructors:* GORNET, KIRCHNER; *Adjunct Instructing Staff:* ELIADES, HALILA, HOLMES, POSS, PREUSSE, SCHMERZLER, WEISMAN, WILNER, WORDEN.

Mechanical Engineering is concerned with the design, development, manufacture and operation of a wide variety of machines and apparatus devoted to the creation, conversion or use of power.

Practicing mechanical engineers may perform one or more of the above functions in such technological areas as aircraft engines and structures, including gas and gasoline engines, rockets and missiles; large scale power plants such as steam, hydraulic, gas and nuclear plants; materials of engineering construction; automatic control systems; production methods; and in the creation, design and use of equipment to accomplish these ends.

For the first two years the curriculum centers on the basic sciences of mathematics, physics, chemistry and mechanics. Supplementing this core of science courses are service courses in English, engineering graphics, electricity, materials of engineering, an introduction to the humanities and a program of orientation toward engineering and the problems of engineers.

During the third and fourth years, major emphasis is directed toward the establishment of a thorough grounding in the sciences of thermodynamics, fluid mechanics and heat transfer; in metallurgy and the properties of engineering materials; and in stress and vibration analysis. These are implemented through a study of manufacturing processes and through application courses in the areas of machine design and applied thermodynamics. The courses are supplemented by laboratory work, where appropriate, to develop an understanding of and a respect for testing procedures. Courses in the humanities and in the business side of the profession are continued, and various terminal courses are provided to give the student an insight into the methods available for applying theory to practice.

The undergraduate curriculum is designed to prepare the student for professional work in his field of major interest. It does more than this, however, for by virtue of the abundance of training in the basic and engineering sciences it provides the student with the background needed for continued study at the graduate level.

The Department feels strongly that a professional attitude should be developed early in an engineering career and that professional and honorary engineering societies provide substantial encouragement in its development. The Department has a student section of the American Society of Mechanical Engineers and a chapter of Pi Tau Sigma, the honorary mechanical engineering society. Students are encouraged to meet the requirements for membership in both organizations.

COURSES OF INSTRUCTION

ME 10. MANUFACTURING PROCESSES. 2 *credits.*

A combined lecture and laboratory course dealing with basic machining and fabrication processes. The lectures emphasize the advantages, disadvantages, accuracies, and economics of various machines and methods. Laboratory experiments are performed to study the generation of motion, power requirements, machineability, surface finishes, and joining methods.

ME 14. METALLURGY. 2½ *credits.*

Prerequisite: Chem 25. A course designed to acquaint the student with the nature of a metal and the characteristics of the various types of alloys. Plastic deformation, phase-change interruption, and precipitation-hardening are emphasized. These are illustrated by frequent reference to such common commercial metals as brass, steel and aluminum alloys.

ME 15. METALLOGRAPHY. 1½ *credits.*

Prerequisite: ME 14. Corequisite for Evening students only: ME 14. A laboratory course wherein the principles discussed in ME 14 are illustrated. The various techniques used include sample preparation, hardness testing, microscopy and photo-micrography, and thermal analysis. Both ferrous and non-ferrous alloys are subjected to cold-rolling and/or heat treatment and the results studied in relation to the effects on properties and microstructure.

ME 31. MECHANISMS. 3 *credits.*

Prerequisites: EG 2, Mech 2. Techniques of analysis based on the canonical vector equations of kinematics are developed and applied to various types of mechanisms. Typical applications in the geometry and motion study include simple and compound linkages, spur gearing, planetary gear trains, and cam systems.

ME 33. VIBRATION ANALYSIS. 2½ *credits.*

Prerequisites: Math 30, Mech 2. The purpose of this course is to present the fundamentals of vibration theory and to provide a general background for advanced study in this field. The basic theory of systems with single and multiple degrees of freedom is developed and applied. Damped vibration, vibration isolation, vibration of continuous media, and electrical-mechanical analogies are among the topics considered.

ME 34. MACHINE DESIGN I. 3 *credits.*

Prerequisites: ME 31, Mech 6. Principles of mechanics, strength of materials and mechanisms are utilized and supplemented in developing various techniques of analysis for the design of machine elements. Linkage members, shafts, power screws and mechanical springs are some of the elements considered. Design projects are assigned which include library research and optional use of the computer.

ME 36. MACHINE DESIGN II. 3 *credits.*

Prerequisites: ME 33, 34. A continuation of ME 34 with similar emphasis on techniques of analysis. Some of the machine elements considered here are spur gears, helical gears, hydrodynamic bearings and rolling-contact bearings. Design projects are also assigned in this course.

ME 37. STRUCTURAL ANALYSIS. 2 *credits.*

Prerequisite: Mech 6. A course designed to acquaint mechanical engineering students with the fundamentals of structural analysis. Consideration is given to such topics as moving loads, deflections, beams and columns, members and connections for both steel and reinforced concrete structures. Methods for graphical and analytical solution are developed.

ME 39. MACHINE DESIGN FUNDAMENTALS. 2½ *credits.*

Prerequisites: EG 2, Chem 25, Mech 2, 6, IE 24. A lecture and problem course for Industrial Engineering students. Major emphasis is on techniques of analysis as related to the design of basic machine components and mechanical drives. Some of the topics considered are kinematics of machines, design methods for fatigue loading, power screws, springs, brakes and clutches, belt and chain drives, gear drives, bearings and lubrication, and vibration fundamentals.

ME 41. THERMODYNAMICS I. 2½ *credits.*

Prerequisites: Math 25, Phys 2. A course in thermodynamic fundamentals. Among those principles introduced are the first and second laws of thermodynamics, physical properties of pure substances including real and ideal gases, entropy and availability.

ME 42. THERMODYNAMICS II. 3 *credits.*

Prerequisite: ME 41. A continuation of ME 41 including a study of gas-vapor mixtures and combustion. The principles are applied to analyses of gas power cycles, vapor power cycles, refrigeration cycles and air conditioning systems.

ME 43. MECHANICAL LABORATORY I. 2 *credits.*

Prerequisite: ME 41. A laboratory course in instrumentation and measurement for mechanical engineering students. Applications for the sensing of such variables as pressure, temperature, displacement and time under steady and transient conditions. Particular attention will be directed towards the range of applicability and sensitivity of instruments studied.

ME 44. FLUID MECHANICS. 2½ *credits.*

Prerequisites: Math 25, Phys 2. A course in the fundamentals of fluid mechanics treating the principles of fluid statics, one dimensional incompressible flow, dimensional analysis, dynamic similarity, laminar and turbulent flow, and an introduction to two dimensional flow of an ideal fluid.

ME 45. HEAT TRANSFER. 3 *credits.*

Prerequisites: ME 42, 44. A course for senior mechanical engineering students dealing with the principles of heat transfer as an engineering science. The subject matter includes steady and non-steady state conduction in one and two dimensions, fundamentals of convection including boundary layer concepts, experimental correlations based on dimensional analysis, radiation and heat transfer during phase change. These are applied to the design and analysis of heat exchangers.

ME 46. MECHANICAL LABORATORY II. 2½ *credits.*

Prerequisites: ME 43, 44. A laboratory course for mechanical engineering students applying the principles of thermodynamics, fluid flow and heat transfer to energy conversion systems.

ME 48. MECHANICAL LABORATORY III. 2½ *credits.*

Prerequisites: ME 45, 46. An advanced laboratory course for mechanical engineering students in the testing and evaluating performances of complete energy conversion systems associated with steam power plants, internal combustion engines, air conditioning and refrigeration, and power absorption units.

ME 53. ENERGY CONVERSION. 2½ *credits.*

Prerequisites: ME 42, 44, Math 30, Phys 4. A course in the analysis of energy conversion and applications to power systems. Introduction to chemical, nuclear, thermoelectric, thermionic, photovoltaic, and magnetohydrodynamic energy conversion devices and the analysis of cycles using these concepts.

ME 54. GAS DYNAMICS. 2½ *credits.*

Prerequisites: ME 42, 44, Math 30. Equations of one dimensional compressible flow. Included are flows with variable area, friction, mass addition, heat addition, normal shocks, and combination of these effects. Special topics in two dimensional flows including oblique shocks.

ME 55. AUTOMATIC CONTROLS. 2½ *credits.*

Prerequisites: Math 30, Mech 2, Phys 3. 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.

ME 56. FLUID MACHINERY. 2½ *credits.*

Prerequisites: ME 42, 44, Math 30. 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 73. THERMODYNAMICS FOR CIVIL ENGINEERS II. 2 *credits.*

Prerequisite: ME 41. A continuation of ME 41, for civil engineering students. The principles of thermodynamics are applied to combustion processes, air conditioning, gas power and vapor power cycles and compression processes. The fundamentals of heat transfer are introduced.

ME 75. THERMODYNAMICS FOR INDUSTRIAL ENGINEERS II. 2 *credits.*

Prerequisite: ME 41. An introduction to fluid mechanics, continuity, momentum and energy equations. Fundamentals of heat transfer, including basic laws of conduction, convection and radiation. Applications of thermodynamics to air conditioning systems, gas and vapor power cycles, and combustion processes.

ME 77. Power and Fluids Laboratory. 2 *credits.*

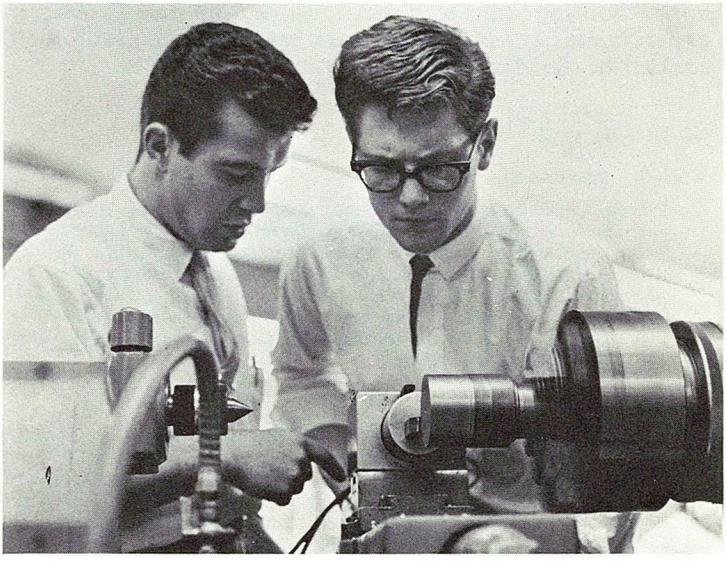
Prerequisite: CE 44. Corequisite: ME 41. A laboratory course for civil engineering students in which the fundamentals of thermodynamics and fluid mechanics are applied to the experimental investigation of flow in pipes, fluid meters and open channels. Tests are run on pumps, compressors, turbines, weirs and other hydraulic and pneumatic equipment.

ME 78. Thermodynamics for Electrical Engineers II. 2 *credits.*

Prerequisite: ME 41. A continuation of ME 41. The subject matter includes an introduction to fluid mechanics with fluids in static equilibrium, energy, continuity, Bernouilli's equation, momentum equations, heat transfer including conduction, convection and radiation and an introduction to direct energy conversion devices.

ME 79. Computer Solutions in Mechanical Engineering. 2½ *credits.*

Prerequisite: Math 25. An introduction to digital and analog computing machine techniques for the solution of mechanical engineering problems. Topics include numerical methods and Fortran programming. Problems relating to thermodynamics, fluid mechanics and vibrations are solved at the Computing Center.



DEPARTMENT OF PHYSICS AND MECHANICS

Chairman: PAUL O. HOFFMANN.
Associate Chairman: ACHILLE CAPECELATRO.
Assistant Chairman (Applied Mechanics): EIVIND G. F. RAMBERG.
Assistant Chairman (Physics): LEONARD M. SALZARULO.

Professors: BERTSCH, CAPECELATRO, HOFFMANN, MAINARDI, NIELSEN, ORENS, RAMBERG, REFF, SMITH; *Associate Professors:* DUURSEMA, MONACK, SAGURTON, WELLER, WILLIAMS; *Assistant Professors:* CIESLA, GRANIK, KINGERY, KUHARETZ, LANDSMAN, LOVERIDGE, NEIDHARDT, OLECK, REIZISS, RUSSO, SALZARULO, SHUKUR, TOWFIK, WITTES; *Instructors:* DISTEFANO, GIORDANO, MCGURN, REISMAN, SAVIN, TAYLOR; *Assistant Instructor:* MCGOVERN; *Special Instructing Staff:* AARON, SCHWEIZER; *Adjunct Instructing Staff:* BAZAZ, CONRAD, DEMCHAK, DOOLIN, FEENEY, FRANGIPANE, GERHARD, GROSSMAN, KEVIN, KOSSMAN, KRAMER, LARSON, MOSKOWITZ, RAUPPIUS, RUF, SIBILIA, WEBER, WEI, WEINER.

The Department of Physics and Mechanics has arranged the content of its courses to give the engineering student a sound background in physics and engineering mechanics. It is the aim of the department to have the student realize that physics and engineering mechanics serves as the foundation upon which his engineering knowledge must be based. Emphasis is placed upon the fact that the fundamental principles of those sciences must be applied in later professional studies.

The schedule of instruction includes a rather small amount of formal lecturing with a large number of informal recitations, problem work and demonstration periods, together with laboratory work in general physics and stress and strain analysis. The Department of Physics and Mechanics is supplied with four General Physics laboratories completely equipped to enable the student to perform experiments in mechanics, electricity, heat, sound and light. The stress analysis laboratories have equipment approximating industrial laboratories, and the performance of experiments is carried out in such manner as to verify the theory studied in the classroom.

COURSES OF INSTRUCTION

Mech 1. STATICS. 2 *credits.*

Prerequisites: Phys 1, Math 20 (or concurrently). This course is devoted entirely to statics. Topics include elementary vector algebra, scalar and vector products applied to two and three dimensional force systems, equilibrium, friction (sliding, belt, and bearing) second moments of areas and of masses, flexible cables, virtual work, and engineering applications of statics. The emphasis in this course is on engineering mechanics in which a maximum use is made of the free body diagram approach, together with vector analysis methods.

Mech 2. DYNAMICS. 2 *credits.*

Prerequisites: Mech 1, Math 25 (or concurrently). This course covers kinematics and kinetics. The topics of instruction include curvilinear motion with respect to fixed and rotating axes of particles and rigid bodies, Newton's Laws of motion for particles and rigid bodies, principle of work and energy, and principle of impulse and momentum. The free body diagram approach and vector analysis methods are used.

Mech 5. MECHANICS OF DEFORMABLE BODIES. 4 *credits.*

Prerequisites: Mech 1, Math 25. The physical basis of stress and strain analysis is studied in theory and demonstrated by laboratory experiments. The principles and methods are applied to practical problems involving the elements of which structures and machines are composed such as axial, flexural, and torsional members and combinations of these.

Mech 6. MECHANICS OF DEFORMABLE BODIES. 4 *credits.*

Prerequisites: Mech 1, Math 25. Similar to Mech 5, except that less time is devoted to laboratory experiments.

Phys 1. PHYSICS I. 3½ *credits.*

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, circular and simple harmonic motion; equilibrium and Newton's laws of motion; work, energy, momentum, and the conservation laws. Correlated experiments and computations run concurrently with lectures and recitations.

Phys 2. PHYSICS II. 3½ *credits.*

Prerequisite: Phys 1. Elements of heat, sound, and light form the contents of this course. The concept of wave motion and the transfer of energy by means of wave motion is emphasized. The First Law of Thermodynamics serves as a further example of the conservation laws. In the study of light the principles of geometric optics are applied to lenses and optical instruments. Correlated experiments and computations run concurrently with lectures and recitations.

Phys 3. PHYSICS III. 3½ *credits.*

Prerequisite: Phys 2. Electricity and magnetism are presented from the point of view of the field concept and the conservation laws. The study of the electric field and the magnetic field culminates in the important relationships between electric and magnetic concepts which can be used in later courses as foundations upon which Maxwell's equations can be built. The laws of conservation of charge, mass and energy are used throughout the course, particularly in the study of capacitors, direct currents and alternating currents. Correlated experiments and computations run concurrently with lectures and recitations.

Phys 4. PHYSICS IV. 3½ *credits.*

Prerequisite: Phys 3. The ideas of Modern Physics are taken up in this course. 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 now broadened to include the law of equivalence of mass and energy. Elements of solid state and nuclear physics are introduced. Correlated experiments and computations run concurrently with lectures and recitations.

Phys 5. ELECTRONIC PHYSICS. 2 *credits.*

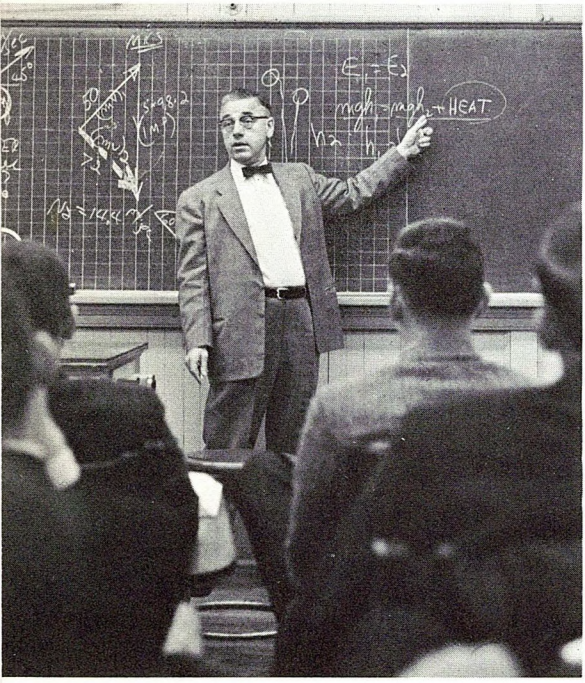
Prerequisites: Phys 3, 4. In this course the fundamental physical laws which determine the behavior of the electron in a vacuum, in a gaseous material and in solids are examined and applied to problems of interest to the electrical engineer. This involves the study of atomic structure, the elements of quantum mechanics, semiconductors, junction effects, photoelectric phenomena and gaseous conduction. These concepts are applied to vacuum and gas electron tubes, photoelectric devices and transistors.

Phys 6. ENGINEERING PHYSICS. 2 *credits.*

Prerequisites: Phys 4, Mech 2, Math 30. Lagrange's and Hamilton's equations are studied. Field concepts are applied to elasticity, fluid flow, elastic waves and heat flow. Boundary value problems are solved, based on the wave equation, Laplace's equation and the equation of heat flow.

Phys 7. NUCLEAR ENGINEERING. 2 *credits.*

Prerequisites: Phys 4, Math 30. Neutron physics is applied to elementary nuclear reactor design. Topics included are nuclear reactions, nuclear fission, neutron diffusion, criticality, reactor start-up and reactor transients, radiation detection and shielding.



DEPARTMENT OF INDUSTRIAL RELATIONS

Chairman: ROBERT E. KIEHL.
Associate Chairman: JOHN H. METZLER.

Professors: CAMBRELENG, KIEHL, STEPHANS; *Associate Professors:* LORD, LUBIN, METZLER, STOCHAJ, ZIMMER; *Assistant Professors:* GILROY, RUCKER; *Assistant Instructor:* MURRAY; *Special Instructing Staff:* CHAPLEAU, ERICKSON, ILIVICKY, MALONE, MINNIS, NOYES; *Adjunct Instructing Staff:* BEVERLEY, BURNS, GOODWILLIE, HABER, MENK, O'CONNOR, OKERSON, YAROSZ.

The guiding philosophy of the Department of Industrial Relations, derived from the stated aims and objectives of the College, is based on a recognition that the student must understand himself as a maturing individual if he is to take his place in the community as a genuinely educated man.

To assist in the achievement of this important goal, the courses are planned to provide a broad foundation upon which to build an understanding, not only of the relationship of the individual to other individuals, which is the province of human relations, but also an appreciation of the complex industrial world. With this knowledge, the scientific annd mathematical proficiency of the engineer will be complemented by insights important to leadership and success.

The Department of Industrial Relations is associated with the Placement Office and the Counseling Center in assisting students with career choices and placement.

COURSES OF INSTRUCTION

IR 21. PSYCHOLOGY OF PERSONAL ADJUSTMENT. ½ *credit.*

A course of study in introductory psychology that is designed to assist first year students in their adjustment to college and to the engineering profession. Emphasis is given to science's contribution in the understanding of learning, study habits, remembering, forgetting, and in problem solving.

IR 22. PSYCHOLOGY OF PERSONAL ADJUSTMENT. ½ *credit.*

Prerequisite: IR 21. A continuation of IR 21 in which the nature of the engineering profession together with the occupational choices within its branches and functions are considered in the discussions on the psychology of career planning.

IR 23. ELEMENTS OF INDUSTRIAL GROWTH. 1 *credit.*

A comprehensive survey of the growth of Industry in the United States. Consideration is given to the social, economic, cultural and political forces which helped shape America. There is an examination of the problems encountered by management and labor in a growing and expanding U.S.A. Emphasis is on the relation of the individual to other individuals and the role of the engineer in an industrial society.

IR 24. ELEMENTS OF INDUSTRIAL GROWTH. 1 *credit.*

Prerequisite: IR 23. A continuation of IR 23.

IR 25. HUMAN RELATIONS. 1½ *credits.*

Students consider the basic needs of the individual employee and the ways in which modern industry satisfies these needs in on-the-job relationships. Analytical techniques broadly applicable to all groups are considered. Study is made of the human problems of management, individual and group motivation, the impact of technology, and the skills of face-to-face supervision.

IR 26. PERSONNEL ADMINISTRATION. 1½ *credits.*

Prerequisite: IR 25. A study of methods that are used in managing people and in administering work situations. Such aspects of personnel administration as recruitment, selection, rating, promotion, training, incentive systems, and benefit programs are evaluated.

IR 27. LABOR RELATIONS. 2 *credits.*

Prerequisite: IR 24. Labor-management relations are explored and specific attention is given to the organization and policies of unions, collective bargaining, employers' associations, the settlement of disputes, and the social control of activities through appropriate legislative acts. The conference method and lectures are used.

IR 28. CONTEMPORARY ISSUES. 2 *credits.*

Prerequisite: IR 26. The student studies an integrated picture of human society through the emphasized interrelationships of anthropology, sociology, economics, and political science. Special emphasis is placed upon the culture concepts, developed through a senior convocation program, class conferences and lectures.

IR 29. COTEMPORARY ISSUES. 1½ *credits.*

A series of senior convocations combined with class discussion and student readings to emphasize the interrelationships of anthropology, sociology, economics, and political science. For ROTC students only.

IR 31. PSYCHOLOGY OF PERSONAL ADJUSTMENT. 1 *credit.*

This course is similar in content to IR 21 and IR 22 combined.

IR 34. ELEMENTS OF INDUSTRIAL GROWTH. 2 *credits.*

This course is similar in content to IR 23 and IR 24 combined.

IR 38. INDUSTRIAL RELATIONS. 1½ *credits.*

Prerequisite: IR 34. Prepared especially for the ROTC student. This course includes a study of the union organization, an analysis of collective bargaining, the legislation affecting labor-management relations and the effects of technological change on society.

IR 46. HUMAN RELATIONS AND PERSONNEL ADMINISTRATION. 3 *credits.*

Prerequisite: IR 24 or IR 34. This is a series of conferences and lectures designed to explore the human relationships in industry and to study existing personnel programs which are intended to maintain high morale. The broad area of manpower management and personnel administration is investigated.

IR 48. LABOR RELATIONS AND SOCIAL PROBLEMS. 3 *credits.*

Prerequisite: IR 46 or IR 26. Labor-management relations and other current social problems are studied through conferences and lectures. The organization and policies of unions, collective bargaining, employers' associations, the settlement of disputes and social control through legislation and other appropriate activities are studied.

DIVISION OF HEALTH, PHYSICAL EDUCATION AND ATHLETICS

Director: ROBERT F. SWANSON.
Associate Director: PAUL C. HAUSSER.
Associate Professors: HAUSSER, SWANSON; *Assistant Professor:* SIMON.

The acquisition and maintenance of student health for the purpose of pursuing an engineering education is the primary purpose of physical education and athletics at the College. To accomplish this purpose, the Division marshals the available resources of the community, conducts a formal instruction program for freshman students, and coordinates and advises students in the operation of various intramural and intercollegiate athletic activities.

PHYSICAL EDUCATION. *No credit, two semesters.*

Physical Education is required of all freshman students. Those freshmen who submit evidence of a disability, or who have been examined by the College physician and declared physically unable to participate in strenuous physical activity, take part in an individualized program under the guidance of a physical education instructor.

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