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University of Maine, Office of Student Records

College of Education

MARK R. SHIBLES, DEAN

COLLEGE OF EDUCATION

The College of Education offers four-year programs designed for the preparation of elementary, junior and senior high school teachers; also teachers of physical education, athletics, health and recreation. Within the four-year undergraduate program a student may start his preparation for such positions as a specialist in reading, guidance counselor, principal, supervisor, and school administrator. These programs are usually completed during a period of graduate study.

The College of Education also provides instruction, on a service basis, in the professional subjects essential to the preparation for teaching, to undergraduate students from other divisions of the University and also for students registered with the Faculty of Graduate Study.

GENERAL INFORMATION

The College of Education concerns itself only with those students who are planning for a career in the field of education. All of its undergraduate programs are designed so that each student will include a substantial amount of college work in the humanities, a concentration of academic work closely related to the area of special teaching interest, and basic professional work in education and psychology. No undergraduate student in the College of Education will be recommended for a degree until he has fulfilled these requirements.

ADMISSION

Students are ordinarily admitted to the College of Education as first-year students in the four-year program. The specific admission requirements are given on page 27 of this catalog. Any deficiencies in these requirements must be made up during the student's first two years. A student admitted with advanced standing must satisfy all basic entrance requirements during his first year in the College of Education.

DESCRIPTION OF THE FOUR-YEAR PROGRAM

The booklet, "A Four-Year Program in the College of Education," describing in detail the special requirements in general education, the courses needed for the development of various teaching fields, and the required work in professional education, has been prepared for students who desire to enter education.

A copy of this booklet may be obtained by writing to the Director of Admissions or the Dean of the College of Education.

ADMISSION WITH ADVANCED STANDING

Students from other institutions who have already completed a portion of a teacher-education program or who desire to change their professional plans and enter education are invited to apply for admission by transfer. Each such case will be considered on its own merits. When such students are accepted, they will be given advanced standing in the College of Education for work already completed which meets the established standards of quality and the specific course requirements of the program to which they are seeking admission.

The procedure for admission to advanced standing varies slightly according to the type of institution involved. This is explained below:

A. **From the Various Colleges of the University of Maine**

Students in the College of Arts and Sciences, Agriculture, and Technology who desire to change their professional or vocational plans and enter education may be accepted for transfer to the College of Education. (This does not apply to students who expect to teach agriculture or home economics. The direction of their professional work remains in the College of Agriculture.) When students from other Colleges of the University are admitted to the College of Education, work previously completed will be accepted insofar as it applies to the proposed program in the College of Education, and meets the minimum standards of quality established by the University.

Students from any other college of the University of Maine who desire to consider such a transfer are invited to consult with the Dean of the College of Education. The actual transfer is initiated by the student through the office of the Director of Admissions.

B. **From Institutions other than the University of Maine**

1. **Maine Normal Schools and Teachers Colleges.**—Undergraduate students from Maine normal schools and teachers colleges will be considered for admission by transfer with advanced standing provided they are recommended by the institution involved.

Graduates of the three-year courses in the normal schools who have had teaching experience, provided they have the recommendation of the institution, may be admitted to senior standing, and may be graduated on the satisfactory completion of one year of work. This program is ordinarily restricted to elementary school teachers, supervisors, and administrators who plan to remain in the elementary school field.

Normal school and teachers college students who are interested in entering the College of Education should request application forms from the Director of admissions of the University.

2. **All other Institutions.**—Students who desire to transfer from another institution to the University of Maine for the purpose of preparing to teach should apply for admission to the College of Education. Initial correspondence concerning such admission should be with the Director of Admissions. Applicants accepted by transfer with advanced standing to the College of Education will be responsible for fulfilling the same general requirements as those students coming as freshmen directly from secondary schools.

Summer Session and Extension Class Students.—Students whose only work to date in the College of Education has been, and those whose first work in the College of Education will be, in the summer session, by class extension, at the various Extension centers, are strongly urged to apply for admission to the University exactly as they would if they expected to enroll for resident work during the regular school year. This recommendation applies both to students who expect to work for a degree in the College of Education and also those who have not yet fully decided on the matter.

Among the advantages which come to a student by reason of being admitted to the University are: Immediate assignment of a major adviser to counsel on registration, requirements, etc.; and eligibility for guidance and counseling service. Students who expect their work to be in the summer session should apply prior

to their first registration; students whose first work is to be by class extension should apply during their first extension course.

Application for admission should be made directly to the Director of Admissions, University of Maine. (See sections immediately above.)

GUIDANCE SERVICE FOR STUDENTS

A guidance and testing service is provided for all students enrolled in the College of Education. This service is briefly described below.

Testing.—Students admitted to the College of Education will be expected to take a series of tests, either prior to or immediately after their first registration in a regular session. These tests will cover general scholastic ability and achievement in broad academic fields. In addition, tests, scales, and inventories in such areas as personality, interests and aptitudes, will be available for those students who desire this service.

The results of these tests will be made known to the individual student through his adviser. These test results will be used by the adviser as a basis for counseling.

Counseling.—Immediately upon admittance to the College of Education each student is assigned a staff member to act as his major adviser. The major adviser will assist the student in the selection of a field of concentration, advise with him on the selection of specific courses, check registration and graduation requirements and counsel with personal and vocational problems.

GRADUATION REQUIREMENTS

The completion of the required work of the College of Education leads to the degree of Bachelor of Science in Education (B.S. in Ed.).

A total of 128 degree hours of college work, exclusive of credit for basic military training, is required for graduation. In addition, each student must accumulate a total number of "grade points" equal to 2 times the number of hours in which he receives grades. Grade points are computed by multiplying each hour of the letter grade by a factor as follows: A by 4, B by 3, C by 2, and D by 1.

Included in the 128 semester hours required for graduation for those who follow the *elementary teacher* program, are a minimum of 50 degree hours in general education, 25 to 27 degree hours of courses in professional subjects, and 24 hours in a major academic field. Special work in appropriate fields (such as art, music, speech, psychology, child growth and development, and health and physical education) is also required.

All work by the student registered in the College of Education must be carried with an average grade of C (2.0) or better.

Those who follow the *secondary teacher* program, are required to complete a minimum of 42 degree hours in general education, 18 to 20 degree hours in professional education, and 50 degree hours in the field of concentration. The foregoing are included in the 128 hours required for a degree.

Students who expect to qualify to teach in a specialized field, such as physical education, will use the work in this special area as their field of concentration.

All work in the student's program, including those subjects in his field of concentration, must be carried with an average grade of C or better to qualify for a degree from the College of Education.

General Education Subjects Required.—Information concerning the specific

courses required in general education is available from the Office of the Dean. The subjects and credit hours are:

English	12 credit hours
*Speech	2-4 credit hours
Social Studies	8-10 credit hours
Science	6-8 credit hours
Fine Arts	6-10 credit hours
*General Psychology	9 credit hours
Elective in the above areas to total	42-47 credit hours

*Students in the elementary program must complete 4 hours in the area of speech and 9 hours in the area of psychology.

In addition to their regular subjects, teachers generally participate in the direction of student activities such as music, debating, dramatics, clubs, and games. Each student in the College of Education should develop some proficiency in at least one of these fields.

Professional Subjects Required.—The professional subjects required for a degree from the College of Education also meet the current state requirements for a teaching certificate. Students who desire to qualify for general teaching in the junior and senior high school only are required to complete 18 to 20 credit hours in professional education subjects plus courses in general and educational psychology. Students who desire to qualify for general teaching in the elementary school are required to complete 25 to 27 credit hours in professional education plus general and educational psychology.

The required professional subjects are designed to acquaint the student with the general aims of education and the techniques and principles of teaching. These courses are arranged so that they culminate in the course, *Observation and Supervised Student Teaching*. Two plans are provided for this student teaching experience. In one, the student spends one half of each day for one semester in regular college work and the other half-day as a student teacher in a local school; under the second plan, the student spends full days in regular college work for one half of the semester, and full days as a student teacher in the public schools for the other half semester.

The sequence of courses for each plan for student teaching is given below.

GENERAL SECONDARY ONLY

Plan I—Observation and Student Teaching for half days for full semester

Plan II—Observation and Student Teaching for full days for half semester

Freshman Year

FALL SEMESTER

Ed A 2 Orientation 0

Sophomore Year

FALL SEMESTER

Py 1 Gen. Psych. ..... 3 hrs.

SPRING SEMESTER

Py 2 Gen. Psych. ..... 3 hrs.
Ed H 1 Intro. to Ed. ..... 2 hrs.

FALL SEMESTER

Py 1 Gen. Psych. ..... 3 hrs.

SPRING SEMESTER

Py 2 Gen. Psych. ..... 3 hrs.
Ed H 1 Intro. to Ed. ..... 2 hrs.

Junior Year

FALL SEMESTER

Py	65	Ed. Psych.	3 hrs.

SPRING SEMESTER

Ed	C 1	Sec. Sch. Curr.	2 hrs.
Ed	M 6	Prin. of Teach.	2 hrs.

(Ed H 1 and Py 65 are both prerequisites to Ed M 6)

*Ed ..... 2 to 4 hrs.

FALL SEMESTER

Py	65	Ed. Psych.	3 hrs.
Ed	C 1	Sec. Sch. Curr.	2 hrs.

SPRING SEMESTER

Ed	C 1	Sec. Sch. Curr.	2 hrs.
Ed	M 6	Prin. of Teach.	2 hrs.

(Ed H 1 and Py 65 are both prerequisites to Ed M 6)

Senior Year

FALL SEMESTER

*Ed ..... 2 to 6 hrs.

SPRING SEMESTER

*Ed ..... 2 to 6 hrs.

*The following courses are to be taken during these three semesters, as follows:

A. Any of the three semesters:

Ed	C 2	Aud. Vis. Aids	2 hrs.
Ed	A 21	Meas, in Sec. Sch.	2 hrs.

B. Either semester of senior year:

Ed	M 93	Half-day Stud.Teach. (Sec.)	6 hrs.
Ed	A 51	Prin. & Tech. Guid.	2 hrs.

FALL SEMESTER

Sy	55	Educ. Sociology	2 hrs.
*Ed	M 91	Full-day Stud. Teach. (Sec.)	8 hrs.
Ed	C 2	Aud. Vis. Aids	2 hrs.
Ed	A 21	Meas. in Sec. Sch.	2 hrs.
Ed	A 51	Prin. & Tech. Guid.	2 hrs.

*All day for 8 weeks. All other courses taken in the alternate 8 weeks.

SPRING SEMESTER

Ed	M 91	Full-day Stud. Teach. (Sec.)	8 hrs.
Ed	C 2	Aud. Vis. Aids	2 hrs.
Ed	A 21	Meas. in Sec. Sch.	2 hrs.
Ed	A 51	Prin. & Tech. Guid.	2 hrs.

GENERAL ELEMENTARY ONLY

Plan I—Observation and Student Teaching for half days for full semester

Plan II—Observation and Student Teaching for full days for half semester

Sophomore Year

FALL SEMESTER

Py	1	Gen. Psych.	3 hrs.

SPRING SEMESTER

Py	2	Gen. Psych.	3 hrs.
Ed	H 1	Intro. to Ed.	2 hrs.

FALL SEMESTER

Py	1	Gen. Psych.	3 hrs.

SPRING SEMESTER

Py	2	Gen. Psych.	3 hrs.
Ed	H 1	Intro. to Ed.	2 hrs.

Junior Year

FALL SEMESTER

Py	65	Ed. Psych.	3 hrs.
Ed	M 13	Teach. Reading	3 hrs.

FALL SEMESTER

Py	65	Ed. Psych.	3 hrs.
Ed	M 13	Teach. Reading	3 hrs.

SPRING SEMESTER

Ed M 14	Teach. Arith.	3 hrs.

SPRING SEMESTER

Ed M 14	Teach. Arith.	3 hrs.
Ed A 11	Measurement in the Elem. Sch.	2 hrs.

Senior Year

FALL SEMESTER

*Ed M 92	Half-day Stud. Teach. (Ele.)	6 hrs.
Ed M 15	Teach. Social Studies in the Elem. Sch.	3 hrs.
Ed M 16	Teaching Science in the Elem. Sch.	3 hrs.
Mc 7	Teaching Music in the Elem. Sch.	3 hrs.

FALL SEMESTER

Ed M 15	Teach. Social Studies in the Elem. Sch.	3 hrs.
Ed M 90	Full-day Stud. Teach. (Ele.)	8 hrs.
Ed M 16	Teaching Science in the Elem. Sch.	3 hrs.
Mc 7	Teaching Music in the Elem. Sch.	3 hrs.

SPRING SEMESTER

*Ed M 92	Half-day Stud. Teach.	6 hrs.
Ed M 18	Teach. Lang. Arts	3 hrs.

SPRING SEMESTER

Ed M 18	Teach. Lang. Arts	3 hrs.

Ed M 92 to be taken in either but not both of the semesters indicated.

Normally these courses are taken in the years indicated; however, a student who did not start this sequence during his sophomore year may still be admitted to the College of Education. Such students when admitted, must complete these courses in sequence. It may be necessary for such students to use more than the normal eight semesters to satisfy graduation requirements.

Students whose work before entering the College of Education has been at an institution other than the University of Maine, will be expected to complete the above requirements, or their equivalent.

RESIDENCE REQUIREMENTS

A minimum of thirty semester hours of credit must be earned while in residence at the University to qualify a candidate for a degree. This requirement may be met by one academic year of residence, or by attendance in summer sessions. For students who are enrolled in correspondence, extension and summer session courses, the thirty hours of residence credit may be obtained over an extended period of time and need not be continuous; however, such candidates must enroll for the last six hours of credit on the campus. Work taken at the Extension Centers is considered resident credit for undergraduate students in the College of Education. Off-campus students, before enrolling for a correspondence or extension course, should ascertain from the Dean of the College of Education the amount of such work which is allowed toward fulfilling the requirements for the degree. In all cases, this requirement of thirty hours of residence work must be met after the student has become a candidate for a degree in the College of Education.

Exceptions to these rules will not be permitted except by a vote of the faculty.

EDUCATION COURSES IN THE SUMMER SESSION, BY EXTENSION, OR CORRESPONDENCE

Numerous education courses are offered during the Summer Session, and by correspondence and class extension; however, students admitted to a degree program on or after September 1, 1960, are not granted degree credit for cor-

respondence study. Detailed information regarding the Summer Session and General Extension Courses may be obtained by communicating with the Director, Mark R. Shibles, College of Education, Orono, Maine.

BUREAU OF EDUCATIONAL RESEARCH AND SERVICE

Organized as an integral part of the College of Education, the Bureau of Educational Research and Service is available to render specialized service in connection with testing programs, surveys, and counseling, both on campus and to the schools of the State. Information concerning these services, including appointments and fees, may be obtained from the Director.

In addition to being available for consultation on special problems, the Bureau maintains the regular services listed below.

Testing Service on the University Campus.—An International Business Machine Test scoring machine is available for campus use with either standardized or informal tests. Sample tests and catalogs of test publishers are available for study by members of the University faculty. Answer sheets, scoring keys, special pencils, and other materials, as well as information booklets on the construction of informal tests for machine scoring, are carried in stock.

Scoring and reporting the results of Freshman Week Tests are also carried on by the Bureau.

Testing Service Off-Campus.—The Bureau is available for consultation by school officials of the State in planning testing programs. Arrangements may be made for scoring tests used in such programs. Basic materials for use with the International Business Machine scoring machine can be rented from the Bureau.

AUDIO-VISUAL SERVICE

The Audio-Visual Service, under the auspices of the College of Education, maintains a lending library of educational motion pictures, and renders assistance in their selection and use. These materials and services are available to the schools of the State, responsible civic groups, student organizations, and campus classes at the University.

A small rental or service fee is charged for these materials when they are sent off campus; no fee is charged for their educational use on the campus. In addition, projection equipment, and a staff of student operators, are available for campus use. A projection room, accommodating 65 people, is provided in Stevens Hall, South, for use when suitable classroom space is unavailable.

In order to assist in the selection and use of audio-visual teaching aids, interested persons are invited to inspect these materials, and also the catalogs and descriptive publications of the various manufacturers. The Office will be glad to arrange previews of any of its material.

Details of this service are contained in a separate bulletin which is available on request. For this bulletin, or other information, address the Office of the Director of Audio-Visual Service, Stevens Hall, South.

CERTIFICATES FOR TEACHERS

It should be clearly understood that the State Department of Education has sole authority to issue certificates for teaching. The Office of the Dean of the College of Education, however, is in a position to advise prospective teachers concerning certificates.

In order to provide for the many types of school positions, the State Department issues several types of certificates. Most types of certificates are issued in

three grades—Provisional Grade B, Provisional Grade A, and Standard—depending upon the amount and type of work presented by the applicant. The graduation requirements of the College of Education are established so that all students who are graduated from the College will meet or exceed the requirements for the Provisional Grade A certificate of the particular type involved.

In addition to furnishing courses for its own students, the College of Education acts as a service agency to provide professional training for students from other teaching units of the University who wish to qualify for a teaching certificate. Such students are enrolled in the same classes with students from the College of Education and if they follow the same pattern will receive the same grade certificate. This pattern is given on pages 177-179. Occasionally, students from other units of the University desire to qualify initially for the Provisional Grade B certificate. The 15 hours of basic work (Py 1, 2 and 65; Ed H 1, Ed C 1 and Ed M 6 meet the professional subject requirements for the General Secondary Provisional Grade B certificate. Students who wish to meet the requirements for the General Elementary Provisional Grade B certificate are required to complete 12 additional hours in courses in elementary school methods and materials. These 12 hours are made up of:

Ed M 13	Teaching of Reading	3 credit hours
Ed M 14	Teaching of Arithmetic	3 credit hours

and 6 hours from among other courses in elementary school methods and materials. Students who expect to apply for the general secondary certificate must fufill the requirement of a *teaching field*. This teaching field requirement refers to subjects or areas commonly taught in secondary schools and may be met by either of the following patterns:

Pattern A

(1) A minimum of *thirty* semester credit hours in a subject field, excepting Latin or Mathematics which are recognized upon the completion of *eighteen* semester credit hours, together with (2) a minimum of *twenty-one* semester credit hours in a second subject field *or* a minimum of *twelve* semester credit hours each in not less than two additional subject fields, excepting Latin or Mathematics which are recognized upon the completion of *eight* semester credit hours.

Pattern B

A minimum of *fifty* semester credit hours within an area of specialization (i.e., social studies, English, science and mathematics, the sciences) in which at least three common subject fields are represented.

Information concerning requirements for certificates to teach physical education differ from the above, and may be obtained upon inquiry at the office of the College of Education.

Students who expect to obtain the general elementary certificate must satisfactorily complete a minimum of *twenty-four* semester credit hours in a subject field selected from the following: history, government, sociology, English, speech, economics, natural sciences, languages, mathematics, psychology.

PLACEMENT BUREAU FOR TEACHERS

The Placement Bureau for Teachers, described on page 19, is administered by the College of Education. It is designed to assist prospective teachers in placement and to facilitate promotion of teachers in service. Information regarding this service may be obtained from Teacher Placement Bureau, Room 22, Stevens Hall, South.

COURSES OF INSTRUCTION

Courses numbered 1-99 are for undergraduates; courses numbered 200 and above are primarily for graduates. Courses numbered below 100 which have been approved for graduate credit are indicated by a graduate designation, in parentheses, after the regular course number.

For descriptions of courses in Psychology required in programs in Education see page 160.

PROFESSORS SHIBLES, CRAWFORD, RANKIN, SUPPLE, AND DAVIS; ASSOCIATE PROFESSORS FREEMAN AND CAUGHRAN; ASSISTANT PROFESSORS CARPENTER, MACCAMPBELL, FINK, OLSON, SANFORD, BAILEY, PORTER-SHIRLEY, REARDON AND MYERS; MR. FOBES AND MRS. BOYCE

Appraisal—Pupil Adjustment and Personnel Practices (Ed A)

1 (101). Statistical Methods in Education.—Use of statistical techniques as guides and controls in the solution of problems in education. *Cr* 3. [Formerly numbered Ed 40] MR. CRAWFORD

11 (111). Measurement in the Elementary School.—Philosophy, principles, and techniques of measuring in the elementary school. Tests for use in such areas as basic abilities, readiness, diagnosis, and achievement will be studied. *Cr* 2. [Formerly numbered Ed 41C] MR. FINK

21 (121). Measurement in the Secondary School.—Principles and techniques of measuring in the secondary school; methods for measuring basic abilities, aptitude, and achievement; practice in the construction of teacher-made and the selection of standardized tests. *Cr* 2. [Formerly numbered Ed 41F] MR. FINK

31 (131). Use of Standard Tests.—Selection, administration, interpretation, and use of standardized tests in Grades 1 through 12. *Cr* 2. [Formerly numbered Ed 42] MR. CRAWFORD, MR. FINK

51 (151). Principles and Techniques of Guidance.—Philosophy, current concepts, underlying principles, and essential elements of a guidance program; organization and administration of guidance programs. *Cr* 2. [Formerly numbered Ed 45] MR. FREEMAN, MR. SANFORD

52 (152). Group Guidance.—Analysis of the meaning of group experience. Examination and evaluation of guidance techniques, materials, and programs with groups at all grade levels. *Cr* 3. [Formerly numbered Ed 45A] MR. FREEMAN

53 (153). Occupational and Educational Information.—Sources and nature of occupational and educational information; collection, evaluation, and use of informational materials with individuals and groups. *Cr* 3. [Formerly numbered Ed 46] MR. FREEMAN, MR. SANFORD

54 (154). Organization and Administration of Pupil Personnel Services.—Scope and general character of pupil personnel services; the duties of the director, organization and administration of the program and the interrelationship and functioning of various aspects of the service. *Cr* 2. [Formerly numbered Ed 47] MR. SANFORD

55 (155). Principles and Techniques of Counseling.—The functions of the guidance counselor in educational-vocational-personal counseling; methods of gathering data and interviewing. *Cr* 3. [Formerly numbered Ed 48] MR. FREEMAN

Curriculum and Instructional Materials (Ed C)

1. Secondary School Curriculum.—Development and present status of

the curriculum of the American secondary school. Prerequisite, Ed H 1 or equivalent course. *Cr* 2. [Formerly numbered Ed 5] Mr. Davis

2 (102). Audia-Visual Instructional Materials.—Production, selection, utilization, evaluation, and administration of audio visual instructional materials; operation of selected types of equipment; assistance on specialized problems and projects. *Rec* 1, *Lab* 2, *Cr* 2. [Formerly numbered Ed 16] Mr. Reardon

11 (111). Planning the Elementary School Curriculum.—Aims and philosophy of elementary education; present status of the curriculum; factors affecting curriculum changes, curriculum development and modern child psychology. *Cr* 3. [Formerly numbered Ed 20C] Mr. MacCampbell

21 (121). Planning the Secondary School Curriculm.—Plans of curriculum reorganization designed to bring the curriculum into harmony with needs of modern life. Prerequisite, Ed C 1 or equivalent course, or a year of teaching experience. *Cr* 3. [Formerly numbered Ed 25F] Mr. Fink

Graduate-Level Courses (Ed G)

200. Seminar: Education in the United States.—This seminar is intended to provide a common background of understandings in the philosophy and issues of modern education. Another purpose is to provide experience in library research techniques and report writing. Required of all students in the Master of Education program. *Cr* 3. Mr. Crawford

201. Seminar in Reading.—Discussions and individual reports on problems related to better reading programs. Prerequisite, Ed M 13, Teaching Reading in the Elementary School, or Ed M 50, Newer Practices in Reading, or equivalent course. *Cr* 2. [Formerly numbered Ed 212A] Mr. Olson, Mr. Caughran

202. Seminar in Arithmetic.—Study and reports on special problems in arithmetic instruction. Prerequisite, Ed M 51, Newer Practices in Arithmetic, or equivalent course. *Cr* 2. [Formerly numbered Ed 212B] Mrs. Boyce

203. Seminar in Social Studies (Elementary).—Problems in the development of the curriculum, materials, resources, and methods of social studies in elementary schools. Prerequisite, Ed M 15, Teaching Social Studies in the Elementary School, or equivalent course. *Cr* 2. [Formerly numbered Ed 212C] Mr. Supple

204. Seminar in Science (Elementary).—Problems in curriculum, materials, resources, and methods of science in the elementary school. Prerequisite, Ed M 16, Teaching Science in the Elementary School, or equivalent course. *Cr* 2. [Formerly numbered Ed 212D] Mr. Davis

207. Seminar in Language Arts.—Discussions and experiences designed to improve the practices and the background in Language Arts. Prerequisite, Ed M 18, Teaching Language Arts in the Elementary School. *Cr* 2. [Formerly numbered Ed 212G] Mr. MacCampbell

215. Seminar in Methods of Teaching.—Study and reports on specific problems in the area of teaching. Prerequisite, a basic course in methods or a year of teaching experience. *Cr* 2. [Formerly numbered Ed 215] Mr. MacCampbell

216. Seminar in Audio-Visucl Aids.—Special problems or projects in the field of audio-visual aids to instruction selected to meet the needs of the individual student. Prerequisite, Ed C 2, Audio-Visual Instructional Materials, or equivalent course. *Cr* 2. [Formerly numbered Ed 216] Mr. Reardon

221. Seminar in Social Studies (Secondary).—Problems in curriculum,

materials, resources and methods in social studies in the secondary school. Prerequisite, Ed M 41, Teaching Social Studies in the Secondary School, or equivalent course. *Cr* 2. [Formerly numbered Ed 219C] MR. SUPPLE

222. Seminar in Science (Secondary).—Problems in curriculum, materials, resources, and methods in science in the secondary school. Prerequisite, Ed M 42, Teaching Science in the Secondary School, or equivalent course. *Cr* 2. [Formerly numbered Ed 219D] MR. DAVIS

231. Seminar in Elementary School Curriculum.—Study and reports on specific problems in the field of curriculum construction and curriculum reorganization. Prerequisite, a basic course in the curriculum field or a year of teaching experience. *Cr* 2. [Formerly numbered Ed 220] MR. DAVIS

232. Seminar in Secondary School Curriculum.—Study and reports on specific problems in the fields of curriculum construction and curriculum reorganization. Prerequisite, a basic course in the curriculum field or a year of teaching experience. *Cr* 2. [Formerly numbered Ed 220] MR. DAVIS

241. Seminar in Supervision.—Problems related to the improvement of instruction. In general, the problems studied will be determined by the needs of the class. Prerequisite, Ed L 1, Supervision of Instruction, or equivalent course, or administrative or supervisory school experience. *Cr* 2. [Formerly numbered Ed 230] MR. CARPENTER

242. Seminar in School Administration.—Problems related to the operation and control of the school. Prerequisite, Ed L 2, School Organization and Administration, or equivalent course, or administrative or supervisory school experience. *Cr* 2. [Formerly numbered Ed 250] MR. PORTER-SHIRLEY

251. Seminar in Measurement and Evaluation.—The use of measurement and evaluation in problems of improvement of instruction, pupil counseling and guidance, and research in education. Prerequisite, Ed A 11 Measurement in the Elementary School, or equivalent course. *Cr* 2. [Formerly numbered Ed 241] MR. CRAWFORD, MR. FINK

261. Seminar in Guidance.—Study of current problems in guidance and the development of individual projects in guidance activities. Prerequisite, Ed A 51, Principles and Techniques of Guidance, or equivalent course. *Cr* 2. [Formerly numbered Ed 245] MR. FREEMAN

291. Graduate Apprenticeship.—Apprenticeship training available in such areas as administration, supervision and guidance. A minimum of thirty clock hours of work is required for each hour of credit. *Cr* 2-6. [Formerly numbered Ed 208] MR. PORTER-SHIRLEY, MR. FREEMAN, MR. SANFORD

299. The Thesis.—Required of candidates for the Master of Arts or Master of Science degree. *Cr* 6. *Time arranged.* [Formerly numbered Ed 299] MR. CRAWFORD, MR. MACCAMPBELL

History and Philosophy (Ed H)

1. Introduction to Education.—General aims and purposes of education in our society; the development of the American school system; organization, support, and control of education in the United States; education as a profession. *Cr* 2. [Formerly numbered Ed 4] MR. SUPPLE, MR. BAILEY

School Leadership (Ed L)

1 (101). Supervision of Instruction.—Nature and scope of democratic

supervision; improvement of the teaching-learning situation; observational and evaluation techniques. *Cr* 3. [Formerly numbered Ed 30] MR. CARPENTER

2 (102). School Organization and Administration.—Scope and general character of the American public school system; its organization and pattern of general control; selected problems in areas such as personnel policies, finance, reports, and public relations. *Cr* 3. [Formerly numbered Ed 50] MR. BAILEY

11 (111). The Elementary School Principalship.—Organization and administration of the elementary school with special emphasis upon the duties of the elementary school principal. *Cr* 3. [Formerly numbered Ed 51C]
MR. MACCAMPBELL

21 (121). The Secondary School Principalship.—Organization and administration of the secondary school with special emphasis upon the duties of the secondary school principal. *Cr* 3. [Formerly numbered Ed 51F]
MR. MCCAMPBELL

31 (131). School Law.—A study of the legal bases of public education in the State of Maine. *Cr* 2. [Formerly numbered Ed 56D] MR. BAILEY

Methods (Ed M)

6. Principles of Teaching.—Methods and techniques of teaching; principles and routine of classroom management; discipline; planning for instruction. Prerequisite, Ed H 1, and Py 65, or equivalent courses. *Cr* 2. [Formerly numbered Ed 6] MR. PORTER-SHIRLEY, MR. CAUGHRAN

13. Teaching Reading in the Elementary School.—General background for teaching reading in the elementary school; reading readiness, phonetics, seatwork, study skills, recreational reading, and testing. An introductory course. *Cr* 3. [Formerly numbered Ed 12A] MR. OLSON, MR. CAUGHRAN

14 (114). Teaching Arithmetic in the Elementary School.—The arithmetic curriculum in the elementary school; methods and techniques in teaching arithmetic; the arithmetic readiness program; instructional and evaluation material. An introductory course. *Cr* 3. [Formerly numbered Ed 12B] MRS. BOYCE

15 (115). Teaching Social Studies in the Elementary School.—Methods and materials for social studies in the elementary school; ways of relating the work of the social studies class to the understanding of practical problems of the community. *Cr* 3. [Formerly numbered Ed 12C] MR. SUPPLE

16 (116). Teaching Science in the Elementary School.—Materials, methods, devices, and activities appropriate to the program of science in the elementary school. *Cr* 3. [Formerly numbered Ed 12D] MR. DAVIS

17 (117). Teaching Literature in the Elementary School.—Methods of teaching, selection and organization of the materials for literature in the elementary school. Special emphasis will be given to the problem of providing for individual needs. *Cr* 3. [Formerly numbered Ed 12F] MR. MACCAMPBELL

***18 (118).* Teaching Language Arts in the Elementary School.**—Current methods and materials in teaching handwriting, spelling, oral and written composition; analysis and correction of basic difficulties; fusion of the language arts with other school subjects. *Cr* 3. [Formerly numbered Ed 12G]
MR. MACCAMPBELL

40 (140). Teaching Reading in the Secondary School.—Appraisal of reading achievement and needs; teaching reading and study skills in the content areas; survey of diagnostic and remedial programs in reading in the junior-senior high school. *Cr* 3. [Formerly numbered Ed 19A] MR. OLSON

41 (141). Teaching Social Studies in the Secondary School.—Current practices in teaching social studies; selection and use of instructional materials; modern trends in curriculum construction for social studies in the secondary school. *Cr* 3. [Formerly numbered Ed 19C] MR. SUPPLE

42 (142). Teaching Science in the Secondary School.—Methods and materials in the teaching of science; development of the science curriculum, and equipment, supplies, and supplementary materials for science teaching in the secondary schools. *Cr* 3. [Formerly numbered Ed 19D] MR. DAVIS

60 (160). Correction of Reading Difficulties in the Secondary School.—Causes, diagnosis, and correction of reading difficulties; methods, materials, and procedures for corrective work, both group and individual. Grade 7 through 12. *Cr* 3. [Formerly numbered Ed 19R] MR. OLSON

Observation and Student Teaching

The University's arrangements for Observation and Student Teaching are made semester by semester and are based upon actual need (number, subjects, grades, etc.).

The campus demand for this work has increased to the point where it has become necessary to require written permission from the Director of Student Teaching in order to pre-register for the Student Teaching courses. Normally, this written permission should be obtained during the pre-registration period.

90 (190). Full-Day Student Teaching (Elementary).—A full-day, off-campus internship program in a selected school for one half of the semester; a full-day, on-campus program of college courses is provided for the other half of the semester. *Cr* 8. [Formerly numbered Ed 7C] MR. PORTER-SHIRLEY, MR. CARPENTER, MR. BAILEY, MR. RANKIN, MR. MACCAMPBELL, MR. MYERS, MR. DAVIS, MR. CAUGHRAN

91 (191). Full-Day Student Teaching (Secondary).—A full-day, off-campus internship program in a selected school for one half of the semester; a full-day, on-campus program of college courses is provided for the other half of the semester. *Cr* 8. [Formerly numbered Ed 7F] MR. PORTER-SHIRLEY, MR. CARPENTER, MR. BAILEY, MR. RANKIN, MR. MACCAMPBELL, MR. MYERS, MR. DAVIS, MR. CAUGHRAN

92 (192). Half-Day Student Teaching (Elementary).—A half-day program of observation and student teaching in a selected school in the University area. The same four consecutive periods must be free daily in order to schedule this course. *Cr* 6. [Formerly numbered Ed 8C] MR. PORTER-SHIRLEY, MR. CARPENTER, MR. BAILEY, MR. RANKIN, MR. MACCAMPBELL, MR. MYERS, MR. DAVIS, MR. CAUGHRAN

93 (193). Half-Day Student Teaching (Secondary).—A half-day program of observation and student teaching in a selected school in the University area. The same four consecutive periods must be free daily in order to schedule this course. *Cr* 6. [Formerly numbered Ed 8F] MR. PORTER-SHIRLEY, MR. CARPENTER, MR. BAILEY, MR. RANKIN, MR. MACCAMPBELL, MR. MYERS, MR. DAVIS, MR. CAUGHRAN

94 (194). Supervised Student Teaching (Elementary).—A limited program of observation, with some opportunity for supervised teaching available to students who cannot meet schedule requirements of Ed M 90 or Ed M 92. *Cr* 2. [Formerly numbered Ed 9C] MR. PORTER-SHIRLEY, MR. CARPENTER, MR. BAILEY, MR. RANKIN, MR. MACCAMPBELL, MR. MYERS, MR. DAVIS, MR. CAUGHRAN

95 (195). Supervised Student Teaching (Secondary).—A limited program of observation with some opportunity for supervised teaching available to students who cannot meet schedule requirements of Ed M 91 or Ed M 93. *Cr* 3. [Formerly numbered Ed 9F]

MR. PORTER-SHIRLEY, MR. CARPENTER, MR. BAILEY, MR. RANKIN, MR. MACCAMPBELL, MR. MYERS, MR. DAVIS, MR. CAUGHRAN

General (Ed X)

98 (198). Problems in Education.—Individual work on a problem of the student's own selection. Primarily for majors in Education. *Cr, Ar.* [Formerly numbered Ed 98]

MR. CRAWFORD

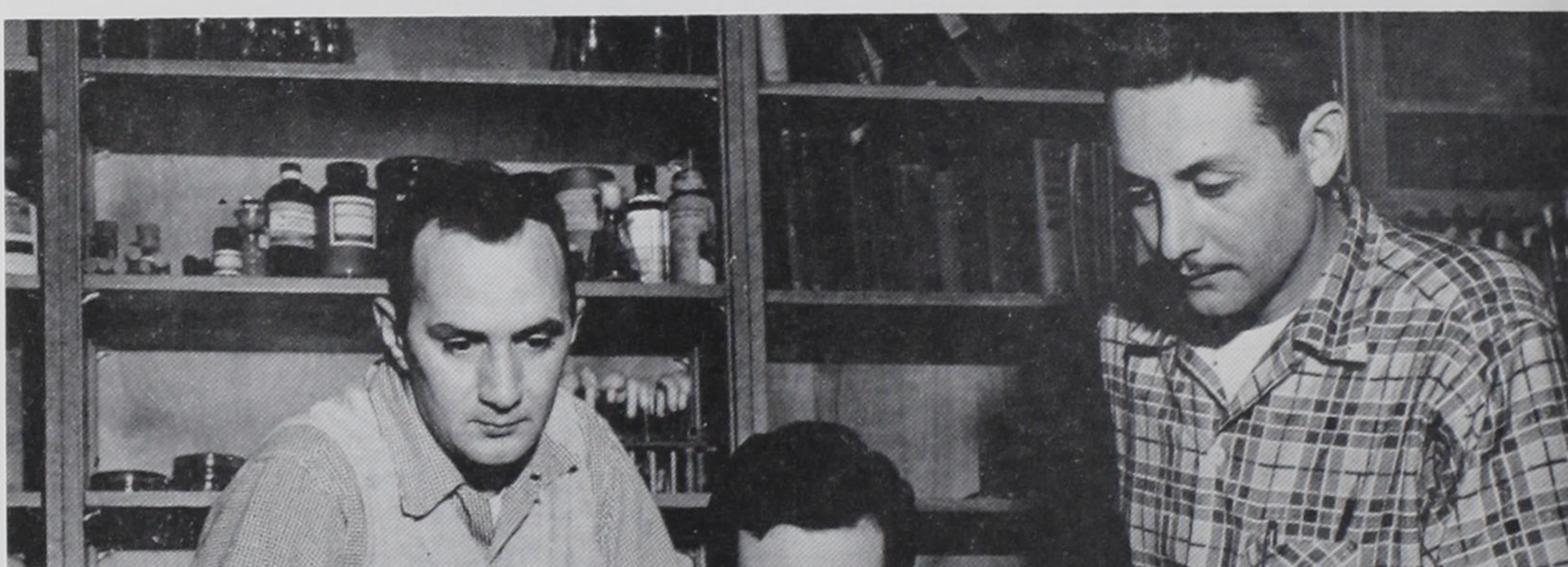
New Numbering System

Effective July 1, 1959, course numbers were changed. Following is a list of courses which shows the old numbers and corresponding new numbers.

OLD NUMBER	NEW NUMBER	TITLE
Ed 4	Ed H1	Introduction to Education
Ed 5	Ed C1	Secondary School Curriculum
Ed 6	Ed M6	Principles of Teaching
Ed 7C	Ed M90	Full-Day Student Teaching (Elem.)
Ed 7F	Ed M91	Full-Day Student Teaching (Sec.)
Ed 8C	Ed M92	Half-Day Student Teaching (Elem.)
Ed 8F	Ed M93	Half-Day Student Teaching (Sec.)
Ed 9C	Ed M94	Supervised Student Teaching (Elem.)
Ed 9F	Ed M95	Supervised Student Teaching (Sec.)
Ed 12A	Ed M13	Teaching Reading in Elem. School
Ed 12B	Ed M14	Teaching Arithmetic in Elem. School
Ed 12C	Ed M15	Teaching Social Studies in Elem. School
Ed 12D	Ed M16	Teaching Science in Elem. School
Ed 12F	Ed M17	Teaching Literature in Elem. School
Ed 12G	Ed M18	Teaching Lang. Arts in Elem. School
Ed 14B	Ed M51	Newer Practices in Arithmetic
Ed 16	Ed C2	Audio-Visual Instruction Materials
Ed 19A	Ed M40	Teaching Reading in Secondary School
Ed 19C	Ed M41	Teaching Social Studies in Secondary School
Ed 19D	Ed M42	Teaching Science in Secondary School
Ed 19R	Ed M60	Correction of Reading Difficulties in Secondary School
Ed 20C	Ed C11	Status and Trends of the Elementary School Curr.
Ed 25F	Ed C21	Planning Secondary School Curriculum
Ed 30	Ed L1	Supervision of Instruction
Ed 40	Ed A1	Statistical Methods in Education
Ed 41C	Ed A11	Measurement in Elementary School
Ed 41F	Ed A21	Measurement in Secondary School
Ed 42	Ed A31	Use of Standard Tests
Ed 45	Ed A51	Principles and Techniques of Guidance
Ed 45A	Ed A52	Group Guidance
Ed 46	Ed A53	Occupational and Educational Information

COLLEGE OF EDUCATION

Ed 47	Ed A54	Organization and Administration of Pupil Personnel Services
Ed 48	Ed A55	Principles and Techniques of Counseling
Ed 50	Ed L2	School Organization and Administration
Ed 51C	Ed L11	Elementary School Principalship
Ed 51F	Ed L21	Secondary School Principalship
Ed 56D	Ed L31	School Law
Ed 208	Ed G291	Graduate Apprenticeship
Ed 212A	Ed G201	Seminar in Reading
Ed 212B	Ed G202	Seminar in Arithmetic
Ed 212C	Ed G203	Seminar in Social Studies (Elementary)
Ed 212D	Ed G204	Seminar in Science (Elementary)
Ed 212G	Ed G207	Seminar in Language Arts
Ed 215	Ed G215	Seminar in Methods of Teaching
Ed 216	Ed G216	Seminar in Audio-Visual Aids
Ed 219C	Ed G221	Seminar in Social Studies (Secondary)
Ed 219D	Ed G222	Seminar in Science (Secondary)
Ed 220	Ed G231	Seminar in Curriculum (Elementary)
	Ed G232	Seminar in Curriculum (Secondary)
Ed 230	Ed G241	Seminar in Supervision
Ed 245	Ed G261	Seminar in Guidance
Ed 250	Ed G242	Seminar in Administration
Ed 299	Ed G299	The Thesis



Future scientists studying at Maine

College of Technology

W. S. EVANS, DEAN

COLLEGE OF TECHNOLOGY

The College of Technology, which recommends the degree of Bachelor of Science upon completion of any of its curricula, provides instruction in the following:

Agricultural Engineering (Jointly with College of Agriculture)
Chemical Engineering
Chemistry
Civil Engineering
- Highway Engineering
- Sanitary Engineering
- Structural Engineering
- Public Management

Electrical Engineering
- Communication
- Power

Engineering Physics
Mechanical Engineering
Pulp and Paper Technology

By special arrangement, a Five-Year Pulp and Paper Management Curriculum may be arranged in conjunction with any of the above curricula or the Forestry curriculum.

For Agricultural Engineering see page 78.

The freshman year is common to all engineering courses and chemistry.

Freshman Year

FALL SEMESTER

		Subject	Hours Rec	Lab	Cr
Ch	1	Gen. Chemistry	3	3	4
Eh	1	Freshman Comp.	3	0	3
Eg	1	Engineering Drawing	0	4	2
Ms	1	Trigonometry	2	0	2
Ms	3	Algebra	2	0	2
Mt	1	Military Science I	2	1	1½
Pe	1	Physical Education	0	2	0
Ps	1	General Physics	4	2	5

SPRING SEMESTER

		Subject	Hours Rec	Lab	Cr
Ch	2	Gen. Chemistry	3	3	4
Eh	2	Freshman Comp.	3	0	3
Eg	2	Engineering Drawing	0	4	2
Ms	12	Anal. Geom. & Cal.	4	0	4
Mt	2	Military Science I	2	1	1½
Pe	2	Physical Education	0	2	0
Ps	2	General Physics	4	2	5

For information on advanced placement, see page 28.

Entering freshmen, especially well prepared in chemistry, may, upon passing a special examination, be permitted to take Ch 2A instead of Ch 1 and Ch 2. If passed with a grade of A or B, this course fulfills the General Chemistry Requirement and carries 8 credit hours.

GRADUATION REQUIREMENTS

(Common to all curricula in the College of Technology)

1. a) Passing grades in all courses required by the major department.
   b) A minimum of 143 degree hours. Degree hours shall not be granted for Basic Military Science, Mt 1, 2, 3, and 4, nor for the Advanced

ROTC courses, Mt 5, 6, 7, and 8, except that regular academic courses, taken as part of the Advanced ROTC program, may receive degree hour credit if they meet regular graduation requirements. Degree hour credit is not allowed for courses in which a grade of E is received.

c) An accumulative average of 1.80.

2. Passing grades in the following courses:
   a) Drawing, Eg 1 and 2, or equivalent.
   b) Language: Eh 1 and 2, or equivalent, Sh 1, Eh 5, or equivalent.
   c) Mathematics, Ms 1, 3, 12, 27 and 28, or equivalent.
   d) Science: Ch 1 and 2, Ps 1 and 2, or equivalent
   e) Military Science and Tactics, seven credit hours. Physical Education, two semesters and the satisfactory completion of required tests or four semesters. Veterans may be excused.

3. Passing grades in a minimum of six credit hours in each of the two categories listed, and a minimum of eighteen credit hours total.

I. Economics, Sociology, Psychology

Any course may be taken that is listed in the catalog under economics and sociology, business administration, modern society, and psychology, for which the student can qualify.

II. History, Philosophy, Languages, English Literature, Art, Music

Any course may be taken that is listed in the catalog under history and government, philosophy, modern languages and classics, English literature, art, or music, for which the student can qualify, excepting Gm 13 & 14 (Scientific German). No more than three credits may be accepted in applied music (e.g., band, chorus, instrumental music lessons, or voice lessons).

Course Expenses

For College of Technology students the minimum and maximum course expenses (inclusive of required equipment, books, and supplies, but exclusive of Military deposit) are indicated in the following table:

Freshmen	$150.00 Per Year, of which approximately $100.00 will be required for the first semester.
Sophomores	$100.00—140.00 Per Year
Juniors	100.00—160.00 Per Year
Seniors	100.00—160.00 Per Year

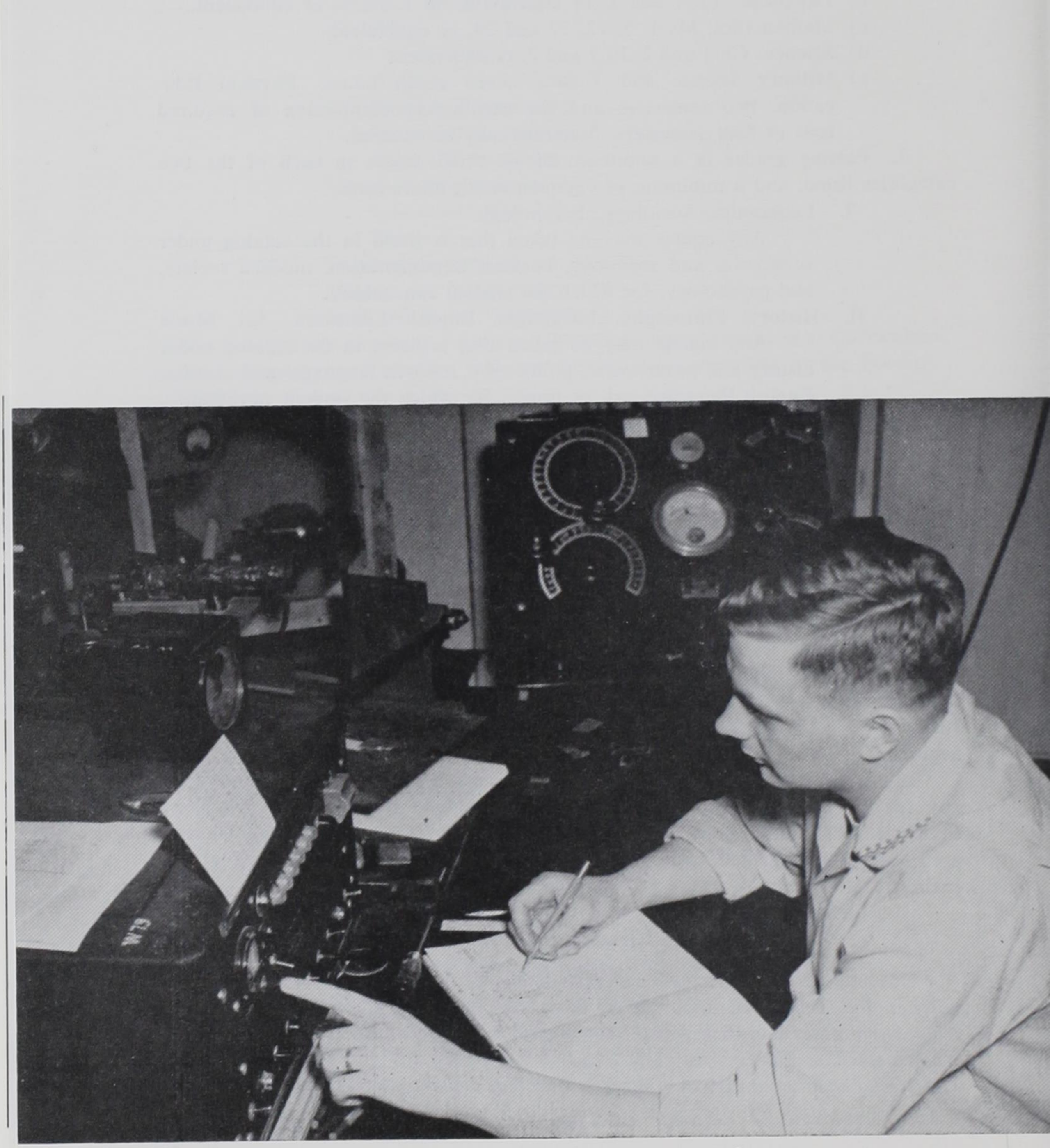
In Chemistry and Chemical Engineering courses, students are required to pay for all apparatus broken or lost and for certain non-returnable supplies. Breakage cards at $3.00 each are obtainable at the Treasurer's office. Unused portions will be refunded at the end of the semester on obtaining clearance at the chemistry storeroom.

Graduate Study

Graduates from accredited undergraduate programs are eligible for graduate study in the College of Technology, provided their undergraduate records meet general requirements. (See general requirements in the catalog section on Graduate Study.) Candidates must complete, without credit, any undergraduate courses which may be prerequisite to courses included in the programs of graduate study.

COLLEGE OF TECHNOLOGY

In the master's degree program, in general, from six to ten credit hours will be devoted to a thesis in the field of major interest. Selection of courses must conform to a general plan laid down either before study begins or very soon after registration.



Engineering students work with many types of apparatus

DEPARTMENTS OF INSTRUCTION

Courses numbered 1-99 are for undergraduates; courses numbered 200 and above are primarily for graduates. Courses numbered below 100 which have been approved for graduate credit are indicated by a graduate designation, in paentheses, after the regular course number.

One number is used for a course which is given both fall and spring.

When a dash is used between the two numbers (e.g., 1-2), both semesters must be taken to obtain credit; when a semicolon is used (e.g., 1;2), the first semester may be taken by itself, but the second cannot be taken unelss the first is taken previously; when a period is used (e.g., 1.2), either semester may be taken for credit.

Courses offered in 1960-61 and alternate years are indicated by the sign (‡) placed before the number of the course; courses offered in 1961-62 and alternate years are indicated by the sign (†) placed before the number of the course.

CHEMICAL ENGINEERING

(including Pulp and Paper Technology)

PROFESSORS JENNESS, DURST, ZIEMINSKI; ASSOCIATE PROFESSORS A. CHASE, BOCKUS; ASSISTANT PROFESSORS GORHAM, R. CHASE; MR. JONES

The Chemical Engineering curriculum is designed to provide the education necessary to prepare men for successful living in the modern world, for those who wish to undertake professional work in the design, operation, and improvement of the processes of chemical industry. The curriculum provides a broad background in the humanities and in the fundamentals of science and engineering, and affords the opportunity for the application of these fundamentals in professional courses.

Since it is essential that chemical engineers have a sound basic training in chemistry, the curriculum in the sophomore and junior years includes all the fundamental courses in the Chemistry curriculum. In order that the student may gain an early understanding of the significance of his major field, professional Chemical Engineering courses are introduced in the sophomore year and are continued through the last three years in logical sequence. The great majority of the course work in the senior year is made up of these professional courses. Necessary basic knowledge of electrical and mechanical engineering is provided by courses in the appropriate departments. The curriculum leads to the degree of Bachelor of Science in Chemical Engineering.

An important activity of this department is the Division of Pulp and Paper Technology. Students who intend to enter the Pulp and Paper industry or allied fields may elect to take a senior year curriculum largely composed of specialized professional subjects in the pulp and paper field, the other years being identical with the straight Chemical Engineering curriculum. This curriculum leads to the Bachelor of Science degree in Pulp and Paper Technology. It is possible for certain students, who do not desire a B.S. degree, to register as special students for a series of related Pulp and Paper and Chemical Engineering courses.

A five year program with emphasis on courses in management is available to students who expect to enter the field of production of Pulp and Paper. This curriculum contains the required courses of the four year curricula in Chemical Engineering and Pulp and Paper Technology. It also includes selected courses

in Economics and Business Administration. It leads to the degree of Bachelor of Science in Chemical Engineering and a certificate indicative of the curriculum.

Graduate Work in Chemical Engineering

Candidates for the degree of Master of Science must have received the degree of Bachelor of Science. They must also have completed a curriculum consistent with the requirements of the American Institute of Chemical Engineers, or take the necessary courses to accomplish that objective without receiving graduate credit for them. Graduate credit for the advanced degree generally consists of twenty hours of professional courses and ten hours of investigation and thesis. Some industrial fellowships and assistantships are available to graduate students. A candidate who accepted either of these usually requires two years to complete the requirements for the Master of Science degree.

Graduate work leading to the Master of Science degree is also offered in the Pulp and Paper Division. Candidates who complete the five year program in Pulp and Paper may receive graduate credit for twenty hours of suitable courses taken in the fifth year.

CURRICULUM IN CHEMICAL ENGINEERING

Freshman Year. See Page 190.

Sophomore Year

FALL SEMESTER

	Subject	Hours Rec	Lab or Comp	Cr
Ch 51	Organic Chemistry	3	4	5
ChE 1	Fund. of Chem. Eng.	2	4	4
Ms 27	Calculus	5	0	5
Mt 3	Military Science II	2	1	2
Pe 3	Physical Education	0	2	0
	Hum. Elective	—	—	—

SPRING SEMESTER

	Subject	Hours Rec	Lab or Comp	Cr
Ch 41	Quantitative Anal.	2	3	3
Ch 52	Organic Chemistry	3	4	5
ChE 2	Fund. of Chem. Eng.	2	4	4
Ms 28	Calculus	5	0	5
Mt 4	Military Science II	2	1	2
Pe 4	Physical Education	0	2	0

Junior Year

		Rec	Lab or Comp	Cr
Ch 71	Physical Chemistry	2	6	5
ChE 37	Intro. to Thermo-dynamics	3	0	3
ChE 64	Elem. of Chem. Eng.	3	0	3
Eh 5	Technical Comp.	2	0	2
Me 53	Applied Mechanics	3	0	3
	Hum. Elective	—	—	—

		Rec	Lab or Comp	Cr
Ch 72	Physical Chemistsry	2	6	5
ChE 65	Elem. of Chem. Eng.	3	0	3
ChE 81	Chem. Eng. Lab.	1	4	3
Me 54	Applied Mechanics	3	0	3
Sh 1	Public Speaking	2	0	2
	Hum. Elective	—	—	—

Senior Year

FALL SEMESTER

Subject			Hours Rec	Lab or Comp	Cr
ChE	77	Chem. Process Industries	3	0	3
ChE	82	Chem. Eng. Lab.	1	4	3
ChE	96	Process Control and Instrumentation	3	0	3
*ChE	99	Thesis	0	2	1
Ee	41	Electric Circuits	2	0	2
		Hum. Elective	—	—	—

SPRING SEMESTER

Subject			Hours Rec	Lab or Comp	Cr
ChE	78	Chem. Process Industries	3	0	3
ChE	94	Chem. Eng. Thermodynamics	3	0	3
*ChE	99	Thesis	0	4	2
ChE		Elective	3	0	3
Ee	43	Applied Electronics or Electrical Machinery	1½	1	2
Me	41	Mechanical Lab.	0	3	1½
		Hum. Elective	—	—	—

* Recommended elective.

CURRICULUM IN PULP AND PAPER TECHNOLOGY

Freshman Year. See Page 190.

Sophomore and **Junior Years,** Identical with Chemical Engineering with the exception of Ch 71 and Ch 72 which are recommended electives.

Senior Year

			Hours Rec	Lab or Comp	Cr
Ee	41	Electric Circuits	2	0	2
Pa	65	Pulp Technology	3	0	3
Pa	73	Pulp Manufacture and Testing	0	8	4
Pa	89	Pulp & Paper Mill Inspections	0	4	2
*Pa	99	Thesis	0	2	1
		Hum. Elective	—	—	—
ChE	86	Chem. Eng. Lab.	1	4	3
Ee	43	Applied Electronics or Electrical Machinery	1½	1	2
Pa	66	Paper Technology	3	0	3
Pa	72	Pulp & Paper Equipment	3	0	3
Pa	74	Paper Manufacture and Testing	0	8	4
*Pa	99	Thesis	0	4	2

* Recommended elective.

CURRICULUM IN FIVE YEAR PULP AND PAPER MANAGEMENT OPTION

Freshman Year. See Page 190.

Sophomore and **Junior Years,** Identical with Chemical Engineering

Senior Year

			Hours Rec	Lab or Comp	Cr
Be	9	Elem. Accounting	3	0	3
ChE	77	Chem. Process Industries	3	0	3
ChE	82	Chem. Eng. Lab.	1	4	3
Ee	41	Electric Circuits	2	0	2
Be	33	Labor Organ. & Legislation	3	0	3
Pa	65	Pulp Technology	3	0	3
		Hum. Elective	—	—	—
ChE	78	Chem. Process Industries	3	0	3
ChE	94	Chem. Eng. Thermodynamics	3	0	3
Ee	43	Applied Electronics or Electrical Machinery	1½	1	2
Me	41	Mechanical Lab.	0	3	1½
Pa	66	Paper Technology	3	0	3
		Hum. Elective	—	—	—

Fifth Year

FALL SEMESTER

Subject			Hours Rec	Lab or Comp	Cr
Be	51	Corp. Finance	3	0	3
ChE	96	Process Control and Instrumentation	3	0	3
Pa	84	Paper Mill Mgt.	3	0	3
Pa	73	Pulp Manufacture and Testing	0	8	4
Pa	89	Pulp and Paper Mill Inspections	0	4	2
Pa	295	Seminar	1	0	½
Pa	99	Thesis	0	2	1
		Hum. Elective	—	—	—

SPRING SEMESTER

Subject			Hours Rec	Lab or Comp	Cr
Be	55	Business Law	3	0	3
Ms	31	Matn. Statistics	3	0	3
Pa	72	Pulp & Paper Mill Equipment	3	0	3
Pa	74	Paper Manufacture and Testing	0	8	4
Pa	295	Seminar	1	0	½
Pa	99	Thesis	0	4	2
		Elective	—	—	—

Courses in Chemical Engineering

(In each laboratory course a breakage card is required.)

1; 2. Fundamentals of Chemical Engineering.—A quantitative correlation of basic concepts of chemistry, physics, and mathematics necessary for the analysis of problems in chemical engineering operations and processes. Prerequisite, Ch 2. *Rec* 2, *Lab* 4, *Cr* 4. MR. JENNESS, MR. JONES

33. Stoichiometry.—Appliction of the principles of heat and material balances to the solution of problems in combustion and industrial chemistry. Transfer students only. Prerequisite, Ch 2. *Rec* 3, *Cr* 3.

37. Introduction to Thermodynamics.—Development of the first law of thermodynamics and its application to engineering problems of both the batch and the flow type. Consideration of the second law. Prerequisite, Ch 2; Ms 8. *Rec* 3, *Cr* 3. MR. DURST

43. Plastics Technology.—An introductory course in the chemistry and physics of high polymeric substances. Practical applications and commercial practice in this field are considered. Lectures, demonstrations, reports. Prerequisite, Ch 51. *Rec* 3, *Cr* 3.

64; 65 (164; 165). Elements of Chemical Engineering.—Basic principles of the Unit Operations and their application to engineering problems. Prerequisite, Ms 8, and either ChE 2 or ChE 33. *Rec* 3, *Cr* 3. MR. ZIEMINSKI, MR. GORHAM

70 (170). Chemical Engineering of Pulp and Paper Manufacture.—An advanced course in those unit operations of particular importance in the manufacture of pulp and paper; e.g., flow of fluids, heat transfer, absorption, evaporation, drying, etc. Prerequisite, Ch 72; ChE 65. *Rec* 3, *Cr* 3. MR. JENNESS

76 (176). Nuclear Engineering.—Reactor design and operation. Preparation and processing of fuels. Special attention to fluid flow and heat transfer problems. Waste treatment and radiation hazards. Applications of nuclear energy to industrial engineering. Prerequisite, Ps 70, Thermodynamics and heat transfer. *Rec* 3, *Cr* 3. MR. DURST

77. 78. Chemical Process Industries.—Representative industrial chemical processes. Quantitative and qualitative evaluations of the processes and proposed changes and improvements are stressed. *Rec* 3, *Cr* 3. MR. ZIEMINSKI

81; 82 (181; 182). Chemical Engineering Laboratory.—Application of the principles of the unit operations in the laboratory, using pilot scale equipment.

Emphasis is placed upon the preparation of formal reports. Prerequisite, ChE 64 for 81, ChE 65 for 82. *Rec* 1, *Lab* 4, *Cr* 3. MR. DURST

84 (184). Nuclear Engineering Laboratory.—A study of the fundamentals of reactor operation including monitoring, measurement of absorption, thermal cross-sections, neutron flux, neutron temperature, critical mass, temperature coefficient and related characteristics. Prerequisite, ChE 76 or taken concurrently. *Rec* 1, *Lab* 3. MR. DURST

86. Chemical Engineering Laboratory.—A one-semester course in chemical engineering laboratory, for pulp and paper majors only. Prerequisite, ChE 65. *Rec* 1, *Lab* 4, *Cr* 3. MR. GORHAM

87. 88 (187; 188). Chemical Engineering Mill Practice.—Group investigations of the operation of commercial equipment in neighboring industrial plants. Open only to seniors and graduate students. *Time and credit arranged.* MR. DURST

94. Chemical Engineering Thermodynamics.—Development and quantitative application of the second law of thermodynamics. Considerations of heat engines, the concept of availability, chemical equilibrium, etc. Prerequisite, ChE 37, 65. *Rec* 3, *Cr* 3. MR. DURST

96. Process Control and Instrumentation.—Techniques employed by process engineers for the control of unit operations and chemical processes. Control theory, operating principles and application of industrial instruments, principles and methods of automatic control. Prerequisite, ChE 37. *Rec* 3, *Cr* 3. MR. CHASE

99. Undergraduate Thesis.—Original investigation of a chemical engineering problem, and reporting of the results. Open only to seniors. *Cr, Ar.* THE CHEMICAL ENGINEERING STAFF

Graduate Courses

242. Colloid Technology.—*Rec* 3, *Cr* 3.
246. Fuels and Combustion.—*Rec* 3, *Cr* 3.
275. Chemical Engineering Plant Design.—*Rec* 3, *Cr* 3.
277. Economic Balance.—*Rec* 3, *Cr* 3.
286. Advanced Unit Operations.—*Rec* 1, *Lab* 4, *Cr* 3.
295. Graduate Seminar.—*Rec* 1, *Cr* ½.
299. Graduate Thesis.—*Cr, Ar.*

Courses in Pulp and Paper Technology

40s. Summer Mill Practice.—The obtaining of practical mill experience is encouraged of students who have completed their junior year and contemplate senior work in pulp and paper technology. *Cr* 2. MR. JENNESS

65 (165). Pulp Technology.—A course in the manufacture of various kinds of wood pulps and the chemistry involved in present-day pulp making. Prerequisite, Ch 2. *Rec* 3, *Cr* 3. MR. CHASE

66 (166). Paper Technology.—A course in the processes of manufacturing paper. Prerequisite, Pa 65. *Rec* 3, *Cr* 3. MR. BOCKUS

72 (172). Pulp and Paper Equipment.—A lecture and recitation course involving the description, and production calculations, of pulping, stock preparation, stock flow, paper formation, power plant, and auxiliary equipment. Prerequisite, Pa 65. *Rec* 3, *Cr* 3. MR. BOCKUS

73 (173). Pulp Manufacture and Testing.—A laboratory course involving the production and testing of chemical and semi-chemical wood pulps,

Prerequisite, Ch 40, Pa 65 (can be taken simultaneously). *Lab* 8, *Cr* 4.
MR. BOCKUS, MR. CHASE

74 (174). Paper Manufacture and Testing.—A laboratory course in the manufacture of paper, including beating, jordaning, sizing, etc., and physical, chemical, and microscopical testing. Prerequisite, Ch 40, Pa 66 (can be taken simultaneously). *Lab* 8, *Cr* 4. MR. CHASE, MR. BOCKUS

84 (184). Pulp and Paper Mill Management.—The operating departments of a paper mill are discussed from the standpoint of their function and management at various levels. *Rec* 3, *Cr* 3. MR. BOCKUS

89 (189). Pulp and Paper Mill Inspections.—Mill visits involving the observation of operations in various types of pulp and paper plants. *Lab* 4, *Cr* 2. This course requires a laboratory fee of approximately $20.00. MR. BOCKUS

99. Undergraduate Thesis.—Original investigation of a pulp and paper problem and reporting of the results. Open only to seniors. *Cr, Ar.*
THE CHEMICAL ENGINEERING STAFF

Graduate Courses

295; 296. Graduate Seminar.—*Rec* 1, *Cr* ½.
299. Graduate Thesis.—*Cr, Ar.*

CHEMISTRY

PROFESSORS BEAMESDERFER, DOUGLASS; ASSOCIATE PROFESSORS BOGAN, BRAUNSTEIN, DUNLAP, MARTIN, OTTO, WOLFHAGEN; ASSISTANT PROFESSORS GEORGITIS, PETTIT; MRS. HESS, MR. HESS, MR. HILL, MR. SOTTERY, MISS THIELE

The Chemistry curriculum is designed to give the student a thorough understanding of the fundamental nature of all material substances, the changes they undergo and the laws governing such changes. It also aims to develop skill in those laboratory techniques required to synthesize and to analyze substances and to study their properties.

Because a knowledge of chemistry is fundamental to successful work in so many fields, the Chemistry curriculum affords an unusual opportunity for a wide choice of electives so that the Chemistry major may adapt his program to his individual interests and future needs. The curriculum leading to American Chemical Society certification prepares the student, upon graduation, for employment in chemical production and control, research, or for graduate study in chemistry. The proper choice of electives will enable the student to enter the related fields of industrial management, technical sales and service, or teaching, and will qualify him for admission to medical school. Students interested in any of these fields may obtain from the Chemistry Department specimen curricula showing recommended elective sequences.

Students intending to major in Chemistry who have a special interest in mathematics, physics, nuclear science, geology, or the biological sciences may also obtain specimen curricula designed to help them attain their educational goals.

The Chemistry major student, in order to qualify for certification to the American Chemical Society Committee on Professional Training, must complete courses 1, 2, 31, 40, 51, 52, 64, 71, 72, 90 and take one of the courses 54, 77, 91 or 84 and also one of the courses 74, 79 or 80. Additional requirements include

one year of physics, a reading knowledge of German, mathematics through differential and integral calculus and 16-18 hours of non-specialized courses other than the physical sciences, exclusive of German and freshman English.

Superior students should give serious consideration toward continuing their studies at the graduate level and should plan on meeting only minimum ACS requirements so that they can include in the undergraduate program a second language, advanced mathematics, and advanced physics.

For Chemistry courses in the Summer Session, see the Summer Session Bulletin.

For a description of courses in biochemistry, see the list of courses given by the Department of Biochemistry.

GRADUATE WORK IN CHEMISTRY

The Department of Chemistry offers a program of study and research leading to the M.S. and Ph.D. degrees. The general requirements for advanced degrees are described in the general section of the Bulletin of the Graduate Division. Specific requirements for admission to advanced study in Chemistry and information about the programs of study offered are given in the Chemistry section of the Bulletin.

CHEMISTRY CURRICULUM

Freshman Year. See Page 190.

Sophomore Year

FALL SEMESTER

		Subject	Hours Rec	Lab or Comp	Cr
Ch	31	Semi-Micro Qualitative Anal.	2	3	3
Ch	51	Organic Chemistry	3	4	5
Ms	27	Calculus	5	0	5
Mt	3	Military Science II	2	1	2
Pe	3	Physical Education	0	2	0
Sh	1	Public Speaking	2	0	2
		Elective			3
		Economics, Sociology or Psychology			

SPRING SEMESTER

		Subject	Hours Rec	Lab or Comp	Cr
Ch	40	Quantitative Anal.	2	6	4
Ch	52	Organic Chemistry	3	4	5
Ms	28	Calculus	5	0	5
Mt	4	Military Science II	2	1	2
Pe	4	Physical Education	0	2	0
		Elective			3
		Economics, Sociology or Psychology			

Junior Year

			Rec	Lab or Comp	Cr
Ch	71	Physical Chemistry	2	6	5
*Ch	64	Int. Quant. Anal.	1	8	4
Gm	11	Scientific German (Elementary)	3	0	3
		Hum. Elective			3
		Other Elective			3

			Rec	Lab or Comp	Cr
Ch	72	Physical Chemistry	2	6	5
*Ch	90	Intermediate Organic Chemistry Lab.	1	4	2
Gm	12	Scientific German (Elementary)	3	0	3
		Hum. Elective			3
		Other Electives			5

Senior Year

FALL SEMESTER

		Subject	Hours Rec	Lab or Comp	Cr
Ch	85	Chem. Literature	2	0	2
*Ch		Elective			3
		Adv. Chem. Lec.			
		*Hum. Elective	2-3	0	2-3
		Other Electives			7-8
Gm	13	Scientific German (Intermediate)	3	0	3

SPRING SEMESTER

		Subject	Hours Rec	Lab or Comp	Cr
*Ch		Elective			2
		Adv. Chem. Lab.			
Eh	5	Technical Comp.	2	0	2
		Other Electives			14

* For American Chemical Society certification.

Courses in Chemistry

(In each laboratory course a breakage card is required.)

1; 2. General Chemistry.—The principles of general chemistry, Ch 2 is largely devoted to an introduction to the elements of qualitative analysis. *Rec* 3, *Lab* 3, *Cr* 4. STAFF

2A. General Chemistry.—Open, by special examination, to students who have excellent preparation in chemistry. Covers in one semester the essential topics of General Chemistry and, if completed satisfactorily, meets the Ch 1, 2 requirement. Admission carries 4 hours of provisional advanced standing credit conditioned on the student's earning A or B grade. *Rec* 3, *Lab* 3, *Cr* 4.

7. General Chemistry.—For Three Year Nursing students only. An introduction to the principles of inorganic and organic chemistry. *Rec* 2, *Lab* 2, *Cr* 3. MRS. HESS

31. Semi-Micro Qualitative Analysis.—A systematic theoretical and laboratory study of the fundamental principles of analysis as applied to the common anions on the semi-micro scale. Prerequisite, Ch 2. *Rec* 2, *Lab* 3, *Cr* 3. MR. OTTO

40 (140*). Quantitative Analysis.—An introductory course illustrating the fundamental principles of gravimetric and volumetric analysis. Prerequisite, Ch 2. *Rec* 2, *Lab* 6, *Cr* 4. MR. BOGAN

41. Quantitative Analysis.—Same course as Ch 40 except that fewer laboratory determinations are made. Prerequisite, Ch 2. *Rec* 2, *Lab* 3, *Cr* 3. MR. BOGAN

51; 52 (151; 152*). Organic Chemistry.—An introduction to the chemistry of carbon compounds. Prerequisite, Ch 2. *Rec* 3, *Lab* 4, *Cr* 5. MR. DOUGLASS

54 (154). Advanced Inorganic Chemistry.—Advanced theoretical and descriptive inorganic chemistry emphasizing periodic relationships. Prerequisite, Ch 2, 31 and 40. *Rec* 3, *Cr* 3. MR. BOGAN

64 (164*). Intermediate Quantitative Analysis.—A continuation of Ch 40, taking up some of the more difficult volumetric and gravimetric methods. Prerequisite, Ch 40. *Rec* 1, *Lab* 8, *Cr* 4. MR. OTTO

71; 72 (171; 172*). Physical Chemistry.—A detailed study of fundamental principles of chemistry and their applications. Prerequisite, Ch 40 or 41, Ps 2, and Ms 28. *Rec* 2, *Lab* 6, *Cr* 5. MR. DUNLAP, MR. BRAUNSTEIN

* Not for graduate students in chemistry and chemical engineering. For others, graduate credit with the approval of the student's adviser.

74 (174). Chemical Microscopy.—The technique of handling and analyzing samples of very small size. Chemical and physical changes, crystalline form, density and refractive index observed under the microscope. Prerequisite, Ch 40. *Lab* 6, *Cr* 2. MR. OTTO

77 (177). Intermediate Physical Chemistry.—A discussion of the modern topics of Physical Chemistry not adequately covered in Ch 71 and 72. Prerequisite, Ch 72. *Rec* 3, *Cr* 3. MR. BEAMESDERFER

79 (179). Advanced Physical Chemistry Laboratory.—An advanced laboratory course with emphasis on the use of physico-chemical methods. Prerequisite, Ch 72. *Lab* 6, *Cr* 2. MR. BEAMESDERFER

80 (180). Radiochemistry.—Chemical aspects of nuclear properties and processes. Application of the techniques involving radioactivity to chemical problems. Prerequisite, Ch 72. *Rec* 1, *Lab* 4, *Cr* 3. MR. BRAUNSTEIN

84. Metallurgy.—A theoretical and descriptive course dealing with ferrous and non-ferrous metals and emphasizing the theory of binary alloys. Prerequisite, Ch 2. *Rec* 3, *Cr* 3. MR. MARTIN

85 (185). Chemical Literature.—A study of methods for searching the chemical literature. Prerequisite, Ch 52 and Elementary German. *Rec* 2, *Cr* 2. MR. MARTIN

90 (190). Intermediate Organic Chemistry Laboratory.—An introduction to the isolation, identification and semi-micro scale preparation of organic compounds. Prerequisite, Ch 52. *Rec* 1, *Lab* 4, *Cr* 2. MR. PETTIT

91 (191). Intermediate Organic Chemistry.—A detailed study of the preparation of the more complex organic compounds and of newer synthetic methods than are considered in Ch 51-52. Prerequisite, Ch 52. *Rec* 3, *Cr* 3. MR. WOLFHAGEN

95 (195). Chemical Thermodynamics.—A brief study of the laws of thermodynamics as applied to chemical problems. Prerequisite, Ch 72. *Rec* 3, *Cr* 3. MR. BRAUNSTEIN

99. Undergraduate Thesis.—The thesis will embody the result of an original investigation carried out in the library and in the laboratory. Open only to seniors with the consent of the department head. *Cr* 1 to 3. CHEMISTRY STAFF

Graduate Courses in Chemistry

†***213. The Chemistry of Cellulose and Wood Components.***—*Rec* 3, *Cr* 3.
251. Topics in Advanced Organic Chemistry.—*Rec* 2, *Cr* 2.
‡***253. The Chemistry of Organic Sulfur Compounds.***—*Rec* 2, *Cr* 2.
‡***254. The Chemistry of Heterocyclic Compounds.***—*Rec* 2, *Cr* 2.
†***256. Mechanisms of Organic Reactions.***—*Rec* 2, *Cr* 2.
265. Organic Quantitative Analysis.—*Lab* 6, *Cr* 3.
271. Topics in Advanced Physical Chemistry.—*Rec* 2, *Cr* 2.
273. Statistical Thermodynamics.—*Rec* 3, *Cr* 3.
‡***274. Colloid and Surface Chemistry.***—*Rec* 2, *Cr* 2.
†***276. Physico-Chemical Methods.***—*Rec* 2, *Cr* 2.
289. Advanced Organic Laboratory.—*Lab* 6, *Cr* 3.
290. Organic Qualitative Analysis.—*Rec* 1, *Lab* 6, *Cr* 4.
295. Graduate Seminar.—*Rec* 1, *Cr* 1.
299. Graduate Thesis.—*Cr, Ar.*

CIVIL ENGINEERING

PROFESSOR TREFETHEN; ASSOCIATE PROFESSORS TAYLOR, GORRILL, WADLIN;
ASSISTANT PROFESSOR SPROUL (On Leave 1959-61); MR. DOTEN;
MR. FOLEY; *MR. NIGHTINGALE; MR. HUNTER; MR. HAMILTON

The Civil Engineering curriculum has been revised to provide a broader understanding of engineering problems in general and at the same time provide for greater specialization in several branches of Civil Engineering and in the field of Public Management. While the new curriculum is broad enough to qualify graduates with the Bachelor of Science Degree to start in any field of Civil Engineering, special emphasis is placed upon Highway Engineering, Sanitary Engineering, and Structural Engineering. While graduates with the Bachelor of Science Degree go directly into Town Management, the Public Management option specifically prepares graduates for a fifth year in the Department of History and Government at the end of which they receive degrees of Master of Arts in Public Management.

While the foundation of all engineering is highly technical, an attempt is made throughout to help the student sense the broader aspects of engineering problems. In addition to this, studies in the social sciences and humanities are included to assist the graduate to assume an administrative position in his chosen field.

Graduate Work in Civil Engineering

Graduate programs are well established in the fields of Public Management, Sanitary Engineering, Highway Engineering, and Structural Engineering. The Public Management program for the fifth year is listed on page 204.

In the other above-mentioned special fields, the graduate program is flexible enough to meet the student's personal desires. The general program will include advanced courses in the student's major field which will constitute about half of his requirements. The other half of the program will consist of advanced courses in mathematics, non-technical courses, and the graduate thesis. This general program leads to the Degree of Master of Science in Civil Engineering..

Freshman Year. See Page 190.

CIVIL ENGINEERING CURRICULUM

Sophomore Year

		FALL SEMESTER					SPRING SEMESTER				
		Subject	Hours					Subject	Hours		
			Rec	Lab	Cr				Rec	Lab	Cr
Ce	4	Civil Eng. Orien.	2	0	0	Gy	16	Geology for Engrs.	2	1½	2½
Ce	5	Surveying	2	3	3	Ee	6	Elec. Engineering Fundamentals	2	2	3
Ee	5	Elec. Engineering Fundamentals	2	2	3	Eg	3	Descriptive Geom.	0	4	2
Ms	27	Calculus	5	0	5	Me	50	Mechanics (Statics)	3	0	3
Mt	3	Military Science II	2	1	2	Ms	28	Calculus	5	0	5
Pe	3	Physical Education	0	2	0	Mt	4	Military Science II	2	1	2
Sh	1	Public Speaking	2	0	2	Pe	4	Physical Education	0	2	0
		Hum. Elective			3			Hum. Elective			3

* On leave of absence 1960-62.

Junior Year

FALL SEMESTER

Subject			Hours Rec	Lab	Cr
Ce	26	Hydraulics	3	3	4
Ce	29	Intro. to High. Engrg.	3	0	3
Ce	31	Intro. to San. Engrg.	3	0	3
Gy	17	Geology for Engrs.	2	1½	2½
Me	51	Strength of Mat.	4	0	4
		Hum. Elective			3

SPRING SEMESTER

Subject			Hours Rec	Lab	Cr
Ce	20	Materials	2	3	3
Ce	32	San. Engrg. Design	2	3	3
Ce	52	Struc. Anal. & Design	3	0	3
Me	43	Heat Engineering	3	0	3
Me	52	Dynamics	3	0	3
		Hum. Elective			3

Senior Year

			Rec	Lab	Cr
Ce	61	Eng. Relations	3	0	3
Ce	57	Reinf. Concrete	3	0	3
		Hum. Elective			3
		Option			9

			Rec	Lab	Cr
Ce	58	Theory of Struc.	3	0	3
Eh	5	Tech. Comp.	2	0	2
		Hum. Elective			3
		Option			9

Highway Engineering Option

			Rec	Lab	Cr
Ce	63	High. Adm. & Traffic Eng.	3	0	3
Ce	65	Soil Mechanics	3	0	3
Ce	68	Highway Engrg.	3	0	3

			Rec	Lab	Cr
Ce	69	Structural and Highway Materials	1	6	3
Ce	72	Highway Engrg.	3	0	3
Ce	76	Soils Engrg.	3	0	3

Structural Option

			Rec	Lab	Cr
Ce	59	Structural Design	0	9	3
Ce	65	Soil Mechanics	3	0	3
Ms	57	Engineering Math.	3	0	3

			Rec	Lab	Cr
Ce	60	Structural Design	0	9	3
Ce	76	Soils Engrg.	3	0	3
Ce	92	Adv. Th. of Struc.	3	0	3

Sanitary Engineering Option

			Rec	Lab	Cr
By	27	Gen. Bacteriology	3	4	5
Ce	71	Sanitary Engrg.	2	3	3

			Rec	Lab	Cr
Ce	34	Sanitary Engrg.	2	6	4
Ce	74	Sanitary Engrg.	2	3	3
Ms	31	Statistics	3	0	3

Public Management Option

The Public Management Option is based on a five-year program, the fifth year being taken in the College of Arts and Sciences. As prerequisites for this fifth year, the following subjects should be taken during the sophomore, junior, and senior years:

			Semester Hours
Be	9	Accounting	3
Gt	1; 2	American Government	6
Gt	7; 8	Maine Government	2
Gt	33	Municipal Government	3
Gt	34	Municipal Administration	3
Gt	40	Community Planning	2
Gt	51; 52	Public Administration	6

P. Mgt. 93—Internship between Junior and Senior years

Fifth Year

For M.A. in Public Management Degree

FALL SEMESTER

		Subject	Hours Rec	Lab	Cr
Be	61	Personnel Mgt.	3	0	3
Be	71	Public Finance	3	0	3
Ce	68	Highway Engrg.	3	0	3
		or			
Ce	71	Sanitary Engrg.	2	3	3
Gt	41	Police and Fire Adm.	2	0	2
Gt	44	Public Relations	2	0	2
Gt	83	Amer. Constitution	3	0	3

SPRING SEMESTER

		Subject	Hours Rec	Lab	Cr
Ce	72	Highway Engrg.	3	0	3
		or			
Ce	74	Sanitary Engrg.	2	3	3
Gt	42	Public Works Adm.	2	0	2
Gt	46	Municipal Law	3	0	3
Gt	58	Public Opinion	3	0	3
Gt	84	Amer. Constitution	3	0	3

P. Mgt. 203 Internship ..... 3 Sem. Hours
Thesis ..... 6 Sem. Hours

See Page 142.

Courses in Civil Engineering

4. Civil Engineering Orientation.—Designed to acquaint Sophomores with the various professional fields of Civil Engineering. *Rec* 2, *Cr* 0.
MR. WADLIN

5. Surveying.—Surveying instruments and their use and the various methods commonly used for plane surveying. Prerequisite, Ms 1. *Rec* 2, *Lab* 3, *Cr* 3.
STAFF

10. Curves and Earthwork.—The geometry of simple, compound, and reverse circular curves, transition curves, vertical curves, and earthwork. Prerequisite, Ce 5. *Rec* 2, *Cr* 2.
MR. BRIDGE

20. Materials.—The properties of materials which are significant in building construction and how they are determined. The selection of materials to fulfill given requirements. Prerequisite, Me 51. *Rec* 2, *Lab* 3, *Cr* 3. MR. FOLEY

26. Hydraulics.—An elementary course presenting fundamental principles of fluid flow and their applications to engineering problems. Includes study of hydrostatics, liquid measuring devices, and channel and pipe flow. Prerequisite, Me 50. *Rec* 3, *Lab* 3, *Cr* 4.
MR. FOLEY

29. Introduction to Highway Engineering.—The geometry of simple and compound curves and spirals; parabolic curves; earthwork computations; drainage; types of pavements and their suitability to various conditions of traffic, soil and climate. Prerequisite, Ce 5. *Rec* 3, *Cr* 3.
MR. DOTEN

31. Introduction to Sanitary Engineering.—Methods and applications of engineering principles involved in providing sewers and sewage treatment, swimming pools, stream pollution programs, garbage and waste disposal, and safe and sanitary water and food supply. Prerequisite, Ce 5. *Rec* 3, *Cr* 3. MR. HUNTER

32. Sanitary Engineering Design.—Study and design problems involved in providing municipal water supplies, sewers, sewage treatment and stream pollution control. Prerequisite Ce 31 and Ce 26. *Rec* 3, *Cr* 3. MR. HUNTER

†***34. Sanitary Engineering.***—Principles, techniques, and interpretation of quantitative analytical chemical theory and tests as related to water, sewage and industrial wastes. Prerequisite, Ce 31. *Rec* 2, *Lab* 6, *Cr* 4.

52. Structural Analysis and Design.—The determination of maximum

stresses and strains, the proportioning of members and the design of connections, for beams, girders, and trusses. Prerequisite, Me 51. *Rec* 3, *Cr* 3. MR. HAMILTON

55 (155). Hydrology.—Application of statistical analysis to rainfall and runoff. The collection and presentation of factors affecting rainfall and runoff data. Methods for developing hydrographs and flood routing. Prerequisite, Ce 33 and 26 or the equivalent. *Rec* 2, *Cr* 2. MR. HUNTER

57. Reinforced Concrete.—The theory underlying the design of plain and reinforced concrete structures such as buildings, retaining walls, footings and short span bridges. Prerequisite, Ce 52. *Rec* 3, *Cr* 3. MR. WADLIN

58. Structural Theory.—Determination of stresses due to unsymmetrical bending. Development and use of moment distribution, shear center, and shear flow. Special topics on section kerns, combined stresses, S-Polygon, and plastic design theory. Prerequisite, Ce 52. *Rec* 3, *Cr* 3. MR. HAMILTON

59; 60. Structural Design.—The designing and detailing of steel and reinforced concrete structures. Prerequisite, Ce 52. *Lab* 9, *Cr* 3. MR. TAYLOR

61 (161). Engineering Relations.—Business phases of engineering. The ethical and legal relations among the parties affected by the making of an engineering contract. Specifications for elementary portions of engineering works. Prerequisite, Ce 20 and 52. *Rec* 3, *Cr* 3. MR. TAYLOR

63 (163). Highway Administration and Traffic Engineering.—The various functions state highway department has to perform; organization to carry out these functions; financing of highways; traffic studies and geometric designs to control and handle traffic. Prerequisite, Ce 29. *Rec* 3, *Cr*. 3. MR. HAMILTON

65 (165). Soil Mechanics.—The fundamental physical properties of soils and their effect on the solution of common problems that arise in practical engineering design and construction. Prerequisite, Me 51. *Rec* 3, *Cr* 3. MR. GORRILL

68 (168). Highway Engineering.—Highway location and relocation, including plans of proposed improvement; subgrade structure; base courses and low type pavements. Prerequisite, Ce 29. *Rec* 3, *Cr* 3. MR. GORRILL

69. Structural and Highway Materials.—Methods of testing, characteristics of, and specifications for the materials commonly used for highway purposes; design of mixes. Prerequisite, Me 51. *Rec* 1, *Lab* 6. *Cr* 3. MR. DOTEN

70 (170). Soils Laboratory.—The technique of performing the usual types of soil tests. Prerequisite, Ce 65. *Lab* 6, *Cr* 2. MR. GORRILL

71 (171). Sanitary Engineering.—Sewerage and the theory and design of sewage disposal works, followed by brief studies of municipal and rural sanitation. Prerequisite, Ce 33. *Rec* 2, *Lab* 3, *Cr* 3. MR. HUNTER

72 (172). Highway Engineering.—Various highway problems; rights of way; traffic engineering; drainage; high type pavements and maintenance. Prerequisite, Ce 68. *Rec* 3, *Cr* 3. MR. GORRILL

74 (174). Sanitary Engineering.—Continuation of study begun in Ce 71 of rural and municipal sanitation, followed by study of water purification and design of water treatment plants. Prerequisite, Ce 71. *Rec* 2, *Lab* 3, *Cr* 3. MR. HUNTER

76 (176). Soils Engineering.—The methods of treating certain foundation problems to which soil mechanics provides a solution. Prerequisite, Ce 65. *Rec* 3, *Cr* 3. MR. GORRILL

81 (181). Seminar.—Written and oral reports with discussions on assigned topics in any special branch of Civil Engineering. *Rec* 1-3, *Cr* 1-3. STAFF

COLLEGE OF TECHNOLOGY

92 (192). Advanced Structural Theory.—The analysis of indeterminate beams, trusses, and frames using the methods of moment-area, elastic weights, conjugate beam, 3-moment theorem, elastic center, column analogy, slope-deflection, and moment distribution. Prerequisite, Ce 52. *Rec* 3, *Cr* 3. MR. WADLIN

99. Thesis.—The study of and report upon some original investigation or design. Time to be arranged. *Cr* 2 or 3.

Graduate Courses

226. Advanced Hydraulics.—*Rec* 3, *Cr* 3
229. Water and Waste Treatment.—*Rec* 3, *Lab* 3, *Cr* 4.
270. Advanced Soils Laboratory.—*Lab* 6, *Cr* 2.
276. Foundations and Underground Structures.—*Rec* 3, *Cr* 3.
290. Vibrations of Structures.—*Rec* 3, *Cr* 3.
291. Numerical Analysis of Structures.—*Rec* 3, *Cr* 3.
292. Indeterminate Structures.—*Rec* 3, *Cr* 3.
299. Graduate Thesis.

GEOLOGY AND GEOGRAPHY

PROFESSOR TREFETHEN; ASSOCIATE PROFESSOR OSBERG; ASSISTANT PROFESSORS EORNS, HOWD; MR. HAGAR; MRS. TREFETHEN

For Courses see Page 139.

ELECTRICAL ENGINEERING

PROFESSORS CREAMER, CRABTREE, PARSONS, LIBBEY; ASSOCIATE PROFESSORS CROSBY, TURNER, MACFARLAND; ASSISTANT PROFESSORS BOWLES, BROWN, YOUNG, *MR. DORRITY, MR. EDE.

The Electrical Engineering curriculum consists of a logical sequence of courses which, beginning with the basic principles of electric circuits and machines and electronic apparatus, progresses in the advanced courses into the design and operating characteristics of equipment involved in both power and communication systems, as well as the functioning of systems as a whole.

Course work in electro-acoustics, illuminating engineering, feedback control, circuit analysis, and engineering management gives breadth to the curriculum. The principles of vacuum tubes, transistors, and their associated circuits developed in the study of radio, television, and ultra-high-frequency systems provide a substantial background of theory and laboratory experience in modern electronics. Opportunity is provided for the student to concentrate his work in either the power or communication division, but many students prefer to elect some courses in each and so achieve a broader training.

It is the aim of this curriculum to train the student in those fundamental principles which not only find application in electrical research, development, design, and other work of a strictly engineering character, but also serve as basic training for advancement to commercial and administrative positions with electric power and communication utilities, governmental agencies, and various manufacturing and industrial organizations.

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*On leave of absence 1960-61

Graduate Work in Electrical Engineering

A program of graduate study is available for a limited number of students. As a condition for acceptance as a candidate for the degree of Master of Science in Electrical Engineering, the student must have obtained honor grades in a large portion of his major undergraduate work.

Freshman Year. See Page 190.

Sophomore Year

FALL SEMESTER

Subject			Hours	Lab Rec or Comp	Cr
Ee	1	Elements of Elec. Eng.	3	4	5
Ms	27	Calculus	5	0	5
Mt	3	Military Science II	2	1	2
Pe	3	Physical Education	0	2	0
Py	1	General Psychology	2	2	3
Sh	1	Public Speaking	2	0	2
		Hum. Elective			3

SPRING SEMESTER

Subject			Hours	Lab Rec or Comp	Cr
Ee	2	Elements of Elec. Eng.	3	4	5
Eh	9	Modern Literature	2	0	2
Ms	28	Calculus	5	0	5
Mt	4	Military Science II	2	1	2
Pe	4	Physical Education	0	2	0
Ps	36	Modern Physics	3	0	3
		Hum. Elective			3

Junior Year

			Lab Rec or Comp		Cr
Ee	13	Electronics	2½	1½	3
Ee	21	Elem. of Communication	2	0	2
Ee	23	D-C Machinery	2	0	2
Ee	29	A-C Networks	2	2	3
Me	55	Statics and Strength of Materials	3	0	3
Ms	57	Eng. Mathematics I	3	0	3
		Hum. Elective			3

			Lab Rec or Comp		Cr
Ee	14	Electronics	2½	1½	3
Ee	24	D-C Machine Lab.	0	3	1
Ee	32	Waves and Fields	2½	1	3
Ee	52	A-C Machinery	3	0	3
Eh	5	Technical Comp.	2	0	2
Me	52	Applied Mechanics	3	0	3
		Hum. Elective			2
		Options—one required			
Ee	26	Wire Communication Sys.	2	0	2
Ms	58	Eng. Mathematics II	3	0	3

Senior Year (Power Engineering)

			Lab Rec or Comp		Cr
Ee	65	Elec. Power Systems	2	3	3
Ee	75	Electric Power Lab.	1	3	2½
Ee	77	Adv. Electric Machinery	2	2	3
Ee	95	Electromagnetic Fields	2	0	2
Me	33	Thermodynamics	3	0	3
		Options—one required			
Ee	91	Illuminating Eng.	2½	1	3
*Ee	99	Thesis			1-3
†Ms	59	Vector Analysis	3	0	3

			Lab Rec or Comp		Cr
Ee	66	Elec. Power Systems	2	2-3	3
Ee	78	Adv. Electric Machinery	2	2	3
Me	62	Heat Trans. and Fluid Flow	3	0	3
		Humanistic Elective			2
		Options—two required			
Ee	64	Elec. Motive Power	3	0	3
Ee	90	Servomechanism Funds.	3	0	3
Ee	94	Eng. Administration	3	0	3
Ms	58	Eng. Mathematics II	3	0	3

* By permission of department
† Strongly recommended

Senior Year (Communication Engineering)

FALL SEMESTER

Subject			Hours Rec or Comp	Lab	Cr
Ee	75	Electric Power Lab.	1	3	2½
Ee	85	Radio Freq. Electronics	2	2	3
Ee	87	Radio Laboratory	0	3	1.5
Ee	95	Electromagnetic Fields	2	0	2
Me	33	Thermodynamics	3	0	3
		Options—two required			
Ee	81	Communication Eng.	0	4	2
Ee	89	Electro-Acoustics	3	0	3
Ee	91	Illuminating Eng.	2½	1	3
†Ms	59	Vector Analysis	3	0	3

SPRING SEMESTER

Subject			Hours Rec or Comp	Lab	Cr
Ee	84	Pulse Techniques	2	0	2
Me	62	Heat Trans. and Fluid Flow	3	0	3
		Hum. Elective			2
		Options—three required			
Ee	82	R-F Energy Trans.	1	4	3
Ee	88	Radio Laboratory	0	3	1½
Ee	90	Servomechanism Funds.	3	0	3
Ee	94	Eng. Administration	3	0	3
*Ee	99	Thesis			1-3
Ms	60	Adv. Eng. Math.	3	0	3

† Strongly recommended.
* By permission of department.

Courses in Electrical Engineering

1; 2. Elements of Electrical Engineering.—Fundamentals of electric, magnetic and dielectric circuits; single phase a-c circuits; electrical measurements. Prerequisite, Ps 1, 2 and Ms 12. *Rec* 3, *Comp* 2, *Lab* 2, *Cr* 5.

5; 6. Electrical Engineering Fundamentals.—Elementary treatment of electric, magnetic, and dielectric circuits with d-c and a-c excitation; electric power apparatus; basic electronics; electrical measurements. Prerequisite, Ms 12 and Ps 2. *Rec* 2, *Lab* 2 *or* 3, *Cr* 3.

7; 8. Electric Circuits and Machines.—Theory of electric circuits; characteristics and applications of electric machinery. Prerequisite, Ms 12 and Ps 2. *Rec* 2½, *Lab* 1½, *Cr* 3.

11. Basic Electrical Engineering.—Basic theory of electric circuits and machinery. More thorough course than Ee 41. Prerequisite, Ms 28. *Rec* 2½, *Lab* 1½, *Cr* 3.

13. Electronics I.—Theory of vacuum tubes, gas tubes; photoelectric cells, and magnetic amplifiers; structure and general behavior of semi-conductors exemplified by crystal rectifiers and transistors; analysis and design of associated circuits; measuring techniques. Prerequisite, Ee 2, 8, 11, or 41. *Rec* 2½, *Lab* 1½, *Cr* 3.

14. Electronics II.—Tube and solid state power rectifiers; multistage audio-frequency and direct current amplifiers; feedback; audio-frequency oscillators and power amplifiers; laboratory examples. Prerequisites, Ee 13. *Rec* 2½, *Lab* 1½, *Cr* 3.

15. Electronics.—The circuitry associated with vacuum tubes, transistors, and other solid state devices; principles of analysis and design. Prerequisite, Ps 66 and Ee 29. *Rec* 2½, *Lab* 1½, *Cr* 3.

21. Elements of Communication.—Characteristics of the auditory and vocal systems; elements of image analysis and vision; colorimetry; visual and aural aspects of information transfer, information theory; coding and decoding of information; noise; storage of information; principles of feedback and automation. Prerequisite, Ps 2 and Ms 12. *Rec* 2, *Cr* 2.

23. Direct Current Machinery.—Theory, construction, operating characteristics, and control of direct current motors and generators; introductory study of

rotating amplifiers and control circuits in which they are applied. Prerequisite, Ee 2. *Rec* 2, *Cr* 2.

24. D-C Machine Laboratory.—Experimental study of d-c machines to illustrate principles outlined in course Ee 23. Prerequisite, Ee 23. *Lab* 3, *Cr* 1.

26. Wire Communication Systems.—Principles of wire communication; typical transducers; types of signals; transmission of these signals over wire lines; applications in communication and control. Prerequisite, Ee 2 or 12. *Rec* 2, *Cr* 2.

29. Alternating Current Networks.—Solution of network equations; network theorems; coupled circuits; balanced and unbalanced multiphase circuits; introduction to symmetrical components. Prerequisite, Ee 2. *Rec* 2, *Comp or Lab* 2, *Cr* 3.

32. Waves and Fields.—Steady-state and transient analysis of circuits utilizing complex waveforms; introduction of the complex frequency concept; review of basic field principles with application of vector algebra. Prerequisite, *Ee* 29. *Rec* 2½, *Comp* 1, *Cr* 3.

41. Electric Circuits.—Basic course for non-electricals in direct current circuits; magnetic circuits; induced electromotive force; alternating current circuits. *Rec* 2, *Cr* 2.

43. Applied Electronics.—Theory and applications of electron tubes. Elementary laboratory tests. Prerequisite, Ee 8, 11 or 41. *Rec* 1½, *Lab* 1, *Cr* 2.

46. Electric Machinery.—Theoretical principles and operating characteristics of direct and alternating current machinery. Prerequisite, Ee 41. *Rec* 2, *Cr* 2.

52. Alternating Current Machinery.—Theory, construction, and operating characteristics of alternating-current motors, generators, transformers, and rectifiers. Utilization of polyphase power. Prerequisites, Ee 23 and 29. *Rec* 3, *Cr* 3.

64 (164). Electromotive Power.—Problems of power requirement and control in railway transportation and other industrial applications with particular attention given to the use of electronic, magnetic, and rotating control devices. Prerequisite, Ee 52. *Rec* 3, *Cr* 3.

65; 66 (165; 166). Electric Power Systems.—Introduction to current practice in the generation, transmission, and distribution of electric power, with emphasis on the technical problems of long lines and system networks. Prerequisites, Ee 29 and 52. *Rec* 2, *Comp or Lab* 2 *or* 3, *Cr* 3.

75. Electric Power Laboratory.—Experimental study of polyphase networks. Commercial tests and laboratory investigations of alternating current generators, motors, transformers, and converters. Prerequisite, Ee 52. *Rec* 1, *Lab* 3, *Cr* 2½.

77; 78. Adanced Electric Machinery.—Advanced study of the principles of d-c and a-c machines, supported by laboratory practice, with some applications of these principles to the theory of machine design. Prerequisite, Ee 52. *Rec* 2 or 2½, *Comp* or *Lab* 2 or 1½, *Cr* 3.

81. Communication Engineering.—Network analysis by use of propagation and image transfer constants; network losses; design of attenuators, equalizers, and filters. Prerequisite Ee 29. *Comp* 4, *Cr* 2.

82. Radio Frequency Energy Transmission.—High frequency lossy and lossless lines; propagation of waves in free space; antennas; wave guides. Prerequisite, Ee 95. *Rec* 1, *Comp* 4, *Cr* 3.

84. Pulse Techniques.—Non-sinusoidal signals in electronic circuits; wave

shaping; switching; pulse generation and amplification; selected applications in modern electronic systems. Prerequisite, Ee 14 or 15. *Rec* 2, *Cr* 2.

85. Radio Frequency Electronics.—Radio frequency circuit elements; mathematical analysis of radio frequency circuits and methods of excitation; amplitude, frequency, and phase modulation and detection. Prerequisite, Ee 14 or 15. Ee 87 is required concurrently. *Rec* 2, *Comp* 2, *Cr* 3.

87; 88 (187; 188). Radio Laboratory.—Frequency measurements; radio-frequency amplifiers; tests of tube transmitters and receivers; speech input systems; filters; modulation; radio direction finding; antenna arrays; field strength measurements. Ee 85 required concurrently with 87. *Lab* 3, *Cr* 1½.

89 (189). Electro-Acoustics.—Physiology of speech and hearing; acoustic waves; dynamical systems of microphones, and loud speakers; sound recording; studio and theater acoustics. Prerequisite, Ee 21. *Rec* 3, with 4 Lab periods substituted for equivalent class time. *Cr* 3.

90 (190). Servomechanism Fundamentals.—The study of feedback control systems with special emphasis on servo systems; demonstration of basic feedback control system design using classical solution of differential equations and Laplace transformations. Prerequisite, Ee 7 or 11 and Ms 55 or 57. *Rec* 3, *Cr* 3.

91 (191). Illuminating Engineering.—General illumination theory; different types of lamps; light, photometry, illumination calculations; problems of interior and exterior lighting. Prerequisite, Ee 21. *Rec* 2½, *Lab* 1, *Cr* 3.

94 (194). Engineering Administration.—Executive techniques in engineering organizations, including capitalization and amortization, engineering surveys and planning, labor relations and utilization, time and motion study, statistical quality control, technical purchasing and inventory control, safety programs, and patent applications. Open only to juniors and Seniors. *Rec* 3, *Cr* 3.

95. Electromagnetic Fields.—Solution of static electric and static magnetic field problems by the methods of vector analysis; boundary value conditions; derivation of Maxwell's equations; introduction to time-varying electromagnetic fields. Prerequisite Ee 32. *Rec* 2, *Cr* 2.

99. Thesis.—The study of and report upon some original investigation or design. See regulations regarding degrees. *Cr* 1-3.

Graduate Courses

235; 236. Advanced Electric Power Systems.—*Rec* 2 or 3, *Cr* 2 or 3.
240; 241. Communication Networks.—*Rec* 2, *Cr* 2.
242. Electromagnetic Waves.—*Rec* 2, *Cr* 2.
247; 248. Circuit Laboratory.—*Lab* 4, *Cr* 2.
280. Pulse Techniques.—*Rec* 2, *Comp* 2, *Cr* 3.
283. Microwave Circuits.—*Rec* 2, *Cr* 2.
292; 293. Transients in Linear Systems.—*Rec* 2, *Cr* 2.
295. Communication Seminar.—*Rec* 2, *Cr* 2.
298. Advanced Control Systems.—*Rec* 3, *Cr* 3.
299. Graduate Thesis.—*Cr* 6-12.

ENGINEERING GRAPHICS

PROFESSOR MCNEARY; ASSISTANT PROFESSOR WESTFALL; MR. DESCHANES, MR. MCLAUGHLIN, MR. KEENE, MR. RANDALL

The thoughts and computations of engineers and all other persons engaged in design must be put down eventually on paper in a form intelligible to the crafts-

man who is to do the actual construction. Making drawings for this form of communication is the most familiar phase of engineering graphics. All Technology students, and many students from other Colleges in the University who have an interest in design, take the basic courses in engineering drawing.

Another phase of engineering graphics concerns itself with problem-solving rather than the delineation of objects for manufacture or construction. Descriptive geometry and nomography are two sciences that fall in this category.

The Department of Engineering Graphics does not have major students, but offers service courses to students majoring in other curricula, principally Technology and Forestry.

1; 2. Engineering Drawing.—Elements of graphic science for engineers. Creative exercises in instrumental drawing, multi-view drawing, freehand technical sketching, and lettering. Course 2 introduces instrumental and freehand pictorial drawing, and concludes with the preparation of working drawings for elementary design problems requiring creative thinking. *Rec & Lab* 4, *Cr* 2. THE STAFF

3. Descriptive Geometry.—The solution of problems of a three-dimensional nature by graphic methods. Theoretical and applied problems are given. Prerequisite, Course 1. *Rec & Lab* 4, *Cr* 2. THE STAFF

4. Machine Drawing.—The making of detail and assembly drawings of machinery. Special attention is given to the specification of allowances and tolerances, surface finishes, and other like matters relating to production processes. Prerequisite, Course 2. *Rec & Lab* 4, *Cr* 2. THE STAFF

5. Architectural Drawing.—The preparation of floor plans, elevations, sections, and pictorial renderings of homes and small buildings. Prerequisite, Course 1. *Rec & Lab* 4, *Cr* 2. MR. WESTFALL

12. Forestry Drawing.—A further study of orthographic and pictorial drawing with applied problems in wood utilization, topographical drawing, and other fields related to forestry. Prerequisite, Course 1. *Rec & Lab* 4, *Cr* 2. MR. WESTFALL

50 (150). Nomography.—The construction of graphical representations of equations which must be solved repeatedly. Topics include stationary adjacent scales, special slide rules, alignment charts, and network charts. Prerequisite Eg 1, Ms 12 or Ms 6. *Rec* 1, *Lab* 2, *Cr* 2. MR. MCNEARY

ENGINEERING PHYSICS

PROFESSORS BENNETT, CROFUTT, AND BISCOE; ASSOCIATE PROFESSORS COFFIN AND KRUEGER; ASSISTANT PROFESSORS TODD, WYLIE, THOMAS, AND CARR; MR. RILEY, MR. RICH, MR. HARTT, MR. RUTA, MR. KEENE, MR. MARSTON

This curriculum is an answer to the growing demand on the part of industry for college men trained in physics in an engineering atmosphere. It recognizes the fact that for certain students undergraduate specialization in a single engineering field is not a rigid requirement for success in industrial work. In such cases, however, concentration on the scientific principles underlying engineering is often assumed. This program is basically one of applied science supplemented by a strong elective minor, consisting of a sequence of technical electives, in one or more of the well-defined engineering or science fields. It is developed around a framework of required courses in intermediate and advanced physics, mathematics, and chemistry in addition to certain strictly engineering courses, some required

and some elected in the last two years. Thus the emphasis is placed upon both engineering and physics.

The curriculum is also suited for those students who, by virtue of their ability and interest, may be preparing to do graduate work. Graduates have successfully pursued graduate study in Physics and in various fields of Engineering.

Graduate Work in Physics

Graduate opportunities and requirements for the Master of Science degree in Physics are given on page 160 and in the catalog section on Graduate Study.

Freshman Year. See Page 190.

Sophomore Year

FALL SEMESTER						SPRING SEMESTER					
		Subject	Hours Rec	Lab or Comp	Cr			Subject	Hours Rec	Lab or Comp	Cr
*Be	1	Prin. of Economics or other				*Be	2	Prin. of Economics or other			
		Hum. Elective I	3	0	3			Hum. Elective I	3	0	3
*Gm	11	Scientific German (Elem.) or other				*Gm	12	Scientific German (Elem.) or other			
		Hum. Elective II	3	0	3			Hum. Elective II	3	0	3
Me	7	Machine Tool Lab.	1	2	1½	Ch	41	Quant. Anal.	2	3	3
Ms	27	Differential Calculus	5	0	5	Ms	28	Integral Calculus	5	0	5
Mt	3	Military Science II	2	1	2	Mt	4	Military Science II	2	1	2
Pe	3	Physical Education	0	2	0	Pe	4	Physical Education	0	2	0
Ps	17	Intermed. Physics	2	4	4	Ps	18	Intermed. Physics	2	4	4
Sh	1	Public Speaking	2	0	2						

Junior Year

			Hours Rec	Lab or Comp	Cr				Hours Rec	Lab or Comp	Cr
Eh	5	Technical Comp.	2	0	2	Me	54	Mechanics	3	0	3
Me	53	Mechanics	3	0	3	Ms	58	Eng. Math. II	3	0	3
Ms	57	Eng. Math. I	3	0	3	*Ps	66	Electronic Phen.	3	0	3
Ps	53	Elec. Meas.	0	4	2	Ps	72	Optics	3	0	3
Ps	55	Elec. and Mag.	3	0	3	Ps	76	Phys. Meas.	0	4	2
		Hum. Elective	3	0	3			Hum. Elective	3	0	3
†Technical Electives (choose one field) —						†Technical Electives (choose one field) —					
†ChE	1	Fund. Chem. Eng.	2	4	4	†ChE	2	Fund. Chem. Eng.	2	4	4
†Ch	71	Physical Chemistry	2	6	5	†Ch	72	Physical Chem.	2	6	5
†Ee	11	Basic Elec. Eng.	2	3	3	†Ee	29	A.C. Circuits	2	2	3
†Me	33	Thermodynamics	3	0	3	†Me	34	Thermodynamics	3	0	3

Senior Year

FALL SEMESTER

			Rec	Lab or Comp	Cr
Ee	11	Basic Elec. Eng.	2	3	3
*Ms	59	Vector Anal.	3	0	3
Ps	69	Modern Physics	3	0	3
*Ps	70	Nuclear Physics	2	1	3
Ps	81	Advanced Lab.	0	6	3
*Ps	91	Math. Physics I	3	0	3
Ps	98a	Seminar	1	0	½
†Technical Electives (same field as chosen in junior year)					
†ChE	64	Elem. Chem. Eng.	3	0	3
†Ch	51	Organic Chem.	3	4	5
†Ee	15	Electronics	2	3	3
†Me	59	Fluid Mechanics	3	0	3

SPRING SEMESTER

			Rec	Lab or Comp	Cr
**Ch	84	Metallurgy (required unless Ch 71 is elected)	3	0	3
**Ee	29	A.C. Circuits	2	2	3
*Ms	60	Adv. Eng. Math.	3	0	3
Ps	62	Heat and Thermo.	3	0	3
Ps	82	Advanced Lab.	0	6	3
*Ps	92	Math Physics II	3	0	3
Ps	98b	Seminar	1	0	½
†Technical Electives (same field as chosen in junior year)					
†ChE	65	Elem. Chem. Eng.	3	0	3
†Ch	52	Organic Chem.	3	4	5
†Ee		Elective			3
†Me	92	Aerodynamics	3	0	3

* The asterisk designates courses which are recommended electives. Approved substitutions can be made. See page 191 for humanity requirements in Bands I and II. It is expected that during the junior and senior years a normal registration will be from 18 to 20 hours each semester. Studnts who may continue with graduate work will do well to take at least one year of German.
† Under Technical Electives the student is expected to complete in the junior and senior years an informal "minor" consisting of approximately 12 hours (or no less than 3 semester courses) in a given field of Engineering or Science. In a given field it is recommended that a sequence of courses be followed, commencing with the course listed under "Technical Electives" in the junior year. Students choosing the field of Electrical Engineering may count the required courses Ee 11 and Ee 29 as technical electives. Students choosing the field of Mechanical Engineering should try to include some mechanical laboratory work in the senior year.
** The double asterisk designates courses which are required unless suitable substitutions are made.

Courses in Engineering Physics. See Page 157.

MECHANICAL ENGINEERING

PROFESSORS WATSON, PRAGEMAN, SPARROW; ASSOCIATE PROFESSORS HILL, SULLIVAN, LYMAN, CLIFFORD; ASSISTANT PROFESSORS CHAPMAN, CLARK; MR. GRANT, MR. HOPKINS, MR. LASKEY, MR. VEST

The Mechanical Engineering curriculum is broad, highly technical, and designed to give the student the necessary background to prepare him for various types of positions available in industry. Emphasis is placed on the fundamental principles underlying the numerous fields of mechanical engineering and their application to practical engineering problems. The fields of mechanical engineering include aeronautical, automotive, steam power, transportation, refrigeration, heating and air conditioning, Diesel engines, industrial safety, sales, research, and management. The mechanical engineer may be responsible, either directly or in an administrative capacity, for the design, development, production, installation, operation and maintenance of machines for industries in the various fields.

Courses in electrical engineering are included in the curriculum to provide the student with a background for this phase of engineering, which he probably will encounter in industry. Non-technical courses are included in the program to broaden the student's perspective and to prepare him for the administrative responsibilities he will assume later.

COLLEGE OF TECHNOLOGY

An option in pulp and paper management, a five-year course, is available to mechanical engineers who are interested in this field of work. This option includes all of the required courses for the four-year curriculum in mechanical engineering, plus essential courses in chemistry, chemical engineering, and pulp and paper, as well as selected courses in business administration. It leads to the Bachelor of Science degree in Mechanical Engineering and a certificate indicative of the Management Option in Pulp and Paper.

Graduate Work in Mechanical Engineering

The program for graduate study will vary in each case since the courses required as a background for the thesis will depend upon the specific phase of mechanical engineering chosen for the investigation. Advanced courses in mathematics are usually required in all programs.

Freshman Year. See Page 190.

Sophomore Year

FALL SEMESTER

Subject			Hours Rec	Lab or Comp	Cr
Eg	3	Desc. Geometry	0	4	2
Me	1	Mfr. Tools & Proc.	1	2	1½
Me	21	Engr. Mats. & Metall.	3	0	3
Ms	27	Calculus	5	0	5
Mt	3	Military Science II	2	1	2
Pe	3	Physical Education	0	2	0
		Hum. Elective			6

SPRING SEMESTER

Subject			Hours Rec	Lab or Comp	Cr
Sh	1	Public Speaking	2	0	2
Me	22	Elem. of Mech. Eng.	3	0	3
Me	26	Mechanical Lab.	0	3	1½
Me	50	Appl. Mechanics, Statics	3	0	3
Ms	28	Calculus	5	0	5
Mt	4	Military Science II	2	1	2
Pe	4	Physical Education	0	2	0
		Hum. Elective			3

Junior Year

			Rec	Lab or Comp	Cr
Me	7	Mach. Tools & Mfr. Proc.	1	2	1½
Me	23	Kinematics	3	3	4
Me	33	Thermodynamics	3	0	3
Me	37	Mechanical Lab.	0	3	1½
Me	51	Strength of Materials	4	0	4
Ms	57	Eng. Math.	3	0	3
		Hum. Elective	—	—	—

			Rec	Lab or Comp	Cr
Eh	5	Technical Comp.	2	0	2
Ee	7	Elec. Cir. & Machines	2	3	3
Me	8	Mach. Tools & Mfr. Proc.	1	2	1½
Me	24	Machine Design	2	3	3
Me	34	Thermodynamics	3	0	3
Me	38	Mechanical Lab.	0	3	1½
Me	52	Appl. Mechanics, Dynamics	3	0	3
		Hum. Elective	—	—	—

Senior Year

			Rec	Lab or Comp	Cr
Ee	8	Elec. Cir. & Mach.	2	3	3
Me	59	Fluid Mechanics	3	0	3
Me	71	Mechanical Lab.	0	3	1½
Me	87	Adv. Mach. Design	1	3	2
		Hum. Elective	—	—	—
		Tech. electives, two required			
Me	81	Modern Turbines	2	3	3
Me	91	Heating & Air Cond.	3	0	3
Me	93	I. C. Engines	3	0	3

			Rec	Lab or Comp	Cr
Ee	43	Appl. Electronics	1½	1	2
Me	60	Heat Transfer	3	0	3
Me	72	Mechanical Lab.	0	3	1½
Me	86	Power Plants	3	0	3
Me	96	Seminar	1	0	1
		Hum. Elective	—	—	—
		Tech. electives, one required			
Me	58	Adv. Strength of Materials	3	0	3
Me	84	Industrial Mgt.	3	0	3
Me	92	Aerodynamics	3	0	3

PULP AND PAPER MANAGEMENT OPTION IN MECHANICAL ENGINEERING

Five Year Program

The first three years of this program are the same as the regular mechanical engineering program, as stated above, including all specified courses through the junior year.

Senior Year

		FALL SEMESTER				SPRING SEMESTER			
		Subject	Hours Rec	Lab or Comp	Cr	Subject	Hours Rec	Lab or Comp	Cr
Ee	8	Elec. Cir. & Mach.	2	3	3	Ee 43 Appl. Electronics	1½	1	2
Me	59	Fluid Mechanics	3	0	3	Me 72 Mechanical Lab.	0	3	1½
Me	71	Mechanical Lab.	0	3	1½	Me 84 Industrial Mgt.	3	0	3
Me	87	Adv. Mach. Design	1	3	2	Me 86 Power Plants	3	0	3
Pa	65	Pulp Technology	3	0	3	Ch 41 Quant. Analysis	2	3	3
		Tech. electives, one required				Be 9 Elem. Acctg.	3	0	3
Me	81	Modern Turbines	2	3	3	Pa 66 Paper Technology	3	0	3
Me	91	Heating & Air Cond.	3	0	3				
Me	93	I. C. Engines	3	0	3				
		Hum. Elective	—	—	—				

Fifth Year

			Hours Rec	Lab or Comp	Cr				Hours Rec	Lab or Comp	Cr
Be	51	Corp. Finance	3	0	3	Ms	31	Math. Statistics	3	0	3
Pa	73	Pulp Mfr. & Test.	0	8	4	Me	60	Heat Transfer	3	0	3
Pa	84	Mgt. and Operation Paper Mills	3	0	3	Me	96	Seminar	1	0	1
Pa	89	Pulp & Paper Mill Inspection	0	4	2	Pa	72	Pulp & Paper Equip.	3	0	3
		Hum. Elective	—	—	—	Pa	74	Paper Mfr. & Testing	0	8	4
		Tech. electives, one required						Engrg. Project			3
Me	81	Modern Turbines	2	3	3			Elective	—	—	—
Me	91	Heating & Air Cond.	3	0	3						
Me	93	I. C. Engines	3	0	3						

A student desiring to elect this option must submit his application before May 1st of his junior year.

Courses in Mechanical Engineering

1. Manufacturing Tools and Processes.—Modern tools and processes, engineering nomenclature and terminology. Discussions of usual shop processes and machines; production processes, their possibilities and limitations as applied to pattern work and foundry processes. Gages used in unit-production and mass-production system measurements. *Rec. and Lab* 3, *Cr* 1½. MR. LASKEY

7; 8. Machine Tools and Manufacturing Processes.—Discussion of various machine tools and materials employed in modern manufacturing processes. Use of basic machine tools, stressing the selection of feeds, speeds, depth of cuts and workability for various metals in different operations. *Rec and Lab* 3, *Cr* 1½. MR. HOPKINS

21. Engineering Materials and Metallurgy.—A study of ferrous and non-

ferrous metals; the theory of binary alloy equilibrium microstructures; properties and their relationship to composition, mechanical work, heat treatment. *Rec* 3, *Cr* 3. MR. LYMAN AND STAFF

22. Elements of Mechanical Engineering.—Elementary thermodynamics, mechanical apparatus, power plant equipment; engineering calculations relative to heat, power, work, and mechanical and electrical energy. *Rec* 3, *Cr* 3.

23. Kinematics.—An analysis of the motions of machine parts, including such machine elements as linkwork, cams, gears, belts, and trains of transmission. *Rec* 3, *Comp* 3, *Cr* 4. MR. PRAGEMAN, MR. CHAPMAN, MR. GRANT

24. Machine Design.—Application of the laws of applied mechanics and strength of materials to the design of machine parts. Safety and economic considerations are included. Prerequisite, Me 23 and 51. *Rec* 2, *Comp* 3, *Cr* 3. MR. PRAGEMAN, MR. CLIFFORD

26. Mechanical Laboratory.—Slide Rule computations and laboratory experiments on calibration and testing of mechanical equipment. *Lab* 3, *Cr* 1½.

33. Thermodynamics.—The thermodynamic system, properties, equations relating properties, processes, the First and Second Laws and their corollaries. Prerequisite, Ms 28 and Ps 1, 2. *Rec* 3, *Cr* 3. MR. HILL, MR. LYMAN

34. Thermodynamics.—The application of the concept and laws of Me 33. Selected topics in the following areas: steam power plants, internal combustion engines, refrigeration, compressors, nozzles and turbines, flow measurement of compressible and incompressible fluids; combustion and air conditioning. Prerequisite, Me 33. *Rec* 3, *Cr* 3. MR. HILL, MR. LYMAN

37; 38. Mechanical Laboratory.—Applications of the principles and laws of thermodynamics and mechanics of materials in experiments on various types of mechanical equipment and engineering materials. Me 33, 51, 34 are required concurrently. *Lab* 3, *Cr* 1½. MR. SPARROW, AND STAFF

41. Mechanical Laboratory.—For non-mechanical engineers. Calibration of instruments; testing strength of materials; testing of steam engines, gas engines, hydraulic testing. Prerequisite, Me 43 or ChE 37. *Lab* 3, *Cr* 1½.

43. Heat Engineering.—A short course for non-mechanical engineers covering the laws of thermodynamics and their application to heat motors, air compressors, refrigerating machinery, and power-plant equipment. Prerequisite, Ms 28 and Ps 2. *Rec* 3, *Cr* 3.

50. Applied Mechanics, Statics.—The study of forces acting on objects in equilibrium. Two and three dimensional systems, moments, couples, force analyses of structures; friction: distributed forces, first and second moments, centroids. Prerequisite, Ms 27. *Rec* 3, *Cr* 3. MR. SULLIVAN, MR. CLARK AND STAFF

51. Strength of Materials.—The principles of mechanics of materials and their application to practical problems. Stresses and strains in objects subject to tension, compression and torsion; beam theory including deflections; columns; combined stresses. Prerequisite, Me 50. *Rec* 4, *Cr* 4. MR. SULLIVAN AND STAFF

52. Applied Mechanics, Dynamics.—The velocities, accelerations, and forces accompanying the motion of objects. Work, energy, impulse, momentum; application to engineering problems. Prerequisite, Me 50. *Rec* 3, *Cr* 3. MR. SULLIVAN AND STAFF

53. Applied Mechanics.—A course similar to Me 50 with some kinematics and kinetics included. Prerequisite, Ms 27. *Rec* 3, *Cr* 3. MR. CLARK, MR. GRANT AND STAFF

54. Strength of Materials.—An abbreviated course similar to Me 51. Prerequisite, Ms 28 and Me 53. *Rec* 3, *Cr* 3. MR. CLARK, MR. GRANT AND STAFF

55. Statics and Strength of Materials.—The basic principles of statics and their applications in strength of materials. Equilibrium of various systems. Stresses and deformations of axially loaded members, connections, circular shafts, beams and columns. Prerequisite, Ms 27. *Rec* 3, *Cr* 3.

57 (157). Advanced Dynamics.—Dynamics of a particle, free and forced vibrations, numerical methods. Energy, momentum, engine balancing, flywheels. Vibrations of masses with single, two, and n-degrees of freedom; viscous damping. Gyroscopic motion. Prerequisite, Ms 28 and Me 52. *Rec* 3, *Cr* 3. MR. SULLIVAN

58 (158). Advanced Strength of Materials.—Limitations of elementary stress formulas, theories of failure, unsymmetrical bending, curved flexural members, flat plates, torsion of non-circular bars, thick-walled cylinder, stress concentrations, energy methods, and introduction to theory of elasticity. Prerequisite, Ms 28 and Me 51. *Rec* 3, *Cr* 3. MR. SULLIVAN

59 (159). Fluid Mechanics.—Statics and dynamics of fluids. Compressible and non-compressible fluids. Measurement of fluid flow. Laws of dynamic similitude. Laminar and turbulent flow. Applications to lubrication, aerodynamics, and hydrodynamics. Prerequisite, Me 34 and 52. *Rec* 3, *Cr* 3.

60 (160). Heat Transfer.—The laws of conduction, convection, and radiation of heat energy and their application to engineering problems. The analytical, numerical, and graphical solution of one, two, and three dimensional problems. Prerequisite, Me 33, 59. *Rec* 3, *Cr* 3.

62. Heat Transfer and Fluid Flow.—For non-mechanical engineers. The laws of conduction, convection, and radiation of heat energy. Principles of fluid flow for non-viscous and viscous fluids. Application of the principles of heat transfer and fluid flow to engineering problems. Prerequisite, Me 33 or 43. *Rec* 3, *Cr* 3.

71; 72. Mechanical Laboratory.—Application of basic laws and theory in tests on condensers, boilers, air compressors, fans, hydraulic equipment, heating equipment, internal combustion engines, turbines, and fuels. Special projects. Prerequisite, Me 38. *Lab* 3, *Cr* 1½ MR. SPARROW AND STAFF

81 (181). Modern Turbines.—A continuation of Me 33 and 34, dealing with steam and gas turbines; considerations affecting the design and efficiency of operation of the various types. Prerequisite, Me 34. *Rec* 2, *Comp* 3, *Cr* 3.
MR. HILL

84. Industrial Management.—The management of industrial enterprises, layout of industrial buildings, time and motion study, wage systems and selection of personnel, labor problems, and finance. Prerequisite, M. E. senior. *Rec* 3, *Cr* 3.
MR. HILL

86 (186). Power Plants.—Design, construction, and operating theory of steam, diesel, and hydroelectric power plants, and the application of engineering economics. Prerequisite M.E. senior. *Rec* 3, *Cr* 3. MR. WATSON, MR. CLIFFORD

87. Advanced Machine Design.—A continuation of Me 24, including the execution of the design of some pieces of mechanical equipment. Emphasis is given to the development of creative ability. Prerequisite, Me 24. *Rec* 1, *Comp* 3, *Cr* 2. MR. PRAGEMAN, MR. CLIFFORD, MR. SULLIVAN

88 (188). Dynamics of Machines.—The forces due to reciprocating and rotating masses with special application to balancing high-speed machinery, designing governors and flywheels. Prerequisite, Me 23, 24, and 87. *Rec* 2, *Cr* 2.

90 (190). Advanced Thermodynamics.—Mathematical relationships; equations of state; equilibrium considerations; thermodynamics of combustion. Prerequisite, Me 93. *Rec* 3, *Cr* 3. MR. HILL

91 (191). Heating and Air-Conditioning.—Determination of transmission coefficients for various wall construction. Heat losses from buildings, costs of heating. Design of heating, ventilating, and air-conditioning systems. Prerequisite, Me 34 or 43. *Rec* 3, *Cr* 3. MR. WATSON

92 (192). Aerodynamics.—Flow of an ideal fluid; application of dimensional analysis to engineering problems; properties of airfoils; engine and propeller characteristics; airplane performance calculations; propeller theory. Prerequisite, Me 52 and 59. *Rec* 3, *Cr* 3. MR. SULLIVAN

93. Internal Combustion Engines.—Application of thermodynamic laws and principles to internal combustion engine cycles; theory of design and operation; fuels and combustion; carburetion, detonation, cooling, and lubrication. Prerequisite, Me 34. *Rec* 3, *Cr* 3. MR. CLIFFORD

94. Hydraulic Machinery.—Prerequisite, Me 52 and 59. *Rec* 3, *Cr* 3.

96. Seminar.—Coordination of various mechanical engineering courses, with the basic principles involved applied to the solution of comprehensive problems. Industrial safety is also covered in this course. *Rec* 1, *Cr* 1 MR. WATSON

99. Thesis.—*Cr, Ar.*

Graduate Courses

201. Metallography.—*Cr, Ar.*

291. Mechanical Engineering Projects.—*Cr, Ar.*