Bulletin of

# TEXAS TECHNOLOGICAL COLLEGE

## The SCHOOL OF ENGINEERING

### Announcements for 1959-1960

Vol. XXXV January, 1959 No. I

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## TECH in brief . . .

- HISTORY: Founded 1923 by 38th Texas Legislature, as a state-supported coeducational college. First students enrolled, Sept. 30, 1925. Original student body, 1,043; now over 9,000. College plant valued at $1,424,000 after one year's operation; by end of 1958, value estimated at $29 million.
- LOCATION: Within corporate limits of Lubbock, a city of approximately 140,000 — medical, cultural, industrial, and agricultural center for the South Plains area. Elevation 3,200 feet.
- SCHOOLS: Agriculture, Arts and Sciences, Business Administration, Engineering, Home Economics, and Graduate.
- BUILDINGS: More than 50 permanent type buildings, including four new men's dormitories. Under construction — classroom and office building, new textile engineering building.
- ACREAGE: Main campus contains 2,008 acres; 1,600 used as an experimental farm. College also operates 5,800-acre PanTech Farm near Amarillo.

# . . . TABLE OF CONTENTS


Page

4 **Glossary and Symbols**

5 **General Information**

6 **Calendar**

8 **Organization of College**

9 **The School of Engineering**

10 Requirements for Admission

11 Undergraduate Degrees

12 Applying for a Degree

13 Second Bachelor's Degree

13 Advanced Degrees in Engineering

14 Expenses and Fees

14 Textile Research Laboratories

16 Architecture and Allied Arts

24 Chemical Engineering

28 Civil Engineering

33 Electrical Engineering

37 Engineering Physics

39 Engineering Seminar

40 Industrial Engineering and Engineering Drawing

45 Mechanical Engineering

49 Petroleum Engineering

53 Textile Engineering

56 **Non-Professional Courses for Engineers**

59 **Board of Directors and Officers of Administration**

60 **Faculty of the School of Engineering**

# GLOSSARY AND SYMBOLS . . .

**academic year.** The period of time during which instruction is offered at the College. This is divided into the fall semester and the spring semester. Summer session is considered separately.

**advanced standing.** Credit toward a degree for work satisfactorily completed elsewhere.

**bachelor's degree.** The degree granted after successful completion of an approved undergraduate college program.

**course.** A unit of measure for instructional purposes. Most courses meet three times a week.

**credit.** A unit of credit, or semester hour, represents one prepared class period or hour a week for one academic semester.

**curriculum** (plural: curricula). A body of courses constituting a complete semester's or year's study, or a full four-year program, usually differing from one department to another.

**elective.** A course outside the specific courses prescribed for a given curriculum.

**grade points.** Quality points per credit hours awarded for performance in each course taken (A — 3, B — 2, C — 1, D — 0, F — 0, W — 0, WP — 0, WF — 0).

**grade point average.** An average indicative of over-all performance; it is computed by dividing the sum of grade points earned by the number of credit hours taken.

**graduate.** As an objective, courses or degrees offered beyond the Bachelor of Science degree.

**laboratory fee.** A special fee is required in certain laboratory courses.

**major.** A principal concentration of study in one field of learning.

**prerequisite.** A requirement (usually a course of study), that the student must fulfill before he is permitted to proceed with his program of study.

**symbols,** as (3:1:4), follow name and number of a course, as Chemistry 141 (4:3:3). The first digit, 4, refers to the credit hours of the course; the second digit, 3, refers to the number of lecture hours scheduled per week; and, the third digit, 3, refers to the number of laboratory hours scheduled per week.

**transfer credit.** Credit transferred to or from another college or university.

**undergraduate.** A course or person involved in the program leading to a Bachelor's degree.

# . . . GENERAL INFORMATION

## How To Use This Bulletin

The Bulletin of the School of Engineering should be used in conjunction with the most recent General Information Bulletin of Texas Technological College. Each student is held responsible for familiarizing himself with the content of both his **School bulletin** and the **General Information Bulletin of the year he enters the college.**

Detailed information is given in this bulletin on the School of Engineering. Reference is made also to general College regulations and many other topics, as admissions, advanced standing, scholarships, general degree requirements, which are detailed in the General Information Bulletin but to which ready and frequent reference is needed by the engineering student.

# CALENDAR for 1959-1960*

## . . . Spring Semester 1959

| | |
|---|---|
| Jan. 27. | Tuesday. Spring semester begins. 8 a.m. Entering freshmen assemble, Ag Memorial Auditorium. |
| Jan. 29-31 | Thursday-Saturday. Registration. |
| Feb. 2 | Monday, 8 A.M. Classes begin. |
| Mar. 25. | Wednesday, 5 P.M. Midsemester reports due. |
| Mar. 26. | Thursday, 10 P.M. Classes dismissed, Easter vacation. |
| Mar. 31. | Tuesday, 8 A.M. Classes resumed. |
| May 20-27. | Wednesday-Wednesday. Final examinations. |
| May 31. | Sunday, 8:30 A.M. Graduation rehearsal. 8 P.M. Baccalaureate sermon. |
| June 1. | Monday, 8 P.M. Commencement. Spring semester ends. |

## . . . Summer Session 1959

### First Term

| | |
|---|---|
| June 2. | Tuesday, 1 P.M. Entering freshmen assemble, C101.<br>2-5 P.M. Begin registration. |
| June 3. | Wednesday. Registration. |
| July 13-14. | Monday-Tuesday. Final examinations. |
| July 14. | Tuesday. First term ends. |

### Second Term

| | |
|---|---|
| July 14. | Tuesday. Second term begins. 1 P.M. Entering freshmen assemble, C101. |
| July 15. | Wednesday. Registration. |
| Aug. 19-20. | Wednesday-Thursday. Final examinations. |
| Aug. 22. | Saturday. Commencement. |

## . . . Fall Semester 1959

| | |
|---|---|
| Sept. 11. | Friday, 10 A.M. General faculty meeting. 2 P.M., Engineering faculty meeting. |
| Sept. 14. | Monday. Fall semester begins. 8 A.M. Entering freshmen assemble on Administration Building Green. |
| Sept. 14-16. | Monday-Wednesday. Freshman counseling. |
| Sept. 16-19. | Wednesday-Saturday. Registration. |
| Sept. 21. | Monday, 8 A.M. Classes begin. |
| Sept. 30. | Wednesday, 10-12 A.M. Student Convocation. Classes dismissed. Selection of class officers. |
| Nov. 7. | Saturday. 5 P.M. Midsemester reports due. |
| Nov. 25. | Wednesday, 10 P.M. Classes dismissed, Thanksgiving holidays. |
| Nov. 30. | Monday, 8 A.M. Classes resumed. |
| Dec. 19. | Saturday, 12 Noon. Classes dismissed, Christmas holidays. |

**1960**

| | |
|---|---|
| Jan. 4. | Monday, 8 A.M. Classes resumed. |
| Jan. 16-23. | Saturday-Saturday. Final examinations. |
| Jan. 23. | Saturday. Fall semester ends. |

## . . . Spring Semester 1960

| | |
|---|---|
| Jan. 26. | Tuesday. Spring semester begins. 8 A.M. Entering freshmen assemble, C101. |
| Jan. 28-30. | Thursday-Saturday. Registration. |
| Feb. 1. | Monday, 8 A.M. Classes begin. |
| Mar. 16. | Wednesday, 5 P.M. Midsemester reports due. |
| Apr. 14. | Thursday, 10 P.M. Classes dismissed, Easter holidays. |
| Apr. 19. | Tuesday, 8 A.M. Classes resumed. |
| May 18-25. | Wednesday-Wednesday. Final examinations. |
| May 29. | Sunday. Baccalaureate sermon. |
| May 30. | Monday. Commencement. Spring semester ends. |

## . . . Summer Session 1960

### First Term

| | |
|---|---|
| May 31. | Tuesday, 1 P.M. Entering freshmen assemble, C101. |
| May 31-June 1. | Tuesday-Wednesday. Registration. |
| July 11-12. | Monday-Tuesday. Final examinations. |
| July 12. | Tuesday. First term ends. |

### Second Term

| | |
|---|---|
| July 12. | Tuesday, 1 P.M. Entering freshmen assemble, C101. |
| July 12-13. | Tuesday-Wednesday. Registration. |
| Aug. 17-18. | Wednesday-Thursday. Final examinations. |
| Aug. 20. | Saturday. Commencement. Second term ends. |

*The College Calendar is subject to change.

From Gen. Mgr. Bulletin

# INSTRUCTIONAL SCHOOLS & DEPARTMENTS

## Agriculture

Agricultural Economics
Agricultural Education
Agricultural Engineering
Agronomy
Animal Husbandry
Dairy Industry
Horticulture and Park Management

## Arts and Sciences

Biblical Literature
Biology
Chemistry
Education and Philosophy
English
Foreign Languages
Geology
Government
Health, Physical Education, and Recreation for Men
Health, Physical Education, and Recreation for Women
History and Anthropology
Journalism
Mathematics
Music
Physics
Psychology
Sociology
Speech

## Business Administration

Accounting
Business Education and Secretarial Administration
Economics and Finance
Management
Marketing

## Engineering

Architecture and Allied Arts
Chemical Engineering
Civil Engineering
Electrical Engineering
Industrial Engineering and Engineering Drawing
Mechanical Engineering
Petroleum Engineering
Textile Engineering

## Home Economics

Applied Arts
Clothing and Textiles
Food and Nutrition
Home and Family Life
Home Economics Education

## Graduate School

Degrees offered:
Master of Arts
Master of Business Administration
Master of Education
Master of Science
Master of Science in Agriculture
Master of Science in Chemical Engineering
Master of Science in Civil Engineering
Master of Science in Electrical Engineering
Master of Science in Mechanical Engineering
Master of Science in Home Economics
Doctor of Education
Doctor of Philosophy

## Reserve Officers Training Corps

Air Force
Army

## Extension

Correspondence Courses
Extension Classes

# MAJOR AREAS OF STUDY

## Agriculture

Agricultural Economics
Agricultural Education
Agricultural Engineering
Agricultural Science
Animal Industry
Crops
Dairy Husbandry
Dairy Industry
Entomology
Horticulture
Park Management
Poultry Husbandry
Range Management
Soils

## Arts and Sciences

Anthropology
Art
Bacteriology
Biology
Botany
Chemistry
Elementary Education
English
French
Geology
German
Government
Health and Physical Education
History
Journalism
Mathematics
Music
Music Education
Philosophy
Physics
Piano
Pre-Law
Pre-Medical
Psychology
Public School Music
Recreation
Science
Secondary Education
Social Science
Sociology
Spanish
Speech
Speech Correction
Voice
Zoology

## Business Administration

Accounting
Advertising
Business Education
Economics
Finance
Industrial Management
International Trade
Marketing
Office Management
Personnel Management
Pre-Law
Public Administration
Retailing
Secretarial Administration
Traffic Management

## Engineering

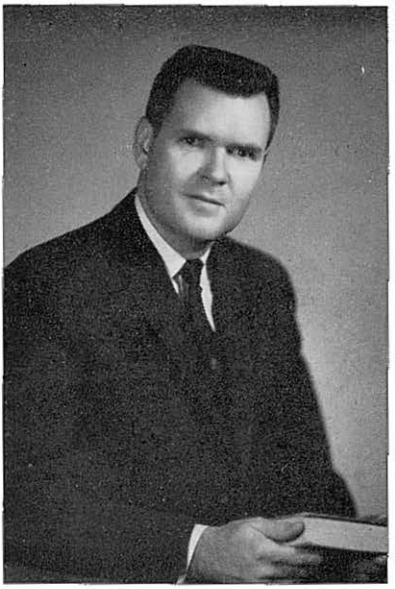
Advertising Art and Design
Architecture, Construction or Design
Chemical Engineering
Civil Engineering
Electrical Engineering
Engineering Physics
Industrial Engineering
Mechanical Engineering
Petroleum Engineering
Textile Engineering

## Home Economics

Applied Arts
Clothing and Textiles
Food and Nutrition
General Home Economics
Home Economics Education
Home and Family Life

## Interdepartmental

Bilingual - Secretarial
Latin American Area Studies



*John R. Bradford, Dean, School of Engineering*

# The SCHOOL OF ENGINEERING

Advertising Art and Design
Architecture, Construction or Design
Chemical Engineering
Civil Engineering
Electrical Engineering
Engineering Physics
Industrial Engineering
Mechanical Engineering
Petroleum Engineering
Textile Engineering

The importance of the School of Engineering is stressed in the first section of the bill by which the Thirty-Eighth Legislature established the College. It is pointed out that the commercial development of the State depends largely upon the opportunities for students to receive thorough training in engineering and manufacturing fields.

The aim of the School of Engineering is to give students a thorough knowledge of the fundamentals of all engineering work, with specialization in one particular line only to the extent that experience appears to demand as a mininmum. The course of study is planned with the view of giving the student basic training which he cannot get after graduation, leaving a large part of his specialization to his later professional employment. Experience has shown this type of training to produce the most successful engineers.

Engineering has been defined as the "scientific utilization of the forces and materials of nature in the construction, production and operation of works for the benefit of man." Therefore, the funda-

*Robert L. Newell, Assistant Dean, School of Engineering*

mental training of the engineer includes a knowledge of pure science, as well as its application to the various specialized fields. As an aid to the development of a scientific attitude, engineering instruction emphasizes the qualities of honesty, loyalty, thoroughness, and industry, and fosters the desire for learning and for a knowledge of the ethics of the profession.

The engineering student upon graduation usually spends a period of time in subordinate positions, securing experience and preparing himself for the more important work of the executive, the designer, the consulting engineer, the teacher, the researcher, or the supervisor of manufacturing operations.

Engineering training is recognized as desirable preparation for a commercial career. From 60 to 70 per cent of the engineering graduates in the past have eventually held executive positions. Surveys of employment records of engineering graduates disclose the fact that men who had an engineering education have found their way into nearly every type of vocation. A few of the vocations which the engineering graduate may reasonably expect to enter upon graduation, or after a period of practical experience, have been indicated in the beginning of the departmental descriptions. Attention is called to the fact that in a civilization such as ours, where one is constantly in contact with the results of our modern industrial development, no type of education is more suitable than that leading to an engineering degree.

## Requirements For Admission

Admission to the School of Engineering, as in all other schools of the College, is under the control of the Dean of Admissions, and all correspondence on this subject should be addressed to him.

For the general requirements for admission and the details of registration, consult the General Information Bulletin.

The study of engineering requires a thorough background of preparation in English, mathematics, physics, and chemistry. It is highly desirable, therefore, for the prospective engineering student to present a high school record which includes 4 units of English, 2 units in algebra, 1 unit in plane geometry, and 2 units in science, one of which must be physics. The student deficient in one of the units in algebra, plane geometry, or physics will be classified as a pre-engineer with conditions. A deficiency in plane geometry may be removed by the successful completion of Mathematics 032. A deficiency in algebra may be removed by successful completion of Mathematics 052. The student deficient in physics shall enroll for Physics 031. Students must begin the removal of deficiencies during the first long session. While removing conditions it will be necessary for the student to defer some of the regular course work as prescribed in his degree plan.

Admission to the School of Engineering will be based on an acceptable high school transcript. However, completion of enrollment and assignment to class in English, mathematics, and physics will not be made until the results of freshmen tests are available. Students showing deficiencies in English, mathematics, and physics as indicated by the freshmen tests must register as pre-engineers in the School of Engineering until such deficiencies shall have been removed. Students with deficiencies as determined by the freshmen tests or high school record may be denied entrance to all sophomore work until the deficiencies are removed.

Physics is not required for admission for majors in advertising art and design or the design option in architecture. Math. 051 should be taken by advertising art majors deficient in algebra.

Applicants for admission to the School of Engineering who have entrance deficiencies are strongly urged to use the summer session immediately preceding the freshman year as the time for removing deficiencies. Otherwise, the ultimate date of graduation may be delayed.

## Undergraduate Degrees

The School of Engineering offers the following four-year curricula, each leading to the Degree of Bachelor of Science in its respective field: Chemical Engineering, Civil Engineering, Electrical Engineering, Engineering Physics, Industrial Engineering, Mechanical Engineering, Petroleum Engineering, Textile Engineering. In the Department of Architecture, a five-year curriculum in architecture and a four-year curriculum in advertising art and design are offered, leading to the Degrees of Bachelor of Architecture and Bachelor of Advertising Art and Design, respectively.

The courses listed in individual curricula are those prescribed for the various degrees and the arrangement by freshman, sophomore, junior and senior years is the recommended sequence of courses, whether a student begins his work in the summer or in

the long session. When he registers for each semester, a student should check course prerequisites carefully and be sure to include in that semester's work the courses which are prerequisite to the courses prescribed for the following semester. Any substitution or deviation from the courses listed in the programs of study requires written approval by the Dean of the School of Engineering and the Head of the Department in which the student is majoring.

ROTC courses may be counted toward undergraduate degree requirements in the School of Engineering as follows:

1. Four semesters of basic ROTC may be substituted for the four semesters of physical education which constitute part of the requirements of all undergraduate degrees offered by the College.
2. Subject to the approval of the student's major department, advanced ROTC may be used to satisfy a maximum of six hours of non-technical electives of the degree program.

General College regulations allow a maximum of 18 semester hours of work of undergraduate degrees to be done by correspondence. In the School of Engineering, not more than 9 of the total 18 credit hours may be in the fields of engineering, science and mathematics. In all cases, credit for correspondence work is subject to the approval of the Dean of Engineering.

## Applying For A Degree

A candidate for a degree must register in the School of Engineering and should apply for a degree in the manner indicated below.

(a) A student who expects to receive a degree during the next school year must file with the Office of the Dean of Engineering an "Application for Degree" during the **spring semester** of the **junior year.** The degree applicant receives a list of the courses and the number of grade points which he lacks prior to his fall registration as a senior student if his application was made at the proper time.

(b) In making application for a degree, the student must indicate the year's bulletins under which he wishes to be checked, as he must meet the requirements of a specific bulletin year in its entirety. This must be one during which he was registered as a student in the School of Engineering, subject to the restriction that all requirements for an undergraduate degree must be completed within seven years of the date of the year's bulletins chosen.

(c) A graduating senior must file with the Placement Office a complete personnel record and two 2"x3" glossy photographic prints for record and identification. This must be done at least three months prior to graduation.

(d) A $5 graduation fee is required.

(e) To receive a degree, a student must either attend commencement exercises or receive approval from the Dean of Engineering to graduate **in absentia.** Application to graduate in this manner must be made within the time specified in the College Calendar. Each student graduating **in absentia** will be charged an additional fee of $1.50.

Regulations governing general requirements for graduation will be found in the General Information Bulletin. The final responsibility for meeting all degree requirements rests on the student.

## Second Bachelor's Degree

A student who has completed the requirements for the bachelor's degree may also receive a second bachelor's degree upon the completion of the curriculum prescribed for the second degree. To qualify for a second degree to be awarded by the School of Engineering, a minimum of 30 additional hours over and above the number of hours completed for the first degree is required.

A formal program leading to a Degree of Bachelor of Science in Petroleum Engineering and Mechanical Engineering is available through the cooperation of the two departments. Details of this plan are given in the mechanical engineering section of this bulletin.

A student, by the proper selection of courses, may complete in five years the requirements for the Degree of Bachelor of Science in Engineering and the Degree of Bachelor of Arts in the School of Arts and Sciences.

## Cooperative Programs With Other Colleges

The School of Engineering now has a cooperative program of study with Abilene Christian College, Baylor University, Hardin-Simmons University, North Texas State College, Trinity University, and McMurry College. Under this program the student is in attendance for three years at one of the above-mentioned schools and two years and one summer at Texas Technological College. This program of study leads to the issuance of a degree from each institution.

## Advanced Degrees In Engineering

The graduate program in the School of Engineering provides course work and research leading to the Degrees of Master of Science in Chemical, Civil, Electrical, and Mechanical Engineering. Major course work in the respective field combined with minor course work in related fields provides for a broad and intensive study in important branches of the profession.

Admission to the Graduate School is based on an above-average undergraduate record and satisfactory standing on the Graduate Record Examinations. The regulations and requirements of the Graduate School are given in the Graduate Bulletin. In addition to the general requirements of the Graduate School which apply to all advanced degree programs in the School of Engineering, the following special requirements are also applicable:

1. A reading knowledge of a foreign language is not required for advanced degree work in the School of Engineering.
2. Upon the election of the major department, a graduate student may substitute graduate course work for the thesis

requirement. In this case, an increase in the total number of hours to complete the degree plan will result.
3. Course work which has been used to satisfy undergraduate degree requirements may not be used for advanced degree credits.

## Expenses and Fees

A complete listing of all expenses normally incurred by students during registration may be found in the General Information Bulletin. Special charges are made in certain courses to cover the costs of expendable items and services required by the course. These charges are indicated following the course description. A **laboratory fee** is charged for all courses in which the combined credit of lecture and laboratory is from 1 to 3 semester hours, a laboratory fee of $2 is charged for each semester. For courses in which the semester credit is 4 semester hours or more, the laboratory fee is $4 per semester. A laboratory fee of $2 is charged for each freshman student participating in the early registration counseling and testing program to cover laboratory materials and supplies.

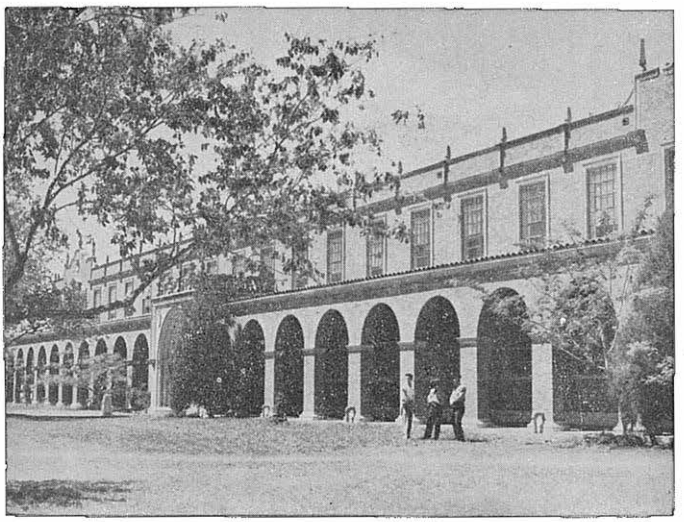
## Textile Research Laboratories

Through the facilities of the Textile Research Laboratories, a program of fundamental and applied research on the utilization of textile fibers in yarn and fabric manufacture is carried out.

The Cotton Research Committee of Texas has, for a number of years, sponsored research designed to bring about increased markets for, and broader use of, Texas cotton in textile manufacturing operations.

Services of Textile Research Laboratories are available for conducting both privately and publicly sponsored research. A modern 1,000-spindle pilot scale spinning research facility was placed in operation March 1, 1958. This facility is available for evaluation of the mill scale performance characteristics of cottons exhibiting any combination of fiber properties. The fiber research laboratory is equipped for developing data and information required for effectively merchandising cotton fibers and organizing manufacturing processes that will permit these cottons to be used in the most effective manner possible.

Facilities of the Textile Engineering Department and the Cotton Research Committee of Texas are housed in the Textile Engineering Building. They are jointly used for research and teaching.



*WEST ENGINEERING, one unit of the Engineering Quadrangle*

# ADVERTISING ART & DESIGN CURRICULUM

## Bachelor of Advertising Art & Design

| FRESHMAN YEAR | | | SEMESTER 1st. | 2nd. |
|---|---|---|---|---|
| Arch. | 121 | Freehand Drawing I | 2 | |
| Arch. | 141 | Prin. of Design | 4 | |
| Al. A | 131 | Hist. of Art | 3 | |
| Math. | 130 | Algebra | 3 | |
| Eng. | 131 | College Rhet. | 3 | |
| P. E., Band or Basic ROTC | | | | |
| Arch. | 122 | Freehand Drawing II | | 2 |
| Al. A. | 143 | Pict. Comp. | | 4 |
| Al. A. | 132 | Hist. of Art | | 3 |
| Math. | 131 | Trigonometry | | 3 |
| Eng. | 132 | College Rhet. | | 3 |
| P. E., Band or Basic ROTC | | | | |
| | | Total credit hours | 15* | 15* |

| SOPHOMORE YEAR | | | SEMESTER 1st. | 2nd. |
|---|---|---|---|---|
| Al. A. | 238 | Pottery | 3 | |
| Arch. | 125 | Arch. Graphics | 2 | |
| Arch. | 224 | Freehand Drawing III | 2 | |
| Al. A. | 233 | Intro. to Lettering | 3 | |
| Eng. | 231 | Mast. of Lit. | 3 | |
| Foreign Language | | | 3 | |
| P. E., Band or Basic ROTC | | | | |
| Al. A. | 239 | Pottery | | 3 |
| Arch. | 326 | Anat. & Life Drawing | | 2 |
| Arch. | 225 | Beginning Watercolor | | 2 |
| Al. A. | 220 | Adv. Office Prac. | | 2 |
| Foreign Language | | | | 3 |
| Journ. | 330 | Advtg. Typog. & Layout | | 3 |
| P. E., Band or Basic ROTC | | | | |
| | | Total credit hours | 16* | 15* |

| JUNIOR YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Arch. | 327 | Life Drawing I | 2 | |
| Al. A. | 3314 | Commercial Illus. | 3 | |
| Al. A. | 342 | Commercial Design I | 4 | |
| Al. A. | 328 | Adv. Lettering & Art Layout | 2 | |
| Foreign Language or | | Elective | 3 | |
| Spch. | 338 | Bus. & Prof. Speech | 3 | |
| Arch. | 423 | Life Drawing II | | 2 |
| Al. A. | 343 | Commercial Design I | | 4 |
| Al. A. | 4314 | Fashion Illus. | | 3 |
| Al. A. | 329 | Adv. Lettering & Art Layout | | 2 |
| Eng. | 232 | Mast. of Lit. or Foreign Language | | 3 |
| Phys. | 237 | Tech. of Photog. | | 3 |
| | | Total credit hours | 17 | 17 |

| SUMMER SESSION (Following Junior Year) | | | Term 1st | 2nd |
|---|---|---|---|---|
| Al. A. | 421 | Art Workshop | 2 | |
| Hist. | 3321 | Heritage of Amer. | 3 | |
| Al. A. | 421 | Art Workshop | | 2 |
| Hist. | 3322 | Heritage of Amer. | | 3 |
| | | Total credit hours | 5 | 5 |

| SENIOR YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Al. A. | 4212 | Commercial Illus. II | 2 | |
| Al. A. | 433 | Commercial Design II | 3 | |
| Al. A. | 4311 | Ceramics or | | |
| Al. A. | 3311 | Drawing, Painting & Design Theory | 3 | |
| Al. A. | 426 | Adv. Painting | 2 | |
| Al. A. | 4318 | Hist. Painting & Sculpture | 3 | |
| Govt. | 233 | Amer. Govt., Org. | 3 | |
| Al. A. | 4213 | Commercial Illus. II | | 2 |
| Al. A. | 434 | Commercial Design II | | 3 |
| Al. A. | 4312 | Ceramics or | | |
| Al. A. | 3312 | Drawing, Painting & Design Theory | | 3 |
| Al. A. | 427 | Adv. Painting | | 2 |
| Al. A. | 4319 | Hist. Painting & Sculpture | | 3 |
| Govt. | 234 | Amer. Govt., Func. | | 3 |
| | | Elective | | 3 |
| | | Total credit hours | 16 | 19 |

Minimum hours required for graduation — 140 and* P. E., Band or Basic ROTC

# ARCHITECTURE CURRICULUM

## Bachelor of Architecture

## Construction Option

| FRESHMAN YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Arch. | 121 | Freehand Drawing I | 2 | |
| Arch. | 141 | Prin. of Design | 4 | |
| Math. | 131 | Trigonometry | 3 | |
| Math. | 133 | Algebra | 3 | |
| Eng. | 131 | College Rhet. | 3 | |
| P. E., Band or Basic ROTC | | | | |
| Arch. | 122 | Freehand Drawing II | | 2 |
| Arch. | 142 | Prin. of Design | | 4 |
| Math. | 231 | Calculus | | 3 |
| Math. | 132 | Anal. Geom. | | 3 |
| Arch. | 125 | Arch. Graphics | | 2 |
| Eng. | 132 | College Rhet. | | 3 |
| P. E., Band or Basic ROTC | | | | |
| | | Total credit hours | 15* | 17* |

| SOPHOMORE YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Arch. | 231 | Arch. Design Grade I | 3 | |
| Arch. | 221 | Hist. of Ancient Arch. | 2 | |
| Math. | 232 | Calculus | 3 | |
| Phys. | 235 | Engr. Physics | 3 | |
| Phys. | 215 | Phys. Meas. | 1 | |
| Eng. | 231 | Mast. of Lit. | 3 | |
| P. E., Band or Basic ROTC | | | | |
| Arch. | 232 | Arch. Design Grade I | | 3 |
| Arch. | 222 | Hist. of Medieval Arch. | | 2 |
| Math. | 331 | Applic. of Calc. | | 3 |
| Phys. | 236 | Engr. Physics | | 3 |
| Phys. | 216 | Phys. Meas. | | 1 |
| Al. A. | 210 | Intro. to the Arts | | 1 |
| C. E. | 233 | Statics | | 3 |
| P. E., Band or Basic ROTC | | | | |
| | | Total credit hours | 15* | 16* |

| JUNIOR YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Arch. | 351 | Arch. Design, Grade II | 5 | |
| Arch. | 322 | Hist. of Renaissance Arch. | 2 | |
| Arch. | 226 | Mat. & Meth. of Const. | 2 | |
| C. E. | 320 | Structures | 2 | |
| C. E. | 332 | Kinematics & Kinetics | 3 | |
| Elective | | | 3 | |
| Arch. | 352 | Arch. Design, Grade II | | 5 |
| Arch. | 323 | Hist. of Modern Arch. | | 2 |
| Arch. | 227 | Mat. & Meth. of Const. | | 2 |
| C. E. | 330 | Structures | | 3 |
| C. E. | 333 | Strength of Mat. | | 3 |
| Spch. | 338 | Bus. & Prof. Speech | | 3 |
| | | Total credit hours | 17 | 18 |

| FOURTH YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Arch. | 451 | Arch. Design, Grade III | 5 | |
| Arch. | 333 | Arch. Working Drawing | 3 | |
| C. E. | 431 | Reinf. Concrete | 3 | |
| E. E. | 335 | Illumination | 3 | |
| Arch. | 324 | Mech. Equip. of Bldgs. | 2 | |
| C. E. | 231 | Plane Surveying | 3 | |
| Arch. | 452 | Arch. Design, Grade III | | 5 |
| Arch. | 334 | Arch. Working Drawing | | 3 |
| C. E. | 432 | Reinf. Concrete | | 3 |
| Arch. | 325 | Mech. Equip. of Bldgs. | | 2 |
| Elective | | | | 3 |
| | | Total credit hours | 19 | 16 |

| FIFTH YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Arch. | 420 | Prof. Practice | 2 | |
| Arch. | 435 | Adv. Arch. Work. Drawings | 3 | |
| C. E. | 433 | Structures | 3 | |
| C. E. | 424 | Materials | 2 | |
| Hist. | 3321 | Heritage of Amer. | 3 | |
| Govt. | 233 | Amer. Govt., Org. | 3 | |
| Arch. | 436 | City Planning | | 3 |
| C. E. | 434 | Structures | | 3 |
| C. E. | 425 | Materials | | 2 |
| C. E. | 4312 | Soil Mech. & Foun. | | 3 |
| Hist. | 3322 | Heritage of Amer. | | 3 |
| Govt. | 234 | Amer. Govt., Func. | | 3 |
| | | Total credit hours | 16 | 17 |

**Minimum hours required for graduation — 166 and* P. E., Band or Basic ROTC**

# ARCHITECTURE CURRICULUM

## Bachelor of Architecture

## Design Option

| FRESHMAN YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Arch. | 121 | Freehand Drawing I | 2 | |
| Arch. | 141 | Prin. of Design | 4 | |
| Math. | 131 | Trigonometry | 3 | |
| Math. | 133 | College Algebra | 3 | |
| Eng. | 131 | College Rhet. | 3 | |
| P. E., Band or Basic ROTC | | | | |
| Arch. | 122 | Freehand Drawing II | | 2 |
| Arch. | 142 | Prin. of Design | | 4 |
| Math. | 231 | Calculus or Elective | | 3 |
| Math. | 132 | Anal. Geom. | | 3 |
| Arch. | 125 | Arch. Graphics | | 2 |
| Eng. | 132 | College Rhet. | | 3 |
| P. E., Band or Basic ROTC | | | | |
| | | Total credit hours | 15* | 17* |

| SOPHOMORE YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Arch. | 231 | Arch. Design Grade I | 3 | |
| Arch. | 221 | Hist. of Ancient Arch. | 2 | |
| Arch. | 224 | Freehand Drawing III | 2 | |
| Arch. | 226 | Mat. & Meth. of Const. | 2 | |
| Phys. | 141 | Gen. Physics | 4 | |
| Hist. | 231 | Hist. U. S. to 1865 | 3 | |
| | | P. E., Band or Basic ROTC | | |
| Arch. | 232 | Arch. Design, Grade I | | 3 |
| Arch. | 222 | Hist. of Medieval Arch. | | 2 |
| Arch. | 225 | Beginning Watercolor | | 2 |
| Arch. | 227 | Mat. & Meth. of Const. | | 2 |
| Phys. | 142 | General Physics | | 4 |
| Hist. | 232 | Hist. U. S. since 1865 | | 3 |
| Al. A. | 210 | Intro. to the Arts | | 1 |
| P. E., Band or Basic ROTC | | | | |
| | | Total credit hours | 16* | 17* |

| JUNIOR YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Arch. | 351 | Arch. Design, Grade II | 5 | |
| Arch. | 326 | Anat. & Life Drawing | 2 | |
| Arch. | 322 | Hist. of Renaissance Arch. | 2 | |
| C. E. | 337 | Struc. Mech. | 3 | |
| Eng. | 231 | Mast. of Lit. or Foreign Language | 3 | |
| E. E. | 335 | Illumination | 3 | |
| Arch. | 352 | Arch. Design, Grade II | | 5 |
| Arch. | 327 | Life Drawing | | 2 |
| C. E. | 338 | Struc. Mech. | | 3 |
| Eng. | 232 | Mast. of Lit. or Foreign Language | | 3 |
| Spch. | 338 | Bus. & Prof. Speech | | 3 |
| | | Total credit hours | 18 | 16 |

| FOURTH YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Arch. | 451 | Arch. Design, Grade III | 5 | |
| Arch. | 321 | Hist. of Early Amer. Arch. | 2 | |
| Arch. | 333 | Arch. Working Drawings | 3 | |
| C. E. | 435 | Simple Theory Reinf. Conc. | 3 | |
| Eng. | 231 | Mast. of Lit. or Foreign Language | 3 | |
| Arch. | 324 | Mech. Equip. of Bldgs. | 2 | |
| Arch. | 452 | Arch. Design, Grade III | | 5 |
| Arch. | 323 | Hist. of Mod. Arch. | | 2 |
| Arch. | 334 | Arch. Working Drawings | | 3 |
| Eng. | 232 | Mast. of Lit. or Foreign Language | | 3 |
| Govt. | 233 | Amer. Govt., Org. | | 3 |
| Arch. | 325 | Mech. Equip. of Bldgs. | | 2 |
| | | Total credit hours | 18 | 18 |

| FIFTH YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Arch. | 463 | Arch. Design, Grade IV | 6 | |
| Arch. | 420 | Prof. Prac. | 2 | |
| Arch. | 4316 | Arch. Sculpture | 3 | |
| Arch. | 435 | Adv. Arch. Working Drawings | 3 | |
| C. E. | 231 | Plane Surveying | 3 | |
| Arch. | 484 | Arch. Design, Grade IV | | 8 |
| Arch. | 436 | City Planning | | 3 |
| Arch. | 4317 | Arch. Sculpture | | 3 |
| Govt. | 234 | Amer. Govt., Func. | | 3 |
| | | Total credit hours | 17 | 17 |

*Nolan Ellmore Barrick, Professor of Architecture and Head of the Department.*

# Department of ARCHITECTURE AND ALLIED ARTS

Professors:
Mr. Barrick, Mr. Bradshaw, Mr. Kleinschmidt, Mr. Lockard, Mr. MacCollin
Associate Professors:
Mr. Duran, Miss Houghton, Mrs. Sasser
Assistant Professors:
Mr. Clark, Mr. Parkinson, Mr. Tracy
Instructors:
Mr. Farrell, Mrs. Farrell (Part-time), Mr. Howze, Mr. Mgebroff, Mr. Felty (Part-time), Mrs. MacCollin (Part-time), Mr. Roberts (Part-time)

The Department of Architecture and Allied Arts is a member of the Association of the Collegiate Schools of Architecture. It is affiliated with the National Institute for Architectural Education, the American Federation of Art, the College Art Association, and it holds valuable teaching aids provided by the Carnegie Foundation.

Curricula open to both men and women lead to:

(1) Bachelor of Architecture, a five-year curriculum for the Design Option or a five-year curriculum for the Construction Option.

(2) Bachelor of Advertising Art and Design, a four-year curriculum.

The five-year program for majors in architecture is a gradual, orderly and integrated development toward apprenticeship and into professional practice. Opportunities in many branches of the building industry are open to graduates having the background of architecture. Standards upheld by the various state registration boards are met, and a degree is the logical step toward apprenticeship and a license to practice architecture.

The primary objective is the creative development of the student as an individual through enlarging his capacities for principled and disciplined thought.

The degree may be obtained through the design option or the construction option. The first-year work is the same in both options so that a student may be given ample opportunity to appraise the two avenues of study. In the design curriculum, emphasis is placed on general requirements which are fundamental to a comprehensive understanding of the many aspects of the profession. The role of an architect as a coordinator is promoted. Basic work in the scientific fields is required and at the same time there is more drawing and design, with the aesthetic approach stressed. In the construction curriculum, considerable attention is given to artistic ideals, but mainly the factors of safety and economy in building are made significent. This course includes more advanced mathematics and required specialization in structural engineering.

The four-year program for majors in advertising art and design is carefully arranged to give a suitable balance of theories, backgrounds, sources, and skills to students who plan to enter any of the diversified branches of the profession. An excellent preparation is given to those entering specialized fields. Students seeking creative training in drawing and painting, sculpture and ceramics, and art history will find the courses especially designed to give freedom of expression and to promote creative development.

Students who wish to work toward a Bachelor of Arts degree with a major in art should consult with the Head of the Department and arrange for a degree plan.

Insofar as possible the design work in the department is taught by the program-competition method in which the students compete with each other in the solving of a wide variety of theoretical and practical problems. Individual development is encouraged by advice and criticism on a faculty-to-student personal conference level.

The problem-solving process, which is the essence of adequate education in the creative arts, is brought into play at every opportunity. Students are stimulated to recognize needs, to express them in terms of programs upon which analysis and research may be applied to reach creative solutions. A comprehensive collection of books, photographs, prints, projection slides, and art objects is available within the department for research in the allied art fields.

Architectural majors are urged to spend their summer months in an office of a registered architect. A student may receive credit for the laboratory period in Architecture 333 and in Architecture 435 upon presentation to the Department Head of satisfactory evidence of three months of summer work for each course in working drawings and details in a registered architect's office.

The department reserves the right to retain, exhibit, and repro-

# Courses in Architecture

A key to the meaning of course numbers, symbols, abbreviations, etc., appears on Page 4.

### For Undergraduates

**121-122. Freehand Drawing I, II. (2:0:6 each)**
Representational drawing in charcoal emphasizing fundamental skills. Alternating problems stressing creative interpretation. Culminating work introducing color with pastels.

**125. Architectural Graphics. (2:0:6)**
Theory of perspective and architectural shades and shadows. Exercises involving application of principles of descriptive geometry to common geometrical solids and architectural forms.

**141-142. Principles of Design. (4:1:9 each)**
Study of the basic principles of design with emphasis on three-dimensional non-objective problems. Exercises in drafting, lettering and rendering in several media.

**221. History of Ancient Architecture. (2:2:0)**
A study of the architectural contributions of ancient Egypt. Mesopotamia, Persia, Greece, and Rome to the cultural heritage of western civilization. Illustrated lectures.

**222. History of Medieval Architecture. (2:2:0)**
Prerequisite: Arch. 221. A study of Early Christian, Byzantine, Romanesque, and Gothic styles, and their relation to the development of Western culture. Illustrated lectures.

**224. Freehand Drawing III. (2:0:6)**
Prerequisite: Arch. 121-122. Pencil, pen and ink rendering and sketching from life and nature.

**225. Beginning Watercolor. (2:0:6)**
Prerequisite: Arch. 224. Beginning course in watercolor painting from life and from nature.

**226. Materials and Methods of Construction. (2:2:0)**
Prerequisite: Registration in Arch. 231. Introduction to properties, specifications and uses of architectural materials.

**227. Materials and Methods of Construction. (2:2:0)**
Continuation of Arch. 226 with emphasis on analysis of structural systems related to architecture.

**231-232. Architectural Design Grade I. (3:0:9 each)**
Prerequisite: Arch. 125, 141-142. 9-hour to 45-hour problems under individual criticism dealing with elements of plan and evaluation. Introduction to the project-completing method of study. 9-hour sketch problems emphasizing composition and presentation.

**324-325. Mechanical Equipment of Buildings. (2:2:0 each)**
Prerequisite: Arch 227 and 232. Heating and air conditioning requirements and systems for buildings.

**326. Anatomy and Life Drawing. (2:0:6)**
Prerequisite: Arch. 224. Study of anatomical structure. Drawing from life. $5 model fee.

**327. Life Drawing I. (2:0:6)**
Prerequisite: Arch 326. Drawing from life in a variety of media and approaches with emphasis upon aesthetic factors. Instruction by individual criticism. $5 model fee.

**333-334. Architectural Working Drawing. (3:1:6 each)**
Prerequisite: Arch. 352. Preparation of working drawings and specifications for small residences or commercial buildings; drawing complete details for construction including heating, plumbing, and electrical services. Occasional visits to building under construction.

**351-352. Architectural Design, Grade II. (5:0:15 each)**
Prerequisite: Arch. 231-232. 15-hour to 75-hour problems under individual criticism dealing with small building types. The project-completion method of study is used. 9-hour sketch problems dealing with details of architecture and with larger architectural compositions.

**451-452. Architectural Design, Grade III. (5:0:15 each)**
Prerequisite: Arch. 351-352. 15 to 90-hour problems under individual criticism dealing with more comprehensive building types and groups of buildings. 9-hour sketches are offered to test creative ability and expression in a limited amount of time.

**463. Architectural Design, Grade IV. (6:0:18)**
Prerequisite: Arch. 451-452. 24 to 120-hour problems under individual criticism dealing with large compositions which include groups of buildings, site planning and studies of circulation, etc. 9-hour sketches are also given.

**484. Architectural Design, Grade IV. (8:0:24)**
Prerequisite: Arch. 463. Continuation of Arch. 463 with one final "thesis" problem selected and programmed by the individual student.

### For Undergraduates and Graduates

**320. History of Furniture and Costume. (2:2:0)**
Prerequisite: Arch. 323. A study of furniture and costume from prehistoric times to the present emphasizing trends relative to man's social history and changing needs. Illustrated lectures.

**321. History of Early American Architecture. (2:2:0)**
Prerequisite: Arch. 322. The American architectural heritage. Pre-Columbian, southwesten colonial, regional styles of the eastern seaboard, Western Reserve, and Greek Revival. Illustrated lectures.

**322. History of Renaissance Architecture. (2:2:0)**
Prerequisite: Arch. 222. A study of the Renaissance architecture of Europe emphasizing the development of styles essential to an understanding of the background of Early American and modern architectural growth. Illustrated lectures.

**323. History of Modern Architecture. (2:2:0)**
Prerequisite: Arch. 322. A study of the cultural and social influences as they determine the development of contemporary architecture in Europe and the Americas. Illustrated lectures.

**420. Professional Practice. (2:2:0)**
Prerequisite: Junior standing. Office organization, ethics, professional relations for architects.

**423-424. Life Drawing II, III. (2:0:6 each)**
Prerequisite: Arch. 327. Continuation of Arch. 327. $5 model fee each.

**4316-4317. Architectural Sculpture. (3:1:6 each)**
Prerequisite: Arch. 224. Clay modeling. Study

of the historic development of sculptural techniques. Architectonic studies in clay and other media. Plaster-mold making, glazing, and firing. Fee for ceramics materials, $5 each.

**435. Advanced Architectural Working Drawings. (3:1:6)**
A continuation of Arch. 333-334. Preparation of working drawings and specifications to comply with building and zoning codes for superior fire-resistant buildings; analyzing and integrating structural system details with architectural design details.

**436. City Planning. (3:1:6)**
Prerequisite: Arch. 435 and registration in Arch. 452. The theory and problems of city development, community planning, housing, and their drawn and rendered solutions under individual criticism.

Many courses in architecture and allied arts, especially those in city planning, history of architecture, and history of painting and sculpture, are available for electives to students majoring in education, history, music, government, landscape architecture, etc. Consent of the instructor may be secured in lieu of the professional prerequisites listed.

## Advertising Art and Design

Allied arts courses which are combined with courses in architecture form the basis for the advertising art and design curriculum. The training and background of several departmental faculty members makes it possible to offer courses that are available to students pursuing training in public school art fields both on the undergraduate and graduate levels.

## Allied Arts Courses in Advertising Art and Design

A key to the meaning of course numbers, symbols, abbreviations, etc., appears on Page 4.

**For Undergraduates**

**131-132. History of Art. (3:3:0 each)**
A survey of architecture, sculpture, painting, and the minor arts from prehistoric times to the present. Emphasis is placed upon the arts as they reveal the visual aspects of man's social, political, and cultural growth. Illustrated lectures. Open to all students except those majoring in architecture, design option and construction option.

**143. Pictorial Composition. (4:1:9)**
Prerequisite: Arch. 141. Theory of space design with emphasis on line and area composition.

**210, 211. Introduction to the Arts. (1:1:0 each**
Prerequisite: English 132. Guided discussions of the arts through a study of current art exhibitions on the campus and investigations of critical reviews in contemporary publications.

**220. Advertising Office Practice. (2:2:0)**
Prerequisite: Al.A. 143. Office organization, ethics, professional relations in the advertising field.

**233. Introduction to Lettering. (3:1:6)**
Prerequisite: Al.A 143. Instruction in general commercial lettering, styles, and practices. Introduction to layout and lettering for reproduction.

**238-239. Pottery. (3:1:6 each)**
Prerequisite: Arch. 141-142. Al.A. 143, or consent of instructor. All hand and simple commercial methods of pottery production. Decorating, glazing and firing of ware. For ceramic materials, fee $5 each.

**328-329. Advanced Lettering and Art Layout. (2:0:6 each)**
Prerequisite: Al.A. 233. Advanced commercial lettering and art layout as applied to newspaper, magazines, etc.

**3311-3312. Principles of Drawing and Painting, and Theory of Design. (3:1:6 each)**
Prerequisite: Arch. 225. Al.A. 3314. Advanced analysis of principles governing good drawing and painting throughout the ages. Lectures illustrated. Laboratory work in line drawing and color.

**3314. Commercial Illustration I. (3:0:9)**
Prerequisite: Arch. 224, A.A. 233 and Arch 125 Illustration applicable to advertising and commercial fields. Drawing and painting in various media for designated processes of reproduction. Analysis of advertising value of drawings and force of design on subject matter. Problems in design of booklets, posters, and illustrations.

**342-343. Commercial Design I. (4:1:9 each)**
Prerequisite: Al.A. 233, Arch. 225 and Arch. 125. Structural representation of originally designed commercial products emphasizing effective techniques of rendering in a variety of media.

**426-427. Advanced Painting. (2:0:6 each)**
Prerequisite: Arch. 225. Principles of design related to various types of composition in conjunction with direct study from the human model, still life, or landscape. Problems in oil or water color may take the form of book illustration, painting or mural decoration. $5 model fee each.

**4212-4213. Commercial Illustration II. (2:0:6 each)**
Prerequisite: Al.A. 3314. A continuation of Al.A. 3314, with problems in presentation and studio practice; specialization in illustration with completion of full scale work.

**4314. Fashion Illustration. (3:0:9)**
Prerequisite: Arch. 327, Al.A. 3314. The drawing and design of the costumed figure for newspaper and magazine fashion illustration.

**For Undergraduates and Graduates**

**421. Art Workshop. (2:0:6)**
For those who wish a refresher course in drawing, painting, pottery, sculpture, ceramics or other graphic media. Instruction on individual project basis. Course may be repeated four (4) times for credit. $5 material fee if taken in ceramics or pottery.

**433-434. Commercial Design II. (3:0:9)**
Continuation of Al.A. 342-343. Problems involving extended research and group product development. Construction of scale models or execution of the finished product where feasible.

**4311-4312. Ceramics. (3:0:9 each)**
Prerequisite: Al.A. 238-239. Advanced pottery design and production. Glaze calculation and clay body construction. Research. Ceramics materials fee, $5 each.

**4318-4319. History of Painting and Sculpture. (3:3:0 each)**
Prerequisite: Junior classification. Illustrated lectures in the development of painting and sculpture from the Egyptian period to the present day. Three hours of library reserach per week.

**4351. Art in Elementary Education. (3:1:6)**
Prerequisite: 12 semester hours of allied arts or equivalent, or two years' art teaching experience plus 6 hours of child psychology. Enrollment limited to graduate students in elementary education. A course in drawing and painting, composition, and color designed primarily for those who have had at least two years of teaching art in public schools.

**For Graduates**

**5335. Art in the Modern World. (3:3:0)**
Prerequisite: Graduate standing. A survey and development of influences upon art forces in the modern world.

# CHEMICAL ENGINEERING CURRICULUM

## Bachelor of Science in Chemical Engineering

| FRESHMAN YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Math. | 131 | Trigonometry | | 3 | |
| Math. | 133 | College Alg. | | 3 | |
| Eng. | 131 | College Rhet. | | 3 | |
| Chem. | 141 | Gen. Chem. | | 4 | |
| E. Dr. | 131 | Engr. Drawing | | 3 | |
| P. E., Band, or Basic ROTC | | | | | |
| Math. | 132 | Anal. Geom. | | | 3 |
| Math. | 231 | Calculus | | | 3 |
| Eng. | 132 | College Rhet. | | | 3 |
| Chem. | 142 | Gen. Chem. | | | 4 |
| E. Dr. | 132 | Descr. Geom. | | | 3 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 16* | 16* |

| SOPHOMORE YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Math. | 232 | Calculus | | 3 | |
| Phys. | 235 | Engr. Physics | | 3 | |
| Phys. | 215 | Phys. Meas. | | 1 | |
| Chem. | 231 | Qual. Anal. | | 3 | |
| Chem. | 345 | Quan. Anal. | | 4 | |
| Govt. | 233 | Amer. Govt., Org. | | 3 | |
| P. E., Band, or Basic ROTC | | | | | |
| Math. | 332 | Diff. Equat. | | | 3 |
| Phys. | 236 | Engr. Physics | | | 3 |
| Phys. | 216 | Phys. Meas. | | | 1 |
| Ch. E. | 244 | Intro. to Chem. Engr. | | | 4 |
| Govt. | 234 | Amer. Govt., Func. | | | 3 |
| Eng. | 233 | Tech. Writing | | | 3 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 17* | 17* |

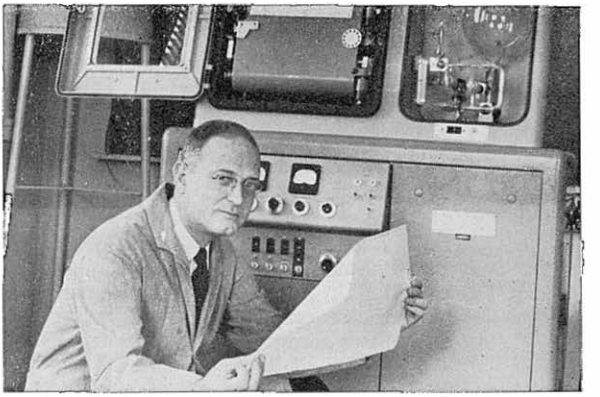
**SUMMER SESSION**

| FIRST TERM | | | | SECOND TERM | | | |
|---|---|---|---|---|---|---|---|
| Ch. E. | 237 | Engr. Materials | 3 | C. E. | 333 | Strength of Materials | 3 |
| C. E. | 233 | Statics | 3 | | | Total credit hours | 3 |
| | | Total credit hours | 6 | | | | |

| JUNIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Chem. | 353 | Org. Chem. | | 5 | |
| Chem. | 441 | Phys. Chem. I | | 4 | |
| Ch. E. | 331 | Prin. of Chem. Engr. I | | 3 | |
| E. Sem. | 412 | Engr. Seminar | | 1 | |
| E. E. | 328 | Elem. of Elec. Engr. | | 2 | |
| E. E. | 318 | Elec. Engr. Lab. | | 1 | |
| Chem. | 354 | Org. Chem. | | | 5 |
| Chem. | 442 | Phys. Chem. II | | | 4 |
| Ch. E. | 332 | Prin. of Chem. Engr. II | | | 3 |
| E. Sem. | 412 | Engr. Seminar | | | 1 |
| E. E. | 329 | Elem. of Elec. Engr. | | | 2 |
| E. E. | 319 | Elec. Engr. Lab. | | | 1 |
| | | Total credit hours | | 16 | 16 |

| SENIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Ch. E. | 431 | Unit Processes | | 3 | |
| Ch. E. | 437 | Prin. of Chem. Engr. III | | 3 | |
| Ch. E. | 435 | Instrumentation | | 3 | |
| Ch. E. | 425 | Unit Oper. Lab. | | 2 | |
| Ch. E. | 433 | Chem. Engr. Thermodyn. | | 3 | |
| Hist. | 3321 | Heritage of Amer. | | 3 | |
| Ch. E. | 430 | Process Development | | | 3 |
| Ch. E. | 432 | Chem. Engr. Plant Design | | | 3 |
| Ch. E. | 426 | Unit Oper. Lab | | | 2 |
| Ch. E. | 434 | Chem. Engr. Thermodyn. | | | 3 |
| Hist. | 3322 | Heritage of America | | | 3 |
| Elective | | | | | 3 |
| | | Total credit hours | | 17 | 17 |

Minimum hours required for graduation — 141 and* P. E., Band, or Basic ROTC



*Joe Dennis, Professor of Chemistry and Head of the Department of Chemical Engineering and Chemistry*

# Department of CHEMICAL ENGINEERING

Professors:
Mr. Dennis, Mr. Bradford, Mr. Oberg
Associate Professor:
Mr. Renard
Instructor:
Mr. Groves
Teaching Fellows:
Mr. Duenkel, Mr. Hannah, Mr. Lewis

Chemical engineering is that branch of engineering concerned with the manufacturing processes in which physical and chemical changes are involved. The work of the chemical engineer has to do with the design, construction, and operation of the equipment in process plants. Included in this category are such widely different industries as petroleum, cement, plastic, metal production, food products, and nuclear energy. The college training which a student receives is directed towards preparing him for beginning professional work immediately after graduation.

The undergraduate curriculum in chemical engineering follows the pattern which is used by most of the engineering schools of the nation. The first two years include the fundamentals which are basic to all types of engineering. Included also are courses in inorganic and analytical chemistry. The first course in principles of chemical engineering is taken at the end of the sophomore year.

The last two years of the curriculum place emphasis on the application of the unit operations, the unit processes, thermodynamics, and instrumentation to industrial processes. Included also are the courses in organic and physical chemistry.

The laboratories include those for the unit operations, the unit processes, process control instrumentation, fuels and combustion, nuclear processes and research. The equipment is of pilot plant size but large enough to obtain results comparable to those met with in industry.

The occupational functions of chemical engineers are as follows: research and development, production, design, technical service, testing and process control, teaching, sales, technical writing, management, etc.

Each year a major plant inspection trip is arranged to supplement the advanced course work. Each student as a junior or senior is required to participate in this trip.

It is highly desirable that a chemical engineering student's accomplishment be of the best quality. Grades of D will not be accepted in more than 20 per cent of the hours counted in the major, and only one D will be accepted in a course which requires two semesters to complete.

## Courses in Chemical Engineering

A key to the meaning of course numbers, symbols and abbreviations, etc., appears on Page 4.

**For Undergraduates**

**237. Engineering Materials. (3:3:0)**
Prerequisite: Sophomore standing. A course on the physical and chemical properties of engineering materials, production of iron and steel, nonferrous alloys, protective coatings, insulating materials, and corrosion.

**244. Introduction to Chemical Engineering. (4:3:3)**
Prerequisite: Sophomore standing. An introduction to the equipment and calculations of chemical engineering. The problems involve material and energy balances. The laboratory includes elementary engineering measurements, and testing of fuels, lubricants and water.

**331-332. Principles of Chemical Engineering I-II. (3:3:0 each)**
Prerequisite: Ch.E. 244 and calculus. Prerequisite or parallel: Chem. 441-442. Principles of the basic unit operations of chemical engineering, such as flow of fluids, heat transfer, etc.

**For Undergraduates and Graduates**

**425-426. Unit Operations Laboratory. (2:0:6 each)**
Prerequisite: Ch.E. 331-332. Laboratory experiments on the unit operations of chemical engineering with written reports.

**430. Chemical Engineering Plant Design. (3:1:6)**
Prerequisite: Ch.E. 437 and parallel registration in Ch.E. 432. Development of a plant process from the pilot plant stage to the industrial size unit.

**431. Unit Processes. (3:3:0)**
Prerequisite: Chem. 353-354, Ch.E. 331-332. A study of the more important chemical industries from the point of view of the unit processes and unit operations involved.

**432. Process Development. (3:3:0)**
Prerequisite: Ch.E. 431. This course must be taken before or parallel with Ch.E. 430. A problem course on the application of fundamental principles in the process calculations and design of pilot plants.

**433-434. Chemical Engineering Thermodynamics. (3:3:0 each)**
Prerequisite: Ch.E. 331-332. A problem course in chemical process calculations and thermodynamics.

**435. Instrumentation. (3:2:3)**
Prerequisite: Ch.E. 331-332. A study of the characteristics of industrial instruments, and their manner of use in controlling process variables.

**437. Principles of Chemical Engineering III. (3:3:0)**
Prerequisite or parallel: Ch.E. 331-332. Theory and problems on selected unit operations.

**439. Nuclear Engineering. (3:3:0)**
Prerequisite: Thermodynamics or its equivalent. A survey of the basic principles applicable to engineering problems of the atomic energy field.

## Graduate Chemical Engineering

General requirements and more detailed information may be found in the Graduate Bulletin.

The graduate program of the Department of Chemical Engineering encompasses a wide range of subject material. Special work in extraction, absorption and distillation may be chosen by those interested in the petroleum and petrochemical industry. Course work in nuclear technology, nuclear chemical engineering, and

radio-chemistry is available for graduate students preparing for the new and expanding field of atomic energy.

## GRADUATE COURSE DESCRIPTIONS

**5293-5294. Nuclear Reactor Laboratory. (2:0:6 each)**
Prerequisite: Simultaneous registration in Ch. E. 5393-5394. An introduction to the use and general characteristics of the nuclear reactor and its instrumentation. The reactor facility consists of a highly enriched assembly of uranium with water moderation and water cooling, operating up to a 10 kw. level.

**531. Advanced Chemical Engineering Thermodynamics. (3:3:0)**
Prerequisite: Ch.E. 433-434 and Ch.E. 437 or equivalent. Advanced topics in applied thermodynamics, including phase equilibria, fluid flow, etc.

**532. Chemical Engineering Design. (3:1:6)**
Prerequisite: Ch.E. 430, Ch.E. 431-432, and Ch.E. 437 or equivalent. The design of the complete plant. Plant location, equipment design or selection, plant layout, building requirements, and estimation of the cost of the plant are included.

**533. Organic Unit Processes. (3:3:0)**
Prerequisite: Chem. 353-354. A detailed study of the major organic unit processes. Equipment, reaction theory, and the unitary aspects of each organic unit process are considered.

**534. Absorption and Extraction. (3:3:0)**
Prerequisite: Ch.E. 433-434 and Ch.E. 437 or equivalent. Theory of absorption and extraction with emphasis on design of equipment and operational problems.

**535. Heat Transfer. (3:3:0)**
Prerequisite: Ch.E. 433-434 and Ch.E. 437 or equivalent. Fundamentals of heat transmission with emphasis on the design of heat transfer equipment.

**536. Distillation. (3:3:0)**
Prerequisite: Ch.E. 433-434 and Ch. E. 437 or equivalent. Theory of distillation with special emphasis on multicomponent distillation and application of theory to problems of design.

**5391-5392. Nuclear Chemical Engineering. (3:3:0 each.)**
Prerequisite: Graduate standing in engineering, chemistry, physics, or mathematics and preferably Ch.E. 439. A graduate course in nuclear reactions, reactor fuel cycles, production of nuclear feed materials, properties of irradiated fuels, and separations processes.

**5393-5394. Principles of Nuclear Reactor Engineering. (3:3:0 each)**
Prerequisites: Graduate standing in Engineering, Mathematics, or the Physical Sciences, and preferably simultaneous registration in Ch. E. 5293-5294. This course is the basis for all other course work in the nuclear field.

**5395-5396 Reactor Shielding. (3:3:0 each)**
Prerequisite: Graduate standing in Engineering, Mathematics, or the Physical Sciences. A detailed study of the data and techniques which are available for the design of a practical shield.

**5397-5398. Nuclear Radiations Laboratory. (3:2:6 each)**
Prerequisite: Graduate standing in Engineering, Mathematics, or the Physical Sciences. A course to acquaint the student with the instruments and techniques used directly or indirectly in the nuclear field. The laboratory is equipped with a water uranium-moderated subcritical reactor. The student will be allowed to a limited extent to carry out research problems as the course develops.

**631-632. Master's Thesis. (6)**

# CIVIL ENGINEERING CURRICULUM

## Bachelor of Science in Civil Engineering

| FRESHMAN YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Math. | 131 | Trigonometry | | 3 | |
| Math. | 133 | College Alg. | | 3 | |
| Eng. | 131 | College Rhet. | | 3 | |
| Chem. | 141 | Gen. Chem. | | 4 | |
| E. Dr. | 131 | Eng. Drawing | | 3 | |
| P. E., Band, or Basic ROTC | | | | | |
| Math. | 132 | Anal. Geom. | | | 3 |
| Math. | 231 | Calculus | | | 3 |
| Eng. | 132 | College Rhet. | | | 3 |
| Chem. | 142 | Gen. Chem. | | | 4 |
| E. Dr. | 132 | Descr. Geom. | | | 3 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 16* | 16* |

| SOPHOMORE YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| C. E. | 231 | Plane Surveying | | 3 | |
| Math. | 232 | Calculus | | 3 | |
| Phys. | 235 | Engr. Physics | | 3 | |
| Phys. | 215 | Phys. Meas. | | 1 | |
| Geol. | 143 | Phys. Geol. | | 4 | |
| Govt. | 233 | Amer. Govt., Org. | | 3 | |
| P. E., Band, or Basic ROTC | | | | | |
| C. E. | 232 | Route Surveying | | | 3 |
| Math | 331 | Applic. of Calc. | | | 3 |
| Phys. | 236 | Engr. Physics | | | 3 |
| Phys. | 216 | Phys. Meas. | | | 1 |
| C. E. | 233 | Statics | | | 3 |
| Govt. | 234 | Amer. Govt. Func. | | | 3 |
| P. E., Band or Basic ROTC | | | | | |
| | | Total credit hours | | 17 | 16* |

**SUMMER SESSION**

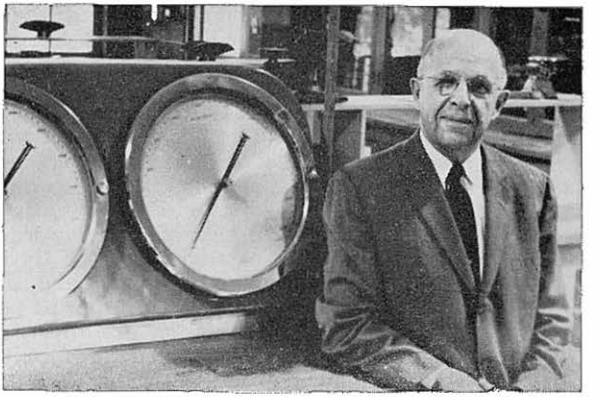
| | | | FIRST TERM | SECOND TERM |
|---|---|---|---|---|
| C. E. | 332 | Kinematics and Kinetics | 3 | |
| Sophomore English | | | 3 | |
| C. E. | 333 | Strength of Materials | | 3 |
| C. E. | 339 | Fluid Mechanics | | 3 |
| | | Total credit hours | 6 | 6 |

| JUNIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| C. E. | 320 | Structures | | 2 | |
| C. E. | 321 | Munic. San. | | 2 | |
| C. E. | 322 | Highway Engr. | | 2 | |
| C. E. | 312 | Fluid Mech. Lab. | | 1 | |
| C. E. | 313 | San. Lab. | | 1 | |
| M. E. | 330 | Engr. Thermo. | | 3 | |
| E. E. | 328 | Elem. of Elec. Engr | | 2 | |
| E. E. | 318 | Elec. Engr. Lab. | | 1 | |
| Hist. | 3321 | Heritage of Amer. | | 3 | |
| Elective | | | | | |
| C. E. | 330 | Structures | | | 3 |
| C. E. | 4312 | Soil Mech. and Foun. | | | 3 |
| C. E. | 311 | Highway Lab. | | | 1 |
| E. E. | 329 | Elements of Elec. Engr. | | | 2 |
| E. E. | 319 | Elec. Engr. Lab. | | | 1 |
| Hist. | 3322 | Heritage of Amer. | | | 3 |
| Elective | | | | | 3 |
| | | Total credit hours | | 17 | 16 |

| SENIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| C. E. | 424 | Materials | | 2 | |
| C. E. | 431 | Reinf. Concrete | | 3 | |
| C. E. | 433 | Structures | | 3 | |
| Elective | | | | 7 | |
| C. E. | 425 | Materials | | | 2 |
| C. E. | 335 | Highway Engr. | | | 3 |
| C. E. | 439 | Law and Ethics in Engr. | | | 3 |
| Elective | | | | | 7 |
| | | Total credit hours | | 15 | 15 |

A minimum of eight credit hours of electives must be selected from the following: C.E. 423, C.E. 432, C.E. 434, C.E. 437, C.E. 438, C.E. 4313, C.E. 4314, C.E. 4315, C.E. 4316.
Six credit hours of material chosen from this list or other courses. but subject to the approval of the department head, may also be used to fulfill the elective requirements.

Minimum hours required for graduation — 140 and* P. E., Band, or Basic ROTC



*James Harold Murdough, Professor of Civil Engineering and Head of the Department*

# Department of CIVIL ENGINEERING

Professors:
Mr. Murdough, Mr. Adams, Mr. Decker, Mr. Whetstone
Associate Professors:
Mr. Keho, Mr. Sanger
Assistant Professors:
Mr.Marmion, Mr. Parrish, (Part-time), Mr. Reid, Mr. Stanovsky
Instructors:
Mr. Aldrich, Mr. Foreman, *Mr. Kiesling, Mr. LeFevre, Mr. McDonald, *Mr. Rowan, Mr. Schnerr

*On leave 1958-1959

The movement of men and materials, involving the construction of roads, bridges, harbors, and docks, was for many years a military and naval enterprise. When the principles of engineering were adapted to the civil population, the name civil engineering, as distinguished from military engineering, came into use. The adaptation of steam power, electrical energy and other sources of power to man's use gave rise to the terms mechanical engineering, electrical engineering and the like. Civil engineering is perhaps the parent stem from which other branches have sprung.

Today, civil engineering has many diversifications, although most of the work of the civil engineer can be included among the following specialties:

**Structures** — the design and construction of bridges, buildings and foundations, and other structures such as airplanes, tanks.
**Highways** — the planning, construction and maintenance of highways, roads and streets, and pavements such as airfields.
**Sanitary Engineering** — the planning, construction and operation of water supplies and of sewage plants, and many municipal facilities.

The fundamental disciplines inherent in the study of mathematics, physics, English, and other basic courses required, as well as in the more special engineering courses, make the pursuit of

a standard curriculum in civil engineering worthwhile to anyone who is adapted to or interested in the general field of engineering.

The courses offered by the Department of Civil Engineering fall into two classes: service courses, such as surveying, applied mechanics, and fluid mechanics, which are required in many engineering curricula; and courses which serve students majoring in civil engineering, and in closely allied fields.

The curriculum in civil engineering leading to the bachelor's degree follows the pattern developed through usage by engineering colleges throughout the nation, and is designed to develop the basic fundamentals of engineering as particularly applied to civil engineering. Opportunities are offered for some specialization in highway engineering, in structures, or in sanitary engineering, or in hydraulic engineering.

As in other fields of engineering, the advances in knowledge and the demands for technical information developing in such specialties as soil mechanics, stress analysis, and structural design, hydrology, and sanitation, make it profitable for the young man entering the practice of civil engineering to consider seriously the pursuit of studies beyond the bachelor's degree.

## Courses in Civil Engineering

A key to the meaning of course numbers, symbols and abbreviations, etc., appears on Page 4.

**For Undergraduates**

**231. Plane Surveying. (3:2:3)**
Prerequisite: Math. 131. The uses and adjustment of surveying instruments; differential and profile leveling; cross sections; stadia; open and closed traverses; simple and vertical curves; land area calculations: land subdivision.

**232. Route Surveying. (3:2:3)**
Prerequisite: C.E. 231. Route location; mathematics of compound, spiraled, and vertical curves; field astronomy; earthwork calculations; mass diagram.

**233. Applied Mechanics. Statics. (3:3:0)**
Prerequisite: Math. 232. Resultants of coplanar and non-coplanar force systems; equilibrium of force systems, friction, centroids, moments of inertia.

**311. Highway Laboratory. (1:0:3)**
Prerequisite: Junior engineering standing. Standard tests of road building materials.

**312. Fluid Mechanics Laboratory. (1:0:3)**
Prerequisite: Registration in C.E. 339.

**313. Sanitation Laboratory. (1:0:3)**
Prerequisite: Registration in C.E. 321. Bacteriology and microscopy of public water supplies and sewage.

**320. Structures. (2:2:2)**
Prerequisite: C.E. 233. Graphic statics; shear, moment, and stresses in framed structures by graphical and analytical methods.

**322. Highway Engineering. (2:1:0)**
Prerequisite: C.E. 335. Rigid type pavement design. Traffic control; highway administration and finance.

**330. Structures. (3:3:0)**
Prerequisite: C.E. 320 and registration in C.E. 333. Moment and shear curves; influence lines, stresses in framed structures; moving loads systems; beam design; column design.

**332. Applied Mechanics—Kinematics and Kinetics. (3:3:0)**
Prerequisite: C.E. 233. Motion of the particle and of rigid bodies; kinetics of translation, rotation, and plane motion; work, energy, impulse, momentum.

**333. Applied Mechanics—Strength of Materials. (3:3:0)**
Prerequisite: C.E. 233. Stresses and strains in elastic bodies subject to tension, compression, and shear; bending and torsion; deflection in homogeneous beams; column theory, combined stresses.

**335. Highway Engineering. (3:3:0 each)**
Prerequisite: C.E. 231. Fundamentals of highway location, design, construction, and maintenance. Traffic control and traffic regulations. History and development of transportation. Highway administration and finance.

**337-338. Structural Mechanics. (3:3:0 each)**
Prerequisite: Math. 131. Statics, strength of materials , and structural design. For students of architecture, design option, and others who desire a brief and general presentation of the material.

**339. Fluid Mechanics. (3:3:0)**
Prerequisite: C.E. 233. Dynamics of viscous and non-viscous fluids, impulse and momentum, pipe flow, fluid resistance.

**435. Simple Theory of Reinforced Concrete. (3:3:0)**
Prerequisite: C.E. 337 and 338. For architect-design option majors and others whose preparation to enter C.E. 431 is inadequate. May not be used in lieu of C.E. 431 to fulfill requirements.

**For Undergraduates and Graduates**

**321. Municipal Sanitation. (2:2:0)**
Prerequisite: Junior standing or approval of Head of Department. General principles of sanitation as applied to the community, including water supply sewerage, refuse disposal, rodent and pest control, food and milk sanitation, housing, lighting, ventilation, and swimming pools.

**423. Economics of Highway Design. (2:0:6)**
Prerequisite: C.E. 335. Traffic engineering and control, intersection design, parking lots, cost-benefit ratio studies.

**424. Materials. (2:1:3)**
Prerequisite: Junior engineering standing. The properties and tests of materials of engineering, with special reference to concrete materials.

**425. Materials. (2:1:3)**
Prerequisite: C.E. 333. The properties and tests of materials of engineering with special reference to wood and steel.

**431. Reinforced Concrete. (3:3:0)**
Prerequisite: C.E. 333. Study and application of the theory of reinforced concrete design. Topics considered are beams, columns, columns with symmetrical bending, spread and combined footings, retaining walls. The accepted elastic theory as modified is followed.

**432. Reinforced Concrete. (3:3:0)**
Prerequisite: C.E. 431. Continuation of C.E. 431. Topics considered are design of types of floor systems: beam and girder, tile and joist, two-way flat slab, edge-supported flat slab. Brief presentation of pre-stressed concrete theory and theory of plastic design are given.

**433. Structures. (3:2:6)**
Prerequisite:C.E. 330, 333. Design and detail in steel with special reference to beams, plate girders, and simple compression members.

**434. Structures. (3:3:0)**
Prerequisite: C.E. 333. Brief presentation of the theory of statically indeterminate structures.

**437. Water Supply and Treatment. (3:2:3)**
Prerequisite: C.E. 339, or Ch.E. 332. Consumption of water; quality of water; sources of supply streams, lakes, impounding reservoirs, wells; theory of treatment-coagulation, softening, filtration, recarburation, aeration, chlorination; laboratory work in the chemistry of water.

**438. Sewerage and Sewage Treatment. (3:2:3)**
Prerequisite: C.E. 339, or Ch.E. 332. Quantity of sewage—both sanitary and storm; composition of sewage; construction of sewers and sewerage systems; theory of different methods of treatment; laboratory work in the chemistry of sewage.

**439. Law and Ethics in Engineering. (3:3:0)**
Prerequisite: Senior standing in engineering or approval of Head of Department. Professional and industrial problems, contracts, specifications, ethics of engineering.

**4312. Soil Mechanics and Foundations. (3:3:0)**
Prerequisite: C.E. 333. Physical and mechanical properties of soils; theories of stress, settlement, and consolidation; stability of earth masses; bearing capacity and settlement of structures.

**4313. Sanitary Engineering Design—Water. (3:1:6)**
Prerequisite: Registration in C.E. 437. The design of structures used in collection, treatment, and distribution of public water supplies.

**4314. Sanitary Engineering Design—Sewage. (3:1:6)**
Prerequisite: Registration in C.E. 438 and C.E. 431. The design of structures employed in the collection of sanitary and storm sewage, the treatment of sewage, and its disposal.

**4315. Hydrology. (3:3:0)**
Prerequisite: C.E. 339. Study of the hydrologic cycle-evaporation, precipitation, infiltration, runoff.

**4316. Elements of Hydraulic Engineering. (3:3:0)**
Prerequisite: C.E. 339. Dams; channels and pressure conduits; hydraulic machinery; hydroelectric power. (Formerly C.E. 3311).

## Graduate Civil Engineering

General requirements and more detailed information may be found in the Graduate Bulletin.

The Department of Civil Engineering offers a graduate program leading to the Degree of Master of Science in Civil Engineering. Advanced courses in strength of materials, elasticity, structures, fluid mechanics, soil mechanics, together with well-selected subjects of a cognate character given in other departments, provide the student with the opportunity of electing a balanced program of high-level work designed to suit his interests.

## Graduate Course Descriptions

**511. Advanced Soil Mechanics Laboratory. (1:0:3)**
Prerequisite: Registration in C.E. 5312. Laboratory tests on consolidation of clays; triaxial tests on sand and clays to determine shear strength, and related properties.

**531. Advanced Strength of Materials. (3:3:0)**
Prerequisite: C.E. 333. Stresses at a point, unsymmetrical bending, tension on circular sections, stress concentration, torsion on noncylindrical pieces, theories of failure.

**532. Theory of Elasticity. (3:3:0)**
Prerequisite: C.E. 333, Math. 331, Math. 332. General analysis of stress and of strain, relationship between stress and strain, structural applications.

**533. Theory of Plastic Limit Design. (3:3:0)**
Prerequisite: C.E. 432, 433, 434. Study of

the developments of the theory of plastic limit design as applied to structures of steel and of reinforced concrete with some reference to shock resistance.

**534. Advanced Structural Analysis. (3:3:0)**
Prerequisite: C.E. 432, 433, 434. Application of statically indeterminate methods of analysis to building frames, arches, rigid bents, continuous trusses.

**535. Dams and Reservoirs. (3:3:0)**
Prerequisites: C.E. 4312, 4315. Selection of dam sites. General principles of design of earth dams. Flow nets and seepage. Spillways and outlet works.

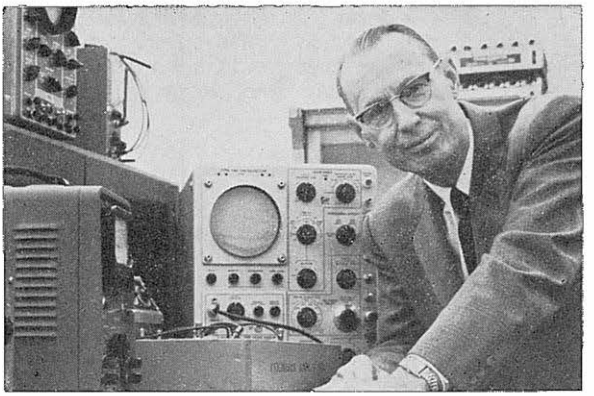
**538. Radioactive Waste Disposal. (3:2:3)**
Prerequisite: C.E. 437, 438, Ch.E. 439. Study of types and sources of radioactive wastes, with methods of decontamination and disposal.

**539. Flow in Porous Media. (3:3:0)**
Prerequisites: C.E. 4315, Math. 434, registration in Math. 435. Flow of homogeneous liquids in confined or unconfined porous formations toward natural outlets or toward wells. Artificial recharge of ground water reservoirs.

**5312. Applied Soil Mechanics. (3:3:0)**
Prerequisite: C.E. 4312, and Math. 332 or consent of instructor. Settlement problems, shear strength, bearing capacity. Slope stability, earth pressure, pile foundations. Highway subgrades, earth dams, sheet pile structures.

**5313, 5314. Advanced Work in Specific Fields. (1 to 6)**
Prerequisites: Graduate standing and approval of Head of Department. Nature of course and amount of credit depend on the nature of the work and the student's interest and performance. An individual study course.

**631-632. Master's Thesis. (6)**



*Charles Victor Bullen, Professor of Electrical Engineering and Head of the Department*

# Department of ELECTRICAL ENGINEERING

Professors:
Mr. Bullen, Mr. Houston
Associate Professors:
Mr. Stenis, Mr. Griffith
Assistant Professors:
Mr. Craig, Mr. Easter, Mr. Hartsfield, Mr. Price
Instructors:
Mr. Breeland, Mr. Cardwell, Mr. Goodson, Mr. Grigsby, Mr. Hart, Mr. Johnson, Mr. Meeks

Electrical engineering is that branch of engineering which embraces the conversion of primary energy into electrical form, the application of this energy to perform useful work, and the study of electrical methods of carrying out sensing, control, and communication functions.

The basic objective of the undergraduate program of the Department of Electrical Engineering is to provide the student with an integrated broad knowledge of enduring fundamentals upon which he can establish a career. Toward this end, the electrical engineering curriculum emphasizes basic concepts, analytical techniques and experimental methods rather than routine skills. To provide proper training for the electrical engineer, the basic sciences of mathematics, physics and chemistry, with emphasis on mechanics, thermodynamics, electricity and magnetism are deemed necessary. Humanistic courses such as English, government, history, economics, etc., are also emphasized to add breadth of learning to the program.

As a result of the almost universal use of electrical energy, electrical engineering graduates are employed in all phases of industry. The application of electrical energy has become so broad that many subdivisions in the profession now exist. The two major areas are the fields of electronics and power, or public utility field. The broad term "electronics" in turn includes myriad branches such as telephone and radio communication, television, automatic control systems and instrumentation for both civilian and military purposes.

# ELECTRICAL ENGINEERING CURRICULUM

## Bachelor of Science in Electrical Engineering

| FRESHMAN YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Math. | 131 | Trigonometry | | 3 | |
| Math. | 133 | College Alg. | | 3 | |
| Eng. | 131 | College Rhet. | | 3 | |
| Chem. | 141 | Gen. Chem. | | 4 | |
| E. Dr. | 131 | Engr. Drawing | | 3 | |
| P. E., Band, or Basic ROTC | | | | | |
| Math. | 132 | Anal. Geom. | | | 3 |
| Math. | 231 | Calculus | | | 3 |
| Eng. | 132 | College Rhet. | | | 3 |
| Chem. | 142 | Gen. Chem. | | | 4 |
| E. Dr. | 132 | Descr. Geom. | | | 3 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 16* | 16* |

| SOPHOMORE YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| E. E. | 231 | Prin. of Elec. Engr. | | 3 | |
| E. E. | 221 | Elec. Engr. Lab. | | 2 | |
| Math. | 232 | Calculus | | 3 | |
| Phys. | 235 | Engr. Physics | | 3 | |
| Phys. | 215 | Phys. Meas. | | 1 | |
| Eng. | 233 | Tech. Writing | | 3 | |
| Hist. | 231 | Hist. U. S. to 1865 | | 3 | |
| P. E., Band, or Basic ROTC | | | | | |
| E. E. | 235 | Prin. of D. C. Mach. | | | 3 |
| E. E. | 225 | D. C. Mach. Lab. | | | 2 |
| Math. | 332 | Diff. Equat. | | | 3 |
| Phys. | 236 | Engr. Physics | | | 3 |
| Phys. | 216 | Phys. Meas. | | | 1 |
| Hist. | 232 | Hist. U. S. since 1865 | | | 3 |
| C. E. | 233 | Statics | | | 3 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 18* | 18* |

**SUMMER SESSION**

| FIRST TERM | | | | SECOND TERM | | | |
|---|---|---|---|---|---|---|---|
| C. E. | 332 | Kinematics and Kinetics | 3 | C. E. | 333 | Strength of Materials | 3 |
| M. E. | 330 | Engr. Thermodyn. | 3 | M. E. | 4315, | 435, 333, or 335 | 3 |
| | | Total credit hours | 6 | | | Total credit hours | 6 |

| JUNIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| E. E. | 332 | A. C. Circ. | | 3 | |
| E. E. | 312 | A. C. Circ. Lab. | | 1 | |
| E. E. | 321 | Static Elec. and Mag. Fields | | 2 | |
| Math. | 331 | Applic. of Calc. | | 3 | |
| Govt. | 233 | Amer. Govt., Org. | | 3 | |
| Spch. | 338 | Bus. and Prof. Speech | | 3 | |
| Elective | | | | 3 | |
| E. E. | 333 | A. C. Circ. | | | 3 |
| E. E. | 313 | A. C. Circ. Lab. | | | 1 |
| E. E. | 337 | Electronics | | | 3 |
| E. E. | 317 | Electronics Lab. | | | 1 |
| Govt. | 234 | Amer. Govt., Func | | | 3 |
| Eco. | 235 | Prin. of Eco. | | | 3 |
| | | Total credit hours | | 18 | 14 |

| SENIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| E. E. | 4312 | A. C. Mach. | | 3 | |
| E. E. | 4112 | A. C. Mach. Lab. | | 1 | |
| E. E. | 4315 | Vacuum Tube Circ. and Sys. | | 3 | |
| E. E. | 4115 | Vacuum Tube Circ. Lab. | | 1 | |
| E. E. | 4221 | Control Sys. Instrum. | | 2 | |
| E. E. | 4121 | Instrum. Lab. | | 1 | |
| E. E. | 4323 | Elec. Transmission Lines | | 3 | |
| E. E. | 4313 | A. C. Mach. | | | 3 |
| E. E. | 4113 | A. C. Mach. Lab. | | | 1 |
| E. E. | 4316 | Vacuum Tube Circ. and Sys | | | 3 |
| E. E. | 4116 | Vac. Tube Circuits Lab. | | | 1 |
| E. E. | 4222 | Control Sys. Instrum. | | | 2 |
| E. E. | 4122 | Instrum. Lab. | | | 1 |
| E. E. | 4224 | Elec. Transmission Lines | | | 2 |
| E. E. | 4124 | Elec. Transmission Lines Lab. | | | 1 |
| | | Total credit hours | | 14 | 14 |

Minimum hours required for graduation—140 and* P. E., Band, or Basic ROTC.

The increasing complexity of electrical engineering demands many engineers with training beyond the bachelor's degree. For those students of ability who are interested in research and development, theoretical analysis or design, at least one year of postgraduate study is recommended.

## Courses in Electrical Engineering

A key to the meaning of course numbers, symbols, abbreviations, etc., appears on Page 4.

### For Undergraduates

**221.* Electrical Engineering Laboratory. (2:0:6)**
Prerequisite: Registration in E.E. 231. A laboratory course to accompany E.E. 231.

**225.* Direct Current Machines Laboratory. (2:0:6)**
Perequisite: Registration in E.E. 235. A laboratory course to accompany E.E. 235.

**231.* Principles of Electrical Engineering. (3:3:0)**
Prerequisite: Concurrent enrollment in Math. 232. Fundamental principles of electric and magnetic circuits. Magnetic properties of iron and steel. Induced and generated electromotive force. Forces on conductors.

**235.* Principles of Direct Current Machinery. (3:3:0)**
Prerequisite: E.E. 231, Math. 232 or concurrent enrollment. A theoretical study of the operating characteristics and applications of direct current generators and motors.

**318-319.* Electrical Engineering Laboratory. (1:0:3 each)**
Prerequisite: Registration in E.E. 328-329 or E.E. 338-339. A laboratory course to provide experience in testing and operating electrical machinery and apparatus. Not for electrical engineering majors.

**328-329. Elements of Electrical Engineering. (2:2:0 each)**
Prerequisite: Phys. 236, Math. 232. Principles and applications of direct and alternating current circuits, apparatus and machines. For civil, chemical, textile, and agricultural engineering students.

**335. Illumination. (3:3:0)**
Prerequisite: Math. 132, 6 semester hours of physics. Basic theory and modern methods of illumination. Design considerations. Required for architectural students.

**338-339.* Elements of Electrical Engineering. (3:3:0 each)**
Prerequisite: Phys. 236. Math. 232. Principles and applications of direct and alternating current circuits, apparatus and machines. For industrial, mechanical, and petroleum engineering students.

### For Undergraduates and Graduates

**312-313.* Alternating Current Circuits Laboratory. (1:0:3 each)**
Prerequisite: Registration in E.E. 332-333. Laboratory course to accompany E.E. 332-333.

**317.* Electronics Laboratory. (1:0:3)**
Prerequisite: Registration in E.E. 337. A laboratory course to accompany E.E. 337. An experimental study of high vacuum tubes, gas tubes, photo-tubes and semi-conductors.

**321.* Static Electric and Magnetic Fields. (2:2:0)**
Prerequisite: Phys. 236, Math. 332. Basic theory of static electric and magnetic fields. Investigation is made of fields having spherical, cylindrical, and plane boundaries. Includes basic concepts of capacitance and inductance.

**332-333.* Alternating Current Circuits. (3:3:0 each)**
Prerequisite: E.E. 221, 231, Math. 232. Fundamentals of alternating current circuits. Network theorems, coupled circuit phenomena, transients and non-sinusoidal wave forms.

**337.* Electronics. (3:3:0)**
Prerequisite: E.E. 321, 332. Principles and methods of analysis of high vacuum tubes, gas tubes, rectifiers, photo-tubes, semiconductor diodes and transistors.

**436-437. Principles of Electromagnetic Fields. (3:3:0 each)**
Prerequisite: Math. 332, E.E. 321. Static field equations, elementary boundary value problems, solutions of Maxwell's equations. High-frequency potential, circuit concepts, and skin effect. Propagation of electromagnetic waves. Wave guides and resonant cavities. Radiation. This is not a required course and can be given only on the basis of sufficient registration.

**4112-4113.* Alternating Current Machinery Laboratory. (1:0:3 each)**
Prerequisite: Registration in E.E. 4312-4313. A laboratory course to accompany E.E. 4312-4313. Machines are operated and tested in the laboratory, and results compared with theoretical characteristics.

**4115-4116. Vacuum Tube Circuits Laboratory. (1:0:3 each)**
Prerequisite: Parallel enrollment in E.E. 4315-4316. A laboratory course to accompany 4315-4316.

**4121-4122. Control System Instrumentation Laboratory. (1:0:3 each)**
Prerequisite: Registration in E.E. 4221-4222. A laboratory course to accompany E.E. 4221-4222.

**4124. Electrical Transmission Lines Laboratory. (1:0:3)**
Prerequisite: Registration in E.E. 4224. A laboratory course to accompany E.E. 4224.

**4221-4222. Control System Instrumentation. (2:2:0 each)**
Prerequisite: Senior standing in electrical engineering. For non-majors, consent of instructor. Dynamics of closed-loop automatic control systems. Basic study of the instrumentation problem. Fundamentals of transducers. Transmission, indication and recording of data. Emphasis on the electrical methods of measurement and control with applications to industrial instrumentation problems. Introduction to use of analog and digital computers.

* Courses normally repeated during summer session when demand justifies.

**4312-4313.* Alternating Current Machines. (3:3:0 each)**
Prerequisite: E.E. 332. Theory and operation of alternating current machines. Transformers, three-phase synchronous motors and generators, three-phase induction motors and small single-phase motors. Theoretical operating characteristics are derived by equivalent circuit solutions and graphical analysis.

**4315-4316. Vacuum Tube Circuits and Systems. (3:3:0 each)**
Prerequisite: E.E. 337, 333. Vacuum tube and transistor amplifiers, oscillators, modulators, demodulators, frequency converters, and wave-shaping circuits.

**4323-4224. Electrical Transmission Lines. (3:3:0) (2:2:0)**
Prerequisite: E.E. 333, 321. Theory of electrical transmission lines. Basic longline equations calculation of line parameters, standing and traveling waves. The fundamental equations are considered in their particular applications to power, telephone, and high-frequency lines.

## Graduate Electrical Engineering

General requirements and more detailed information may be found in the Graduate Bulletin.

The Department of Electrical Engineering offers a graduate program leading to the Degree of Master of Science in Electrical Engineering. Advanced work in electronics, network theory, electrical power systems, electromagnetic fields and automatic controls, together with subjects of a cognate character given in other departments, provides the student with the opportunity of electing a balanced program with specialization to suit his particular interests.

## Graduate Course Descriptions

**531-532. Vacuum Tubes and Associated Circuits. (3:3:0 each)**
Prerequisite: E.E. 4316 or the equivalent and consent of instructor. A detailed study of vacuum tubes and associated circuits. Steady-state and transient reponse of linear amplifiers, random noise, power amplifiers, feedback amplifiers, stability criteria, oscillators, and special topics from current literature.

**533. Symmetrical Components. (3:3:0)**
Prerequisite: B.S. in E.E. or consent of instructor. The theory of the method of symmetrical components is reviewed and supplemented in detail; related components are described, and the method is applied to the calculation of voltages and currents in complex systems under conditions of fault and unbalanced loading. The symmetrical component impedances of machines are defined and calculated, also the zero sequence impedance of lines and cables.

**535. Electric Power Systems. (3:3:0)**
Prerequisite: E.E. 4224 or consent of instructor. Line constants, long-line equations, power-circle diagrams, traveling waves, system stability, line construction, corona.

**536-537. Advanced Network Theory. (3:3:0 each)**
Prerequisite: B.S. in E.E. or consent of instructor. Solution of transients in linear systems by means of the LaPlace transform and matrix methods. Theory of two-terminal and four-terminal networks, impedance transformation, Foster's theorem and extensions, conventional and lattice filters, equalizers, network design and synthesis, application of network theory to vacuum-tube circuits.

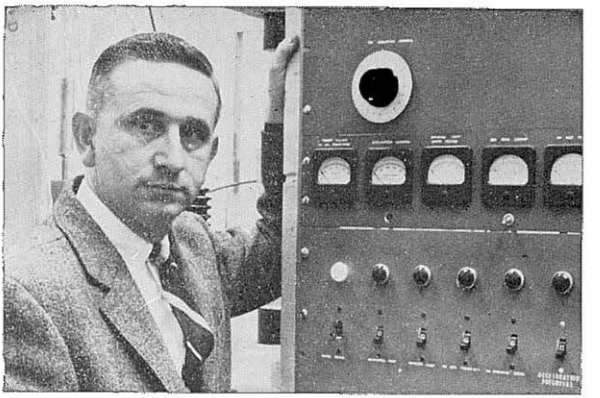
**538-539. Advanced Electrical Machine Theory. (3:3:0 each)**
Prerequisite: B.S. in E.E. or consent of instructor. A rigorous exposition of machine theory. Application of the methods of Doherty, Nickle and Park to many problems. Direct and quadrature-axis concepts of steady-state and transient reactance. Field and armature transient currents by operational calculus methods. Space and time harmonics of magneto-motive force. Emphasis is on operation, but design factors such as flux plotting are considered.

**5211-5212. Special Problems in Electrical Engineering. (2:0:6 each)**
Experimental work to accompany advanced theory courses in electrical engineering.

**5311-5312. Automatic Control Systems. (3:3:0 each)**
Prerequisite: E.E. 4221-4222, or equivalent. Quantitative study of closed-loop automatic control system behavior. Relation between transient and steady-state performance. System synthesis for prescribed design criteria.

**631-632. Master's Thesis. (6)**

* Courses normally repeated during summer session when demand justifies.



*Henry Thomas, Professor of Physics and Head of the Department*

# ENGINEERING PHYSICS

Staff: DEPARTMENT OF PHYSICS
Professors:
Mr. Thomas, Mr. Merrymon, Mr. Schmidt
Associate Professors:
Mr. Day, Mr. Gott
Assistant Professors:
Mr. Basford, Mr. Phillips, Mr. Sandlin*, Mr. Severance
Instructors:
Mr. Clark, Mr. Henson, Mr. Mires
Part-time Instructors:
Mr. Cole, Mr. Sage, Mrs. Pereboom, Mr. Smola

*On leave 1958-1959

The Degree of Bachelor of Science in Engineering Physics is a special engineering science program jointly administered by the Department of Physics of the School of Arts and Sciences and several of the departments of the School of Engineering.

The curriculum of engineering physics is designed to prepare students for careers in technical research and advanced engineering development. Basically the program is one of a sequence of courses in intermediate and advanced physics supplemented by a firm grounding in mathematics, chemistry, and fundamental engineering.

A sound basis for study toward advanced degrees in either physics or the engineering sciences is provided by the curriculum in engineering physics. The program is especially suited for those students of ability who are interested in graduate study in nuclear engineering.

The course of study includes work in atomic physics, developments in contemporary theories of atomic structure, relativity, matter and radiation, atomic spectra and X-rays, radioactivity, laws of radioactive decay, the slowing down of neutrons, artificial radioactive disintegration, formation of isotopes, nuclear fission and fusion, and energy relations. Work in electronics covers

# ENGINEERING PHYSICS CURRICULUM

## Bachelor of Science in Engineering Physics

| FRESHMAN YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Math. | 131 | Trigonometry | | 3 | |
| Math. | 133 | College Alg. | | 3 | |
| Eng. | 131 | College Rhet. | | 3 | |
| Chem. | 141 | Gen. Chem. | | 4 | |
| E. Dr. | 131 | Engr. Drawing | | 3 | |
| P. E., Band, or Basic ROTC | | | | | |
| Math. | 132 | Anal. Geom. | | | 3 |
| Math. | 231 | Calculus | | | 3 |
| Eng. | 132 | College Rhet. | | | 3 |
| Chem. | 142 | Gen. Chem. | | | 4 |
| E. Dr. | 132 | Descr. Geom. | | | 3 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 16* | 16* |

| SOPHOMORE YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Math. | 232 | Calculus | | 3 | |
| Phys. | 235 | Engineering Physics | | 3 | |
| Phys. | 215 | Phy. Meas. | | 1 | |
| Govt. | 233 | Amer. Govt., Org. | | 3 | |
| Eng. | 231 | Mast. of Lit. | | 3 | |
| Hist. | 231 | Hist. U. S. to 1865 | | 3 | |
| P. E., Band, or Basic ROTC | | | | | |
| Math. | 332 | Diff. Equat. | | | 3 |
| Phys. | 236 | Engineering Physics | | | 3 |
| Phys. | 216 | Phys Meas. | | | 1 |
| C. E. | 233 | Statics | | | 3 |
| Eng. | 232 | Mast. of Lit. | | | 3 |
| Govt. | 234 | Amer. Govt., Func. | | | 3 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 16* | 16* |

**SUMMER SESSION**

| FIRST TERM | | | |
|---|---|---|---|
| M. E. | 237 | Metals Engr. | 3 |
| C. E. | 332 | Kinematics and Kinetics | 3 |
| | | Total credit hours | 6 |

| SECOND TERM | | | |
|---|---|---|---|
| C. E. | 333 | Strength of Materials | 3 |
| Hist. | 232 | Hist. U. S. since 1865 | 3 |
| | | Total credit hours | 6 |

| JUNIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Phys. | 337 | Atomic Physics | | 3 | |
| Phys. | 312 | Atomic Physics Lab. | | 1 | |
| Phys. | 331 | Light | | 3 | |
| Phys. | 336 | Elec. and Magnet. | | 3 | |
| M. E. | 330 | Engr. Thermodyn. | | 3 | |
| Elective | | (Non-technical) | | 3 | |
| Phys. | 338 | Nuclear Physics | | | 3 |
| Phys. | 313 | Nuclear Physics Lab. | | | 1 |
| Phys. | 341 | Electron Tubes and Applic. | | | 4 |
| Math. | 432 | Adv. Diff. Equat. | | | 3 |
| Eco. | 235 | Prin. of Eco. | | | 3 |
| Elective | | (Non-technical) | | | 3 |
| | | Total credit hours | | 16 | 17 |

| SENIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Phys. | 423 | Elec. Meas. | | 2 | |
| M. E. | 435 | Fluid Dynamics | | 3 | |
| E. E. | 4221 | Instrumentation | | 2 | |
| E. E. | 4121 | Instrum. Lab. | | 1 | |
| Math. | 439 | Vector Anal. | | 3 | |
| Elective | | (Technical) | | 3 | |
| Phys. | 435 | Mechanics | | | 3 |
| Phys. | 424 | Elec. Meas. | | | 2 |
| M. E. | 4315 | Heat and Mass Trans. | | | 3 |
| Ch. E. | 439 | Nuclear Engr. | | | 3 |
| E. E. | 4222 | Instrumentation | | | 2 |
| E. E. | 4122 | Instrum. Lab. | | | 1 |
| Elective | | (Technical) | | | 3 |
| | | Total credit hours | | 14 | 17 |

Minimum hours required for graduation—140 and* P. E., Band, or Basic ROTC

types and functions of vacuum tubes, instruments and circuits using vacuum tubes, semi-conductors. Courses in nuclear engineering cover the study of reactor construction, control and operation.

## Courses in Physics

A key to the meaning of course numbers, symbols, abbreviations, etc., appears on Page 4.

**For Undergraduates**

**031. Introductory Physics. (3:3:0)**
Prerequisite: Math. 052. or equivalent. Required of engineering students having a deficiency in high school physics. Credit for this course may not be used to replace any physics required in the curriculum concerned nor as a normal degree requirement.

**141-142. General Physics. (4:3:3 each)**
A general course in beginning physics covering mechanics, heat, sound, electricity and magnetism, light, and modern physics.

**215-216. Physical Measurements. (1:0:2 each)**
Must be taken parallel with Phys. 235-236.

**235-236. Engineering Physics. (3:3:0 each)**
Prerequisite: One year of high school or college physics; parallel enrollment in calculus. See Phys. 215-216.

**312-313. Atomic and Nuclear Physics Laboratory. (1:0:3 each)**
Prerequisite: Parallel enrollment in Phys. 337-338. Approval of instructor. Credit will be given for either or both semsters.

**331. Light. (3:2:3)**
Prerequisite: One year of physics and junior standing.

**332. Heat and Thermodynamics. (3:3:0)**
Prerequisite: One year of physics and calculus.

**336. Electricity and Magnetism. (3:3:0)**
Prerequisite: One year of physics and calculus.

**337. Introduction to Atomic Physics. (3:3:0)**
Prerequisite: One year of physics and junior standing.

**338. Introduction to Nuclear Physics. (3:3:0)**
Prerequisite: One year of physics and junior standing.

**341. Electron Tubes and Applications to Physical Science. (4:3:3)**
Prerequisite: Phys. 336. A general course in electronics stressing the fundamentals of electron tubes and the application of these tubes in instruments and apparatus that are of primary importance in the physical sciences.

**411-412. Physical Seminar. (1:1:0 each)**
Prerequisite: 12 hours of physics and calculus.

**415-416. Special Projects. (1:0:3 each)**
Prerequisite: Approval of Head of Department. Individual student study of theoretical or experimental projects in physics under the guidance of a member of the staff. An outline of the proposed project must have been accepted by the Head of the Department before a student registers in this course.

**423-424. Electrical Measurements. (2:0:6 each)**
Prerequisite: 12 hours of physics and calculus.

**435. Mechanics. (3:3:0)**
Prerequisite: 12 hours of physics and calculus.

**436-437. Individual Study in Specified Fields. (3:3:0) or (3:0:9 each)**
Prerequisite: Calculus and 18 hours of physics and approval of Department Head. Individual student study of theoretical or experimental projects under the guidance of a member of the staff. Similar to 415-416 with more credit. For students with pronounced ability.

# ENGINEERING SEMINAR

## Course in Engineering Seminar

**412. Engineering Seminar. (1:1:0)**
Prerequisite: Senior standing and permission of Head of Department unless course is specifically required in curriculum. The investigation and study of engineering problems of special interest and value to the student. May be repeated for credit.

# INDUSTRIAL ENGINEERING CURRICULUM

## Bachelor of Science in Industrial Engineering

| FRESHMAN YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Math. | 131 | Trigonometry | | 3 | |
| Math. | 133 | College Alg. | | 3 | |
| Eng. | 131 | College Rhet. | | 3 | |
| Chem. | 141 | Gen. Chem. | | 4 | |
| E. Dr. | 131 | Engr. Drawing | | 3 | |
| P. E., Band, or Basic ROTC | | | | | |
| Math. | 132 | Anal. Geom. | | | 3 |
| Math. | 231 | Calculus | | | 3 |
| Eng. | 132 | College Rhet. | | | 3 |
| Chem. | 142 | Gen. Chem. | | | 4 |
| E. Dr. | 132 | Descr. Geom. | | | 3 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 16* | 16* |

| SOPHOMORE YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Math. | 232 | Calculus | | 3 | |
| Hist. | 231 | Hist. U. S. to 1865 | | 3 | |
| Psy. | 230 | Gen. Psychology | | 3 | |
| Eco. | 235 | Prin. of Eco. | | 3 | |
| Phys. | 235 | Engr. Physics | | 3 | |
| Phys. | 215 | Phys. Meas. | | 1 | |
| P. E., Band, or Basic ROTC | | | | | |
| Math. | 332 | Diff. Equat. | | | 3 |
| Hist. | 232 | Hist. U. S. since 1865 | | | 3 |
| Acct. | 231 | Industrial Acct. for Engrs. | | | 3 |
| Sophomore English | | | | | 3 |
| Phys. | 236 | Engr. Physics | | | 3 |
| Phys. | 216 | Phys. Meas. | | | 1 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 16* | 16* |

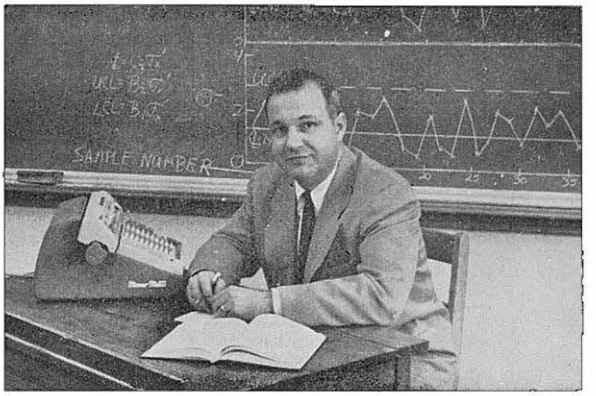
**SUMMER SESSION**

| FIRST TERM | | | | SECOND TERM | | | |
|---|---|---|---|---|---|---|---|
| I. E. | 332 | Indus. Org. and Mgt. | 3 | I. E. | 333 | Manuf. Processes | 3 |
| C. E. | 233 | Statics | 3 | C. E. | 333 | Strength of Materials | 3 |
| | | Total credit hours | 6 | | | Total credit hours | 6 |

| JUNIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| I. E. | 321 | Indus. Relations | | 2 | |
| I. E. | 331 | Motion and Time Study | | 3 | |
| Math. | 4314 | Statistics | | 3 | |
| M. E. | 321 | Metals Fab. | | 2 | |
| M. E. | 330 | Engr. Thermodyn. | | 3 | |
| Govt. | 233 | Amer. Govt., Org. | | 3 | |
| I. E. | 334 | Prod. Tooling | | | 3 |
| I. E. | 337 | Prod. Planning & Control | | | 3 |
| M. E. | 335 | 338, 333, 435 or 4315 | | | 3 |
| Ch. E. | 237 | Engr. Materials | | | 3 |
| | | or | | | |
| M. E. | 237 | Metals Engr. | | | 3 |
| Bus. Law | 338 | Bus. Law I | | | 3 |
| Govt. | 234 | Amer. Govt., Func. | | | 3 |
| | | Total credit hours | | 16 | 18 |

| SENIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| I. E. | 421 | Materials Handling | | 2 | |
| I. E. | 435 | Safety Engr. | | 3 | |
| I. E. | 436 | Engr. Eco. | | 3 | |
| I. E. | 437 | Ind. Stat. & Qual. Control | | 3 | |
| E. E. | 338 | Elem. of Elec. Engr. | | 3 | |
| E. E. | 318 | Elec. Engr. Lab. | | | 1 |
| I. E. | 411 | Indus. Engr. Prob. | | | 1 |
| I. E. | 423 | Indus. Procurement | | | 2 |
| I. E. | 432 | Indus. Plant Design | | | 3 |
| I. E. | 438 | Manuf. Anal. | | | 3 |
| E. E. | 339 | Elem. of Elec. Engr. | | | 3 |
| E. E. | 319 | Elec. Engr. Lab. | | | 1 |
| Elective | | | | | 3 |
| | | Total credit hours | | 15 | 16 |

**Minimum hours required for graduation—141 and* P. E. Band, or Basic ROTC**




*Richard Albert Dudek, Professor of Industrial Engineering, and Head of the Department*

# Department of INDUSTRIAL ENGINEERING and ENGINEERING DRAWING

INDUSTRIAL ENGINEERING STAFF
Professors:
Mr. Dudek, Mr. St. Clair (Part time)
Associate Professor:
Mr. MacKenzie
Assistant Professor:
Mr. Jenkins
Instructor:
Mr. Burford

ENGINEERING DRAWING STAFF
Professor:
Mr. Perryman
Associate Professors:
Mrs. Atkinson, Mr. Lindenmeier
Assistant Professor:
Mr. Martin
Instructors:
Mr. Burford, Mr. Graham, Mr. Reeves
Mr. Burford, Mr. Graham, Mr. Reeves, Mr. Power (part-time)
Teaching Fellow:
Mr. Horne

**Industrial Engineering** is the application of engineering methods and the principles of scientific management to production and the scientific analysis of work and operations. It is based upon the early works in scientific management by Fredrick W. Taylor and the works of Lillian M. and Frank B. Gilbreth in motion study and methods analysis. Industrial engineering began as a profession during the early 1900's and has advanced rapidly since World War II.

As defined by the American Institute of Industrial Engineers: "Industrial Engineering is concerned with the design, improvement, and installation of integrated systems of men, materials, and equipment. It draws upon specialized knowledge and skill

in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems." Industrial engineering is used most widely in manufacturing fields but contributes and is growing in use in such areas as engineering sales, farm management, home economics, hospital work, surgery, hotel and restaurant operation, retail store operation, architecture, construction work, regional planning, mail order selling, and various branches of the Federal government.

The typical industrial engineer is often employed in an advisory capacity, usually on the management staff of an organization. His duties include such things as the design of systems for obtaining maximum utilization and control of the resources of the organization; the determination of costs, quantities, and quality standards for operations; the determination of schedules and standard times for the performance of specific jobs while maintaining a rigid control of quality; the determination of the layout for physical facilities; and the establishment and administration of such programs as job evaluation, wage incentive, training, safety and suggestion systems. The industrial engineer must understand both employee and operating problems for he is in contact with supervision and labor in regard to improvements which will benefit both parties.

The curriculum of industrial engineering includes a core of basic courses in mathematics, drawing, physics, chemistry, English, economics, and psychology as well as the basic courses in mechanical, electrical, and civil engineering. The departmental courses include a survey of industrial engineering and management, motion and time study, production methods and equipment, tool design, safety, materials handling, plant layout, manufacturing analysis, production planning and control, quality control, engineering economy, statistical theory and applications, and operations research techniques. These courses deal primarily with the problems of cost, quality, and quantity of production in an enterprise. The successful solution of such problems involves organizing, planning, and coordinating the effective utilization and control of personnel, money, materials, and facilities which requires the consideration of human and economic factors as well as technical factors.

Special programs sponsored by the Student Chapter AIIE and Alpha Pi Mu, the national honor society, as well as organized departmental seminars, supplement course instruction to keep the student informed of latest developments in the growing field of industrial engineering.

## Courses in Industrial Engineering

A key to the meaning of course numbers, symbols, abbreviations, etc., appears on Page 4.

### For Undergraduates

**321. Industrial Relations. (2:2:0)**
Prerequisite: I. E. 332 or parallel registration. A study of the policies and practices of industrial organizations relative to employees. Emphasis is on responsibility of the personnel department in recruitment, maintenance of personnel, training new workers, working conditions, remuneration, handling of grievances, job evaluation, merit rating, pension plans.

**331. Motion and Time Study. (3:2:3)**
Prerequisite: I. E. 332, Math 4314, or parallel registration. Method of analyzing processes and operations for economical operation. Study of use of therbligs; principles of motion economy; micromotion and memo-motion study; flow process charts; operation process charts; man-machine process charts; man-machine analysis; techniques of stopwatch time study to establish work standards; rating techniques; wage incentive applications; development of mechanical devices to reduce time and fatigue; work sampling theory; and an introduction to standard data systems.

**332. Industrial Organization and Management. (3:3:0)**
Prerequisite:Junior standing. A study of modern manufacturing management. Forms of ownership, financial sources; organization charts; plant location and types of buildings; design of manufacturing processes; use of motion and time study in the management field; principles and methods of quality production and inventory control; wage and salary policies.

**333. Manufacturing Processes. (3:3:0)**
Prerequisite: Junior standing. Processes used in various common industries such as metal, non-ferrous; chemicals; food; textiles; glass; meat-packing, etc. Brief history of growth of each industry. A study of the nature of machines and equipment used; reference to the dollar value of the output of each industry where this information is available. Location of principal centers of production.

**334. Production Tooling. (3:1:5)**
Prerequisite: I. E. 332, 333; M. E. 321; 6 hours of drawing. Elements of machines and tooling. Problems in manufacturing: selection of equipment, jigs and fixtures, estimation, dimensional analysis, etc. Laboratory work includes problems of operation and process design.

**336. Tool Design. (3:1:6) (Fall 1959, Spring 1960 only)**
Prerequisite: E. D. 221; M. E. 321; C. E. 333 or parallel registration. The study of types and characteristics of tools best suited for use in processing various materials. Jigs, dies, fixtures, gauges, etc., are designed in the laboratory.

**337. Production Planning and Control. (3:3:0)**
Prerequisite: I. E. 332, Math 232. Control functions; types of production and types of control; forecasting and estimating; basic information required for control; initiating producton control; flow control; block and load control. Reproduction of forms and communications systems, relationships of product control department with other departments. Value of production control. Introduction to operations research with emphasis on linear programming.

### For Undegraduates and Graduates

**411. Industrial Engineering Problems. (1:1:0)**
Prerequisite: Graduating industrial engineering seniors. A practical solution of a variety of problems which the industrial engineer may be expected to encounter in his work. Problems cover the following subjects; plant layout; production planning; engineering economy; methods improvement; materials handling and other industrial engineering problems.

**421. Materials Handling. (2:2:0)**
Prerequisite: I. E. 331 and 334. A study of the various types of materials handling, such as railroads, trucks, elevators, conveyors of various types, and the application of the proper type to various materials handling problems.

**423. Industrial Procurement. (2:2:0)**
Prerequisite: I. E. 332, senior standing or some experience in the field of procurement. The meaning and function of procurement field. Organization for procurement; the purchasing procedure; determination of quality; inspection of purchased items; importance and methods of inventory control; price policies; selection of sources of supply; forward buying and speculation; legal status of procurement officer.

**432. Industrial Plant Design. (3:1:6)**
Prerequisite: I. E. 421, 334; and 436 or parallel registration. The layout of an industrial plant, including machinery, buildings, materials handling equipment. flow diagram, storage and shipping facilities. Various types of industries are considered.

**435. Safety Engineering. (3:3:0)**
Prerequisite: Senior standing in engineering or business management. History of the safety movement as applied to manufacturing processes. Costs of accidents; methods of accident prevention; methods of training and enforcing safety regulations. Frequency rates, severity rates. Protective equipment for various types of work. Accident investigations and reports; first aid. Outside assignments (usually one to each student), and reports on published articles, relating to safety.

**436. Engineering Economy. (3:3:0)**
Prerequisite: 3 hours of economics and senior standing in engineering. Analysis and evaluation of factors involved in decision making; model construction for problems of economic differences in alternatives; cost studies; time value of money; prospective return on increment investments; depreciation; equipment retirement policies. Problems illustrative of the various subjects listed above.

**437. Industrial Statistics and Quality Control. (3:3:0)**
Prerequisite: I. E. 337, Math 4314. The application of statistical techniques to quality control; statistical approach to acceptance procedures. The place of quality control in various types of operations. Statistical applications to other types of industrial problems.

**438. Manufacturing Analysis. (3:3:0)**
Prerequisite: I. E. 334 and parallel registration in I. E. 432. A case study and problem approach to an understanding of industrial engineering principles and fundamental management concepts. Emphasis is placed on the whole of the operational unit with special consideration given the inter-relationship of the various management functions. Supplementary reading and term projects are required.

**Engineering Drawing** courses are required for all engineering students. The objective of these courses is to familiarize the student with engineering drawing conventions and to train the student to use skillfully and intelligently engineering drawing techniques as a basis for specialized engineering and design work. Approved drawing equipment is required in all courses.

## Courses in Engineering Drawing

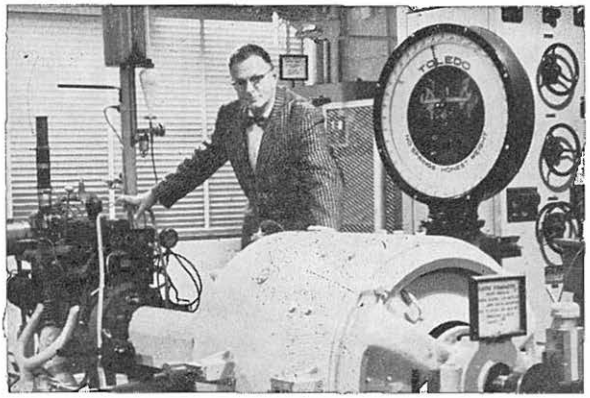
A key to the meaning of course numbers, symbols, abbreviations, etc., appears on Page 4.

### For Undergraduates

**131. Engineering Drawing. (3:1:5)**
Prerequisite: Plane geometry. The essentials of drafting, including freehand, sketching, use of instruments, lettering, engineering, geometry, orthographic projection, sections, isometric drawings, oblique drawings, dimensioning, elementary working drawings.

**132. Descriptive Geometry. (3:1:5)**
Prerequisite: E.Dr. 131. Theory of engineering drawing, which provides training in exact thinking. Point, line, and plane problems, tangent planes, intersections and developments, single and double curved surfaces, and warped surfaces.

**221. Machine Drawing. (2:0:6)**
Prerequisite: E.Dr. 132. Application of the graphic language to engineering purposes; engineering sketches; machine fastenings; conventional practice; machine details and assembly drawings.



*Louis John Powers, Professor of Mechanical Engineering and Head of the Department*

# Department of MECHANICAL ENGINEERING

Professors:
Mr. Powers, Mr. Godeke (Emeritus), Mr. Newell
Associate Professors:
Mr. Helmers, Mr. Martin, Mr. Mason
Assistant Professor:
Mr. Monasch**
Instructors:
*Mr. Davenport, Mr. Dumis, Mr. Edmondson, Mr. Gentry, Mr. Lawrence, *Mr. Lowery, Mr. Reis, (Part-time), Mr. Swinson

*On leave 1958-1959
** Deceased Jan. 1, 1959

Mechanical engineering is that branch of engineering whose basic functions deal with the transformations of energy into heat and work and the mechanisms by which these are accomplished. The course of study thus deals with the generation, transmission, and utilization of heat and mechanical power, and with the design, construction, operation, and testing of machines. Laboratory courses are employed to familiarize the student with manufacturing processes and testing methods. Emphasis is placed upon the acquisition of a thorough foundation in fundamental concepts and techniques so that the graduate will be prepared to advance and develop in the profession of engineering.

The practice of mechanical engineering associated with heat power is concerned with the means by which power requirements are established, criteria by which power equipment is designed and selected, and specification of the installation, testing and operation of basic power equipment such as pumps, blowers, steam generators, and nuclear power reactors. The practice of mechanical design deals with the establishing of requirements for and the designing of mechanical components of such varied items as power plant equipment, air-, land-, and marine-vehicles; electro-mechanical control systems; and the balance and vibration of machinery.

# MECHANICAL ENGINEERING CURRICULUM

## Bachelor of Science in Mechanical Engineering

| FRESHMAN YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Math. | 131 | Trigonometry | 3 | |
| Math. | 133 | College Alg. | 3 | |
| Eng. | 131 | College Rhet. | 3 | |
| Chem. | 141 | Gen. Chem. | 4 | |
| E. Dr. | 131 | Engr. Drawing | 3 | |
| P. E., Band, or Basic ROTC | | | | |
| Math. | 132 | Anal. Geom. | | 3 |
| Math. | 231 | Calculus | | 3 |
| Eng. | 132 | College Rhet. | | 3 |
| Chem. | 142 | Gen. Chem. | | 4 |
| E. Dr. | 132 | Descr. Geom. | | 3 |
| P. E., Band, or Basic ROTC | | | | |
| | | Total credit hours | 16* | 16* |

| SOPHOMORE YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| Math. | 232 | Calculus | 3 | |
| Phys. | 235 | Engineering Physics | 3 | |
| Phys. | 215 | Phys. Meas. | 1 | |
| Govt. | 233 | American Govt., Org. | 3 | |
| Hist. | 231 | Hist. U. S. to 1865 | 3 | |
| English Literature | | | 3 | |
| P. E., Band, or Basic ROTC | | | | |
| Math. | 332 | Diff. Equat. | | 3 |
| Phys. | 236 | Engineering Physics | | 3 |
| Phys. | 216 | Phys. Meas. | | 1 |
| Govt. | 234 | Amer. Govt., Func. | | 3 |
| Hist. | 232 | Hist. U. S. since 1865 | | 3 |
| C. E. | 233 | Statics | | 3 |
| P. E., Band, or Basic ROTC | | | | |
| | | Total credit hours | 16* | 16* |

**SUMMER SESSION**

| FIRST TERM | | | | SECOND TERM | | | |
|---|---|---|---|---|---|---|---|
| M. E. | 330 | Engr. Thermodyn. | 3 | M. E. | 333 | Combustion Engines | 3 |
| M. E. | 320 | Metals Fab. | 2 | M. E. | 321 | Metals Fab. | 2 |
| | | Total credit hours | 5 | | | Total credit hours | 5 |

| JUNIOR YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| E. E. | 338 | Elem. of Elec. Engr. | 3 | |
| E. E. | 318 | Elec. Engr. Lab. | 1 | |
| C. E. | 333 | Strength of Materials | 3 | |
| M. E. | 237 | Metals Engr. | 3 | |
| M. E. | 338 | Air Cond. | 3 | |
| M. E. | 3314 | Mech. Design | 3 | |
| E. E. | 339 | Elem. of Elec. Engr. | | 3 |
| E. E. | 319 | Elec. Engr. Lab. | | 1 |
| C. E. | 332 | Kinematics and Kinetics | | 3 |
| Math | 331 | Applic. of Calc. | | 3 |
| M. E. | 335 | Heat Power Design | | 3 |
| M. E. | 3315 | Mech. Design | | 3 |
| | | Total credit hours | 16 | 16 |

| SENIOR YEAR | | | SEMESTER 1st | 2nd |
|---|---|---|---|---|
| M. E. | 3312 | Mech. of Mach. | 3 | |
| M. E. | 410 | Spec. Prob. Lab. | 1 | |
| M. E. | 420 | Spec. Prob. | 2 | |
| M. E. | 430 | Mech. Equip. Lab | 3 | |
| M. E. | 435 | Fluid Dynamics | 3 | |
| M. E. | 4212 | Thermodynamics | 2 | |
| Elective | | | 3 | |
| M. E. | 3313 | Dynamics | | 3 |
| M. E. | 422 | Phys. Metallurgy | | 2 |
| M. E. | 412 | Phys. Met. Lab. | | 1 |
| M. E. | 431 | Mech. Equip. Lab | | 3 |
| M. E. | 4315 | Heat and Mass Trans. | | 3 |
| M. E. | 4213 | Thermodynamics | | 2 |
| Elective | | | | 3 |
| | | Total credit hours | 17 | 17 |

**Minimum hours required for graduation — 140 and* P. E., Band, or Basic ROTC**

A high percentage of mechanical engineering graduates go into aeronautical engineering, air-conditioning and refrigeration, design and sales, and the oil and gas industry. Public utility companies have found increased need for mechanical engineering graduates in the production and sale of their products. Many graduates are in the teaching profession, not only in colleges and universities, but in the secondary, vocational, and technical high school as well. Some have continued their education and are now practicing law, either as patent attorneys or as attorneys for companies engaged in highly technical manufacturing processes.

In summary, mechanical engineering prepares the student for a versatile and rewarding profession, and in addition provides him with a practical knowledge and understanding of the mechanical world in which he lives.

## Combination Course Mechanical Engineering—Petroleum Engineering

The Departments of Mechanical Engineering and Petroleum Engineering are cooperating in offering a five-year curriculum. At the successful completion of four years of this curriculum, the Degree of Bachelor of Science in Petroleum Engineering will be awarded. The Degree of Bachelor of Science in Mechanical Engineering will be awarded at the successful completion of the fifth year.

The work of the first four years will include the curriculum of petroleum engineering, except that petroleum students will add M.E. 237 and 333.

The fifth year will include the following mechanical engineering courses: M.E. 320, 321, 3312, 3313, 3314, 3315, 430, 431, 4212, 4213, 4315.

## Courses in Mechanical Engineering

A key to the meaning of course numbers, symbols and abbreviations, etc., appears on Page 4.

**For Undergraduates**

**237. Metals Engineering. (3:3:0)**
Prerequisites: Chem. 141, Math. 231. Metallography, heat treatment, and metal fabrication processes for engineering applications.

**318. Heat Engineering Laboratory. (1:1:2)**
Prerequisite: M.E. 330. Standard tests of engines, pump, blower, turbine, and refrigeration machine.

**320. Metals Fabrication. (2:0:6)**
Prerequisite: Junior standing. Design and manufacture of weldments and castings.

**321. Metals Fabrication. (2:0:6)**
Prerequisite: Junior standing. Design and manufacture of formed and machined parts.

**330. Engineering Thermodynamics. (3:3:0)**
Prerequisites: Math. 232, Chem 142, Physics 235. First and second laws of thermodynamics, thermodynamic processes and cycles and the thermodynamic properties of gases and vapors for engineering applications.

**333. Combustion Engines. (3:3:0)**
Prerequisites: M.E. 330. Types, performance, and applications of spark ignition, compression-ignition, and gas turbine engines.

**335. Heat Power Design. (3:3:0)**
Prerequisite: M.E. 330. Economic and thermodynamic analysis and design of the principal components of steam and combustion engine power plants.

**338. Air Conditioning. (3:3:0)**
Prerequisite: M.E. 330. Thermodynamics of air-steam mixtures. Heating, cooling, and ventilation requirements.

**3312. Mechanics of Machinery. (3:3:0)**
Prerequisite: C.E. 233. Kinematics and dynamics of gears, cams, and linkages.

**3313. Dynamics. (3:3:0)**
Prerequisites: C.E. 332 or M.E. 3312, Math

**332. Dynamics of linear mechanical and electro-mechanical systems.**

**3314, 3315. Mechanical Design. (3:2:3 each)** Prerequisite: C.E. 233. Analysis of stresses in and functions of machine elements. Design of mechanical structures and machines.

**For Advanced Undergraduates and Graduates**

**410. Special Problems Laboratory. (1:0:3)** Prerequisite: Concurrent enrollment in M.E. 420. Experimental studies in research and development.

**412. Physical Metallurgy Laboratory. (1:0:3)** Prerequisite: Concurrent enrollment in M.E. 422. Metallurgical laboratory techniques, lattice and grain structure analysis, metals testing.

**420. Special Problems. (2:2:0)** Prerequisite: Concurrent enrollment in M.E. 410, senior standing. Advances and techniques in mechanical engineering technology. Oral and written report presentation.

**422. Physical Metallurgy. (2:2:0)** Prerequisite: M.E. 330. Concurrent enrollment in M.E. 412. Fundamentals of metal behavior in terms of atomic structure, energy levels and crystal imperfections.

**430. Mechanical Equipment Laboratory. (3:0:9)**

Prerequisites: M.E. 330, 333. Standard performance testing of mechanical equipment. Oral and written report presentation. Outside work required.

**431. Mechanical Equipment Laboratory. (3:0:9)**

Prerequisites: M.E. 330, Math. 332, C.E. 333. Experimental and developmental testing. Strain gauge, photo-elastic, and dynamic testing techniques. Oral and written report presentation. Outside work required.

**435. Fluid Dynamics. (3:3:0)** Prerequisites: M.E. 330, Math. 332. Hydrodynamic theory, compressible flow, dynamic lift and propulsion, dynamic similitude.

**4212, 4213. Thermodynamics. (2:2:0 each)** Prerequisites: M.E. 330, Math. 332. Reversible and irreversible processes, kinetic theory, introduction to statistical mechanics.

**4315. Heat and Mass Transfer. (3:3:0)** Prerequisites: M.E. 330, Math. 332. Heat transfer by conduction, convection, and radiation. Mass transfer in liquids, vapors, and gases.

## Graduate Mechanical Engineering

General requirements and more detailed information may be found in the Graduate Bulletin.

The Department of Mechanical Engineering offers advanced work in the engineering sciences of thermodynamics, heat transfer and dynamics, also courses in the engineering art consisting of computer techniques and of experimental stress analysis. The course selections for the Master of Science Degree in Mechanical Engineering may be arranged to meet the interests of the individual student. For those wishing specialization in nuclear engineering, dynamics, or electro-mechanical systems, suitable cognate work offered by the Departments of Chemical Engineering, Civil Engineering, or Electrical Engineering are available for balanced programs in these areas.

## Graduate Course Descriptions

**531, 532. Statistical Thermodynamics. (3:3:0 each)** Prerequisite: M.E. 4212. Quantum mechanics, molecular spectra, statistical mechanics, intermolecular forces.

**533. Heat Transmission. (3:3:0)** Prerequisite: M.E. 4315. The fundamental laws of the various modes of heat transmission, numerical and approximate solutions, application of the combined modes of heat transmission to design.

**534. Gas Dynamics. (3:3:0)** Prerequisite: M.E. 435. Isentropic and diabatic flow, wave phenomena, aerothermochemistry.

**538. Machine Computations. (3:3:6)** Prerequisite: Graduate standing. Linear computer elements, time and amplitude scale factors, computer techniques, computations on the repetitive analog computer and on the digital differential analyzer.

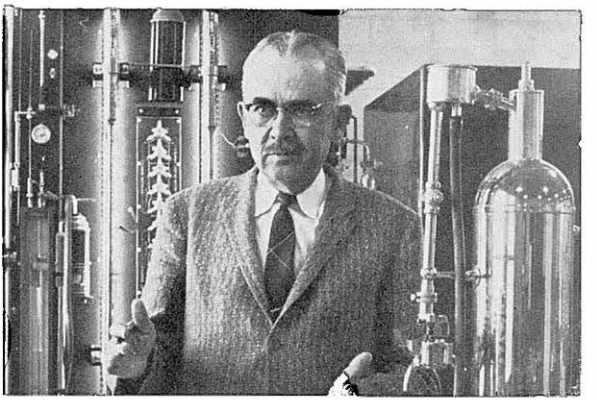
**539. Physics of Metals. (3:3:0)** Prerequisite: M.E. 422. Theory of lattice structures, dislocations and slip interference, and semi-conductors.

**5311. Experimental Stress Analysis. (3:3:6)** Prerequisite: C.E. 333, Math 332. Theory and application of electric strain gages, brittle coatings, and photo-elastic techniques to static and dynamic strain measurements.

**5312. Mechanical Vibrations. (3:3:0)** Prerequisite: M.E. 3313. Free and forced vibrations of linear and non-linear mechanical systems. Vibration of elastic bodies.

**5313. Classical Dynamics. (3:3:0)** Prerequisite: Math 332. Newton's laws, Lagrange's equations of motion, Euler's equations, precessional effects and motions, relativity effects.

**631-632. Master's Thesis. (6)**



*William Lyon Ducker, Jr., Professor of Petroleum Engineering and Head of the Department*

# Department of PETROLEUM ENGINEERING

Professor:
Mr. Ducker
Associate Professor:
Mr. Johnson
Assistant Professors:
Mr. Crawford, Mr. Rodgers
Instructor:
Mr. Carter*

*On leave 1958-1959

The petroleum engineering curriculum is concerned with the development, production, reservoir mechanics, valuation and conservation of petroleum and natural gas reserves. In addition, the curriculum deals with the specialized fields of petroleum and natural gas storage and transportation, rotary drilling fluids, well-logging methods, and secondary recovery.

The student is trained in mathematics, chemistry, physics, geology, engineering mechanics, and other related subjects embracing the background needed in the study of petroleum engineering. Advanced work in production, natural gas, and reservoir engineering prepare the student for the more specialized technical problems encountered in industry. By completing the degree requirements, the graduate is trained for employment as a field production engineer, research engineer, reservoir engineer, or valuation engineer for oil and gas companies either domestic or foreign. The student is also prepared for graduate study or a position with educational and governmental agencies such as the Texas Railroad Commission and the United States Bureau of Mines.

The reservoir and production laboratories are equipped for studies in core analysis, the colloidal properties of fluids, viscosimetry, P-V-T relationships, surface energies, permeabilities, areal sweep efficiencies, and other specialized subjects.

The natural gas laboratory is equipped for standard tests on

# PETROLEUM ENGINEERING CURRICULUM

## Bachelor of Science in Petroleum Engineering

| FRESHMAN YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Math. | 131 | Trigonometry | | 3 | |
| Math. | 133 | College Alg. | | 3 | |
| Eng. | 131 | College Rhet. | | 3 | |
| Chem. | 141 | Gen. Chem. | | 4 | |
| E. Dr. | 131 | Engr. Drawing | | 3 | |
| P. E., Band, or Basic ROTC | | | | | |
| Math. | 132 | Anal. Geom. | | | 3 |
| Math. | 231 | Calculus | | | 3 |
| Eng. | 132 | College Rhet. | | | 3 |
| Chem. | 142 | Gen. Chem. | | | 4 |
| E. Dr. | 132 | Descr. Geom. | | | 3 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 16* | 16* |

| SOPHOMORE YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Chem. | 235 | Hydrocarbon Chem. | | 3 | |
| Chem. | 236 | Anal. Chem. | | 3 | |
| Pet. E. | 230 | Petrol. Devel. Meth. | | 3 | |
| Math. | 232 | Calculus | | 3 | |
| Phys. | 235 | Engr. Physics | | 3 | |
| Phys. | 215 | Phys. Meas. | | 1 | |
| P. E., Band, or Basic ROTC | | | | | |
| C. E. | 233 | Statics | | | 3 |
| Ch. E. | 244 | Intro. to Chem. Engr. | | | 4 |
| Phys. | 236 | Engr. Physics | | | 3 |
| Phys. | 216 | Phys. Meas. | | | 1 |
| Math. | 332 | Diff. Equat. | | | 3 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 16* | 14* |

**SUMMER SESSION**

| | | | FIRST TERM | SECOND TERM |
|---|---|---|---|---|
| Geol. | 143 | Phys. Geol. | 4 | |
| Govt. | 233 | Amer. Govt., Org. | 3 | |
| Geol. | 144 | Hist. Geol. | | 4 |
| Govt. | 234 | Amer. Govt., Func. | | 3 |
| | | Total credit hours | 7 | 7 |

| JUNIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| C. E. | 332 | Kinematics and Kinetics | | 3 | |
| Pet. E. | 220 | Rotary Drilling Fluids | | | |
| | | or | | | |
| Pet. E. | 320 | Well-Logging Meth. | | 2 | |
| Geol. | 234 | Mineral & Petrog. | | 3 | |
| C. E. | 339 | Fluid Mechanics | | 3 | |
| C. E. | 312 | Fluid Mech. Lab. | | 1 | |
| Ch. E. | 433 | Thermodynamics | | 3 | |
| Eng. | 233 | Tech. Writing | | 3 | |
| Pet. E. | 333 | Petrol. Prod. Meth. | | | 3 |
| C. E. | 333 | Strength of Materials | | | 3 |
| Geol. | 332 | Struc. Geol. | | | 3 |
| Ch. E. | 434 | Thermodynamics | | | 3 |
| Bus. Law | 3313 | Oil and Gas Law | | | 3 |
| | | Total credit hours | | 18 | 15 |

| SENIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| E. Sem. | 412 | Engr. Seminar | | 1 | |
| Pet. E. | 414 | Prod. Lab. | | 1 | |
| Pet. E. | 433 | Reservoir Engr. | | 3 | |
| Pet. E. | 434 | Natural Gas Engr. | | 3 | |
| E. E. | 338 | Elem. of Elec. Engr. | | 3 | |
| E. E. | 318 | Elec. Engr. Lab. | | 1 | |
| Hist. | 3321 | Heritage of Amer. | | 3 | |
| M. E. | 318 | Heat Engr. Lab. | | 1 | |
| E. Sem. | 412 | Engr. Seminar | | | 1 |
| E. E. | 339 | Elem. of Elec. Engr. | | | 3 |
| E. E. | 319 | Elec. Engr. Lab. | | | 1 |
| Hist. | 3322 | Heritage of Amer. | | | 3 |
| Geol. | 433 | Petrol. Geol. | | | 3 |
| Elective | | (Technical) | | | 4 |
| | | Total credit hours | | 16 | 15 |

Minimum hours required for graduation — 140 and* P.E., Band, or Basic ROTC

natural gas and natural gasoline, measurement and calibration of flow-metering devices, and experiments in the use of regulation and control equipment. A Podbielniak automatic recording low-temperature fractional distillation apparatus is included in the laboratory equipment.

The department also maintains a drilling fluid laboratory with complete equipment necessary for each student individually to perform the standard tests determining drilling fluid characteristics. The use of special drilling fluids, recognition and control of mud contamination, properties and effects of drilling mud additives, and special drilling mud problems are included in the material covered in the laboratory.

In addition to instructional and laboratory work, field trips are conducted by the Department and the petroleum engineering student organizations to points of interest within the vast oil-producing area surrounding Lubbock. Laboratory experiments on the measurement of oil gravity, dynamometer testing of pumping equipment, and standard tests on natural gas are performed in the field by the students.

## Combination Course Mechanical Engineering—Petroleum Engineering

For the requirements for a Bachelor of Science Degree in Mechanical Engineering in a five-year combination with petroleum engineering refer to the description in the Department of Mechanical Engineering.

## Courses in Petroleum Engineering

A key to the meaning of course numbers, symbols and abbreviations, etc., appears on Page 4.

### For Undergraduates

**220. Rotary Drilling Fluids. (2:1:3)**
Prerequisite: Chem. 142. Testing methods for determining drilling fluid characteristics, drilling fluid problems, and the use of special drilling fluids. Laboratory exercises consist of the practice of altering properties of fresh water and special drilling fluids for drilling through troublesome zones with the rotary system.

**230. Petroleum Development Methods. (3:3:0)**
Prerequisite: Enrollment in Phys. 235. Exploration methods; spacing of wells; rotary and cable tool drilling methods; directional drilling; drilling hazards; oil field hydrology and well completion practices.

**320. Well Logging Methods. (2:2:0)**
Prerequisite: Pet. E. 230 and Phys. 236. A study of the theories of electrical, micro-electrical, radiation, optical, chemical and mechanical well-logging methods, and applications of these theories; field examples and problems.

**321. Phase Behavior. (2:2:0)**
Prerequisite: Phys. 236 and enrollment in Ch. E. 433 or M.E. 330. Introduction to the phase behavior of multiple component hydrocarbons systems. Application to the production of crude oil and condensate reservoirs, and to the separation of natural gasoline from natural gas.

**330. Introduction to Petroleum Industry. (3:3:0)**
Prerequisite: Junior standing in geology or engineering. A general study of the industry, including: the history of the industry; chemistry of petroleum; its occurrence in nature and its importance in the world economy; leasing and royalty; exploration, drilling, and production methods; conservation, transportation, and refining; economics of the industry.

**333. Petroleum Production Methods. (3:2:3)**
Prerequisite: Pet. E. 230 and enrollment in Ch. E. 433. Properties of reservoir fluids and characteristics of the reservoir which influence rates of recovery. Production by flowing, and pumping methods. Oil dehydration, lease operation, and lease storage. Laboratory exercises include core analysis, treatment of oil field emulsions, pumping well characteristics.

### For Undergraduates and Graduates

**413. Natural Gas Laboratory. (1:0:3)**
Prerequisite: Registration in Pet. E. 434 or 435. Natural gas analysis and testing; measurement and calibration of flow-metering devices, regulation and control devices; gas-

phase relations, and natural gasoline techniques.

**414. Production Laboratory. (1:0:3)**
Prerequisite: Registration in Pet. E. 433, or Pet. E. 430. Reserve estimation and valuation problems, miscellaneous data interpretation, and experimental design problems.

**416. Reservoir Engineering Laboratory. (1:0:3)**
Prerequisite: Pet. E. 433. Experiments relating to flow of fluids in porous media, including viscosimetry, P-V-T relationships, surface energies, relative permeability, mobility ratios and areal sweep efficiencies.

**420. Special Petroleum Engineering Problems. (2)**
Prerequisite: Senior standing and approval of the Head of the Department. Laboratory and lecture time varies.

**430. Special Natural Gas and Production Problems. (3:3:0)**
Prerequisite: Pet. E. 333. Theory, design, and operation of gas lift systems. Production problems to include gas-oil control, water control, decline curves, formation damage due to well completion and well workovers.

**433. Reservoir Engineering. (3:3:0)**
Prerequisite: Pet. E. 333. Fundamentals of fluid flow in porous media, including petrophysics, reservoir energy and producing mechanisms, and application of the material balance.

**434. Natural Gas Engineering. (3:3:0)**
Prerequisite: Pet. E. 333, Ch. E. 434. Study of the methods of production, treatment, compression, distribution, measurement, analysis, and utilization of natural gas, and the related thermodynamic principles.

**435. Advanced Natural Gas Engineering. (3:3:0)**
Prerequisite: Pet. E. 434. Study of the processes of natural gas treating, including dehydration, desulfurization, natural gasoline extraction, distillation, absorption, stripping, equilibrium, and kinetic methods.

**436. Advanced Reservoir Engineering. (3:3:0)**
Prerequisite: Pet. E. 433. Analysis of primary depletion mechanisms, including water drive, solution drive, gas-cap reservoir, and condensate reservoirs. Economic studies of secondary recovery methods.

*Raymond Kennett Flege, Professor of Textile Engineering, Head of the Department of Textile Engineering, and Associate Director for the Textile Research Laboratories*

# Department of TEXTILE ENGINEERING and TEXTILE RESEARCH LABORATORIES

Professors:
Mr. Flege, Mr. Hessler, Mr. Parsons
Instructors (Part-time):
Mr. Lofton, Mr. Power

The textile industry is a basic industry and a continuing one. The scope of the industry is illustrated by the fact that approximately 10 per cent of the national income is expended for textile products. Recent progress in the industry has opened many new fields which require high level creative ability for development. Because of the basic nature of the industry and the continued consumer demand for new and improved textile products, a textile engineering graduate may look forward to unlimited opportunities in a well-established and growing field.

Textile engineering courses of study are designed to provide fundamental training in basic science, engineering, and the humanities. Specialized instruction is included to train students in the application of those fundamental scientific principles for analyzing modern complex textile engineering and manufacturing problems.

The Department of Textile Engineering and the Textile Research Laboratories are jointly administered. Research scientists on the staff of the laboratories are thus available to serve as instructors in specialized courses offered by the Department.

This consolidated program of teaching and research permits a program of instruction that is broad in scope. Graduates are well prepared to advance rapidly in their professions, assume technical and administrative responsibilities, and formulate plans for the growth and development of the industry.

# TEXTILE ENGINEERING CURRICULUM

## Bachelor of Science in Textile Engineering

| FRESHMAN YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Math. | 131 | Trigonometry | | 3 | |
| Math. | 133 | College Alg. | | 3 | |
| Eng. | 131 | College Rhet. | | 3 | |
| Chem. | 141 | Gen. Chem. | | 4 | |
| E. Dr. | 131 | Engr. Drawing | | 3 | |
| P. E., Band, or Basic ROTC | | | | | |
| Math. | 132 | Anal. Geom. | | | 3 |
| Math. | 231 | Calculus | | | 3 |
| Eng. | 132 | College Rhet. | | | 3 |
| Chem. | 142 | Gen. Chem. | | | 4 |
| E. Dr. | 132 | Descr. Geom. | | | 3 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 16* | 16* |

| SOPHOMORE YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| Math. | 232 | Calculus | | 3 | |
| Phys. | 235 | Engr. Physics | | 3 | |
| Phys. | 215 | Phys. Meas. | | 1 | |
| T. E. | 235 | Textile Fibers | | 3 | |
| Hist. | 231 | Hist. U. S. to 1865 | | 3 | |
| P. E., Band, or Basic ROTC | | | | | |
| Chem. | 341 | Intro. Org. Chem. | | | 4 |
| Phys. | 236 | Engr. Physics | | | 3 |
| Phys. | 216 | Phys. Meas. | | | 1 |
| C. E. | 233 | Statics | | | 3 |
| Hist. | 232 | Hist. U. S. Since 1865 | | | 3 |
| P. E., Band, or Basic ROTC | | | | | |
| | | Total credit hours | | 13* | 14* |

**SUMMER SESSION**

| | | | FIRST TERM | SECOND TERM |
|---|---|---|---|---|
| Govt. | 233 | Amer. Govt., Org. | 3 | |
| Eco. | 235 | Prin. of Eco. | 3 | |
| Govt. | 234 | Amer. Govt., Func. | | 3 |
| Acct. | 231 | Indus. Acct. for Engr. | | 3 |
| | | Total credit hours | 6 | 6 |

| JUNIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| T. E. | 333 | Textile Bleaching | | 3 | |
| T. E. | 341 | Prin. of Fiber Processing I | | 4 | |
| M. E. | 330 | Engr. Thermodyn | | 3 | |
| I. E. | 332 | Indus. Org. and Mgt. | | 3 | |
| E. E. | 328 | Elem. of Elec. Engr. | | 2 | |
| E. E. | 318 | Elec. Engr. Lab. | | 1 | |
| Sophomore English | | | | 3 | |
| T. E. | 334 | Textile Dyeing | | | 3 |
| T. E. | 338 | Prin. of Fiber Processing II | | | 3 |
| C. E. | 333 | Strength of Materials | | | 3 |
| I. E. | 331 | Motion and Time Study | | | 3 |
| E. E. | 329 | Elem. of Elec. Engr. | | | 2 |
| E. E. | 319 | Elec. Engr. Lab. | | | 1 |
| Elective | | | | | 3 |
| | | Total credit hours | | 19 | 18 |

| SENIOR YEAR | | | SEMESTER | 1st | 2nd |
|---|---|---|---|---|---|
| T. E. | 439 | Cotton Mkt. and Eval. | | 3 | |
| T. E. | 445 | Fabric Design and Const. | | 4 | |
| T. E. | 435 | Textile Finishing | | 3 | |
| I. E. | 436 | Engr. Eco. | | 3 | |
| M. E. | 338 | Air Cond. or | | | |
| M. E. | 435 | Fluid Dynamics | | 3 | |
| T. E. | 430 | Mfg. Process Control | | | 3 |
| T. E. | 431 | Fabric Anal. and Adv. Design | | | 3 |
| T. E. | 428 | Mill Org. | | | 2 |
| T. E. | 432 | Man-made Fibers | | | 3 |
| T. E. | 427 | Textile Costing | | | 2 |
| Elective | | | | | 3 |
| | | Total credit hours | | 16 | 16 |

Minimum hours required for graduation — 140 and* P. E., Band, or Basic ROTC

**The Textile Research Laboratories** are available to both private and public agencies for conducting research on cotton utilization and textile manufacturing problems. The Cotton Research Committee of Texas sponsors a program of research in cotton utilization with the objective of increasing the demand for and use of Texas cotton.

A modern pilot-scale spinning research laboratory was recently put into operation under the joint sponsorship of Plains Cotton Growers and the Cotton Research Committee. This laboratory provides opportunities for a type and scope of instruction not hitherto available. Opportunities for part-time employment are available to a limited number of qualified textile engineering students.

## Courses in Textile Engineering

A key to the meaning of course numbers, symbols, abbreviations, etc., appears on Page 4.

### For Undergraduates

**235. Textile Fibers. (3:3:0)**
A study of the physical and chemical properties of natural textile fibers and their practical utility in the textile industry.

**333. Textile Bleaching. (3:2:3)**
Prerequisite: Current registration in Chem. 341. A study of the physical and chemical principles of the processes required to prepare yarns and fabrics for dyeing and finishing.

**334. Textile Dyeing. (3:2:3)**
Theory and practice of dyeing and coloring all types of textile fibers, yarns and fabrics for industrial usage.

**338. Principles of Fiber Processing II. (2-3)**
Prerequisite: T. E. 341. Technical and economic principles for converting fibers into yarn and the preparation of yarn for fabric construction.

**341. Principles of Fiber Processing I. (4:3:3)**
Fundamental principles and practices for processing raw cotton and man-made fibers into yarn.

**427. Textile Costing. (2:2:0)**
Prerequisite: T. E. 338. Basic economic and accounting principles are applied in a cost analysis of textile mill operations.

**428. Mill Organization. (2:2:0)**
Prerequisite: T. E. 338 and 445. Production operations in a textile mill are planned and scheduled. Management problems are analyzed.

**430. Manufacturing Process Control. (3:2:3)**
Methods of product testing are studied, and process performance analyzed. Test data are correlated and process control charts prepared from data obtained in mill scale operations.

**431. Fabric Analysis and Advanced Design. (3:2:3)**
Prerequisite: T.E. 445. Fabrics are analyzed to provide data required for duplication or improved design. Special loom mechanisms and techniques of design of complex fabric structures are covered.

**432. Man-made Fibers. (3:3:0)**
Physical structure and chemical properties of commercially important synthetic fibers are studied in conjunction with production processes. Principal fields of application of those fibers in industry are covered.

**435. Textile Finishing. (3:3:0)**
Prerequisite: Chem. 341. A study of processes required to convert fabrics as loomed, into products ready for use by the consumer. Engineering principles and economic aspects are emphasized.

**439. Cotton Marketing and Evaluation. (3:2:2)**
Economics of cotton marketing systems; instrumental and conventional methods of evaluating cotton fiber quality.

**445. Fabric Design and Construction. (4:2:6)**
Theory and practice of designing and constructing fabrics. Laboratory periods are devoted to an engineering analysis of automatic weaving mechanisms and their application in fabric construction.

# NON-PROFESSIONAL COURSES FOR ENGINEERING STUDENTS

In addition to the preceding professional courses, and equally important for study, are those which form much of the basic training of the engineering student. On the following pages are listed many of the courses that are required in engineering curricula but are offered by departments outside the School of Engineering. For description of courses not listed, the student should refer to the bulletin of the appropriate school.

## COURSES IN ACCOUNTING

**231. Industrial Accounting for Engineers. (3:3:0)**
Intended for engineers interested in the process and executive uses of industrial accounting. Offers a foundation in basic accounting principles, a treatment of the essentials of cost accounting theory and practice, and training in managerial aspects of accounting.

## COURSES IN AIR FORCE ROTC AND ARMY ROTC

**(See General Information Bulletin.)**

## COURSES IN BUSINESS LAW (See Finance)

## COURSES IN CHEMISTRY

**141-142. General Chemistry. (4:3:3 each)**
Prerequisite for all other courses in chemistry except 133-134. A general course in chemistry for all students of the College except those mentioned under 133-134.

**231. Qualitative Analysis. (3:2:3)**
Prerequisite: Chem. 141-142 (142 may be parallel). The qualitative separation and the detection of common cations and anions with a through consideration of underlying principles.

**232. Inorganic Chemistry. (3:3:0)**
Prerequisite: Chem. 231. A more extended consideration of those principles of chemistry which normally are not covered sufficiently in a first course.

**235. Hydrocarbon Chemistry. (3:3:0)**
Prerequisite: Chem. 141-142. A service course for petroleum engineers. The study of the chemistry of hydrocarbons with particular reference to petroleum, natural gas, and synthetic fuels.

**236. Analytical Chemistry. (3:1:6)**
Prerequisite: Chem. 141-142. A service course for petroleum engineering students. Principles of gravimetric and volumetric quantitative analysis.

**341. Introductory Organic Chemistry. (4:3:3)**
Prerequisite: Chem. 141-142. A study of the compounds of carbon. Primarily for students in agriculture and home economics. Not open to majors in chemistry for credit.

**345. Quantitative Analysis. (4:2:6)**
Prerequisite: Chem. 142 and parallel enrollment in Chem. 231. The basic methods of gravimetric and volumetric analysis. Development of laboratory techniques.

**353-354. Organic Chemistry. (5:3:6 each)**
Prerequisite: Junior standing in chemistry. A thorough foundation course in organic chemistry for chemical engineering majors, chemistry majors, premedical and other students. Prerequisite for all higher numbered courses in organic chemistry. Divided into sections according to student interest.

**441-442. Physical Chemistry I-II. (4:3:3 each)**
Prerequisite: Chem. 331-332, 5-6 semester hours in calculus. 6 semester hours in physics. Prerequisites or parallel: Chem. 353-354. The modern theories of chemistry and the methods of physicochemical measurements.

## COURSES IN ECONOMICS

**231. Principles of Economics. (3:3:0)**
An introduction to modern economic society and theories of production, exchange, and distribution.

**232. Principles of Economics. (3:3:0)**
Prerequisite: Eco. 231. A continuation of Eco. 231. The application of economic theory to current economic problems.

**235. Principles of Economics. (3:3:0)**
An abridged course for students not majoring in economics or business administration.

## COURSES IN ENGLISH

**031. Fundamentals of Writing. (3:3:0)**
Emphasis on spelling, punctuation, grammar, and remedial reading. Required of all students whose scores in the English placement test and/or whose writing shows inadequate preparation for regular college work in English. This course cannot be substituted for English 131. Credit for this course is 3 hours, but this credit will not be used to satisfy normal degree requirements.

**131-132. College Rhetoric. (3:3:0 each)**
Essentials of correct and effective writing. Reading and discussing good literature.

**133-134. Advanced Composition and Literature for Freshmen. (3:3:0 each)**
An honors course designed for those who demonstrate competence in English composition as measured by the English placement test. Expository, narrative, and descriptive writing. Reading of various types of literature.

**231-232. Masterpieces of Literature. (3:3:0 each)**
A careful study of outstanding literary masterpieces. In 231, Greek plays, Chaucer, Shakespeare, and Milton are read. In 232, instructors will select outstanding novels, poems, plays, or biographies written during the eighteenth, nineteenth, and twentieth centuries. Required course for most sophomores.

**233. Technical Writing for Engineers. (3:3:0)**
Prerequisite: 6 hours of freshman English. Techniques of verbal efficiency in the various media of engineering and scientific communication, with stress on report and research-report preparation and letter-writing. Required by most branches of engineering and by chemistry and open to students of all sciences.

## COURSES IN FINANCE (Business Law)

**338. Business Law I. (3:3:0)**
Prerequisite: 60 semester hours. Nature and source of law, courts and procedure, contracts, Texas law of separate and community property, agency.

**3313. Oil and Gas Law. (3:3:0)**
General contracts, oil and gas leases and

their interpretation, titles, royalty, proration and conservation of oil and gas, regulations governing drilling operations, government lands, cases on oil and gas.

## COURSES IN GEOLOGY

**143. Physical Geology. (4:3:2)**
An introductory study of geologic features and processes of the earth.

**144. Historical Geology. (4:3:2)**
Prerequisite: Geol. 143 or 141. An introductory study of geologic history.

**233. General Geology for Engineers. (3:2:3)**
Similar to Geol. 141-142, but a shorter course adapted to the needs of engineering students other than petroleum students.

**234. Mineralogy and Petrography for Petroleum Engineers. (3:2:3)**
Prerequisite: Geol. 143-144. Field identification and classification of minerals and rocks.

**332. Structural Geology. (3:2:3)**
Prerequisites: Geol. 141-142, and approval of instructor. Systematic analysis of the deforming processes and resultant structures in the earth's crust. Graduate credit for minors only.

**433. Petroleum Geology. (3:3:0)**
Prerequisite: Geol. 241; Physics 141-142 or 235-236, and approval of instructor. The origin, migration, and accumulation of oil and gas; petroliferous provinces.

**434. Petroleum Geology. (3:2:3)**
Prerequisites: Geol. 433, and approval of instructor. Subsurface methods; advanced principles.

## COURSES IN GOVERNMENT

**233. American Government, Organization. (3:3:0)**
A study of the constitutions and organizations of the governments of the United States, the states in general, and Texas in particular.

**234. American Government, Functions. (3:3:0)**
A study of the functions and services of the government of the United States, the states in general, and Texas in particular. This course will follow Govt. 233.

**437. Political Geography. (3:3:0)**
Study of the principal political areas of the world from the point of view of politico-geographic factors of power including size, location, population, political and social organization, natural and industrial resources, and national morale.

## COURSES IN HISTORY

**231. History of the United States to 1865. (3:3:0)**

**232. History of the United States since 1865. (3:3:0)**

**235. History of Texas. (3:3:0)**
Survey of Texas history from colonial times to the present.

**3321. The Heritage of America to 1865. (3:3:0)**

**3322. The Heritage of America since 1865. (3:3:0)**

## COURSES IN MATHEMATICS

**032. Introductory Geometry. (3:3:0)**
A course in elementary geometry open to students who cannot satisfy the plane geometry prerequisite for Math. 131. Credit for this course may not be used to satisfy normal degree requirements, and will not be allowed to students who use high school geometry for college entrance.

**051. Introductory Algebra. (5:5:0)**
A comprehensive review of high school algebra plus the topics covered in Math. 130. Only 3 of the 5 credit hours may be applied to normal degree requirements.

**052. College Algebra. (5:5:0)**
Required of engineering students whose placement test scores indicate a deficiency in high schol algebra. A comprehensive review of high school algebra plus the topics covered in Math. 133. Only 3 of the 5 credit hours may be applied to normal degree requirements. A grade of C or better in the course will entitle the student to credit equivalent to that of Math. 133. A grade of D earns credit equivalent to Math. 130. Math 131 may not be taken simultaneously with this course.

**130. Algebra. (3:3:0)**
Prerequisite: One unit of high school algebra. Review of high school algebra; quadratic equations; graphs; binomial theorem; variations; progressions. Course will not be allowed for engineering degree credit.

**131. Trigonometry. (3:3:0)**
Prerequisite: One unit of high school algebra, one unit of plane geometry, and Math. 133 or 130, or concurrent registration in Math 133 or 130. Trigonometric functions; radians; logarithms and exponential equations; solutions of triangles; functions of composite angles; identities; trigonometric equations.

**132. Analytic Geometry. (3:3:0)**
Prerequisite: Math. 133 or 130, and 131. The straight line and conic sections; transformation of coordinates, polar coordinates; parametric equations; introduction to solid analytic geometry.

**133. College Algebra. (3:3:0)**
Prerequisite: Placement test scores which indicate proficiency in high school algebra. A standard course in college algebra required of all engineering students and recommended for mathematics majors and minors.

**231-232. Differential and Integral Calculus. (3:3:0 each)**
Prerequisite: Math. 132 or concurrent registration. Differentiation; rates; maxima and minima; curvature; formal integration; definite integrals; areas; lengths; volumes; centroids; moment of inertia.

**331. Applications of Calculus. (3:3:0)**
Prerequisite: Math. 232. Surfaces; pressure work; partial differentiation; series; multiple integrals; indeterminate forms; hyperbolic functions.

**332. Differential Equations. (3:3:0)**
Prerequisite: Math. 232. Solutions of ordinary differential equations, with geometric and physical applications.

**4314, 4315. Mathematical Statistics. (3:3:0 each)**
Prerequisite: Math. 232. Frequency functions; moments; probability; correlation and regression; testing hypotheses; small sample distributions; analysis of variance; nonparametric methods; sequential analysis.

**432. Advanced Differential Equations. (3:3:0)**
Prerequisite: Math. 332. Total differential equations; systems of differential equations; partial differential equations.

**433. Theory of Equations. (3:3:0)**
Prerequisite: Math. 232. Complex numbers; polynomial equations; symmetric functions; determinants and matrices; systems of equations.

**434, 435. Advanced Calculus. (3:3:0 each)**
Prerequisite: Math. 232. Sets; functions; vector fields, partial derivatives; theory of integration; line, surface, and space integrals; introduction to complex functions and to Fourier series.

**436. Introduction to Finite Groups. (3:3:0)**
Prerequisite: Math. 232 and consent of the

instructor. Lagrange theorem; Cayley theorem; gamma groups; conjugate classes; normalizer; Sylow theory.

**437. Theory of Numbers. (3:3:0)**
Prerequisite: Math. 232. Prime numbers; congruences; theorems of Fermat, Euler, and Wilson; residues; reciprocity law; Diophantine equations.

**439. Vector Analysis. (3:3:0)**
Prerequisite: Math. 232. Scalar and vector products; gradient; divergence; curl; applications.

## COURSES IN PHYSICAL EDUCATION

**010. Introduction to Physical Education Activities. (1:1:1)**
To ascertain the student's physical efficiency and health status through standardized physical efficiency tests and medical reports which will enable the staff to prescribe a sports program that will meet each student's physical needs; to introduce the student to a variety of sports offered in the department through such media as movies, class observation, expert demonstrations, and lectures by the regular staff.
The remaining three semesters of physical education activities will be recommended to the student as to his needs from the following list of courses:

**011. Adapted Sports**
***012. Beginning Swimming**
***013. Advanced Swimming**
***014. Life Saving**
***015. Springboard Diving**
**016. Elementary Tumbling**
**017. Golf**
**018. Archery**
**019. Track and Field**
****0111. Bowling**
**0112. Weight Lifting**
****0113. Advanced Bowling**
**0114. Fly & Bait Casting**
**0121. Handball**
**0122. Badminton**
**0123. Wrestling**
**0124. Fencing (Foil)**
**0125. Social Dancing**
**0126. Fencing (Saber-Epee)**
**0127. Tennis**
**0128. Advanced Tennis**
**0141. Touch Football**
**0142. Basketball**
**0143. Soccer**
**0144. Speedball**
**0145. Softball**
**0146. Folk Dance**
**0147. Volleyball**
***0148. Water Polo**

Students who pass any one course may not repeat the same course for additional credit. These are all laboratory courses involving individual instruction.

## COURSES IN PSYCHOLOGY

**230. General Psychology. (3:3:0)**
A presentation of psychology as a biological science. Suggested as an elective for science and engineering majors and pre-medical students; lectures and demonstrations.

## COURSES IN SPEECH

**338. Business and Professional Speech. (3:3:0)**
Prerequisite: Sophomore classification. Basic principles of speech applied to the speech needs of the professional man and woman. Practice in the construction and delivery of the various types of speeches and participation in group conference, discussion, and interviews. For majors in other fields than speech.

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* Course fee, $5.
** Bowling alley charge, $10.

# BOARD OF DIRECTORS

WINFIELD D. WATKINS, Chairman, Abilene. Term Expires Feb. 19, 1959
JAMES L. LINDSEY, Vice Chairman, Midland. Term Expires Feb. 19, 1959
PARHAM C. CALLAWAY, Corpus Christi. Term Expires Feb. 19, 1959
J. EVETTS HALEY, Canyon. Term Expires Feb. 19, 1961
HAROLD HINN, Plainview. Term Expires Feb. 19, 1963
TOM LINEBERY, Kermit. Term Expires Feb. 19, 1961
DOUGLAS ORME, Big Spring. Term Expires Feb. 19, 1961
C. I. WALL, Amarillo. Term Expires Feb. 19, 1963
FLOYD A. WOOLDRIDGE, Dallas. Term Expires Feb. 19, 1963

# OFFICERS OF ADMINISTRATION

EDWARD NEWLON JONES, B.S., Ph.D., LL.D., President
121 Administration Building
GUSTAV ERNST GIESECKE, A.B., M.A., Ph.D., Vice President
121 Administration Building
JOHN ROSS BRADFORD, B.S., M.S., Ph.D., Dean of Engineering
105 West Engineering
ROBERT LEE NEWELL, B.S., M.S., Assistant Dean of Engineering
105 West Engineering

# FACULTY OF THE SCHOOL OF ENGINEERING

First date indicates year of original appointment; second date, year of appointment to present position and rank.

OTTO VINCENT ADAMS, Professor of Civil Engineering, Emeritus, 1927, 1955; Dean of Engineering, 1932-1949
B.S., in C and I. E., Colo. A. & M.; M.S.E., Michigan; D.Sc., Colo. A. & M.; Reg. Prof. Engr. (Texas)

WELDON W. ALDRICH, Instructor in Civil Engineering, 1958
B.S., M.S. in C.E., Texas A. & M.

MARGARET BRASHEARS ATKINSON, Associate Professor of Engineering Drawing, 1934, 1956
B.S., T.S.C.W.

NOLAN ELLMORE BARRICK, Professor and Head Department of Architecture and Allied Arts, and Supervising Architect, 1953
B.A., B.S., in Arch., M.A., Rice; Reg. Arch. (Texas)

JOHN ROSS BRADFORD, Professor of Chemical Engineering and Dean of Engineering, 1943, 1955
B.S. in Ch.E., M.S. in Ch.E., Texas Tech; Ph.D., Case Institute of Technology; Reg. Prof. Engr., (Ohio, Texas)

WELDON LEROY BRADSHAW, Professor of Architecture, 1938, 1943
B.S. in Arch., Texas A. & M.; Reg. Arch. (Texas)

GEORGE LINDBERGH BREELAND, Instructor in Electrical Engineering, 1957
B.S., Texas Tech

CHARLES VICTOR BULLEN, Professor and Head Department of Electrical Engineering, 1932
B.S. in E.E., Texas; M.S. in E.E., M.I.T.; Reg. Prof. Engr. (Texas)

CHARLES LOUIS BURFORD, Instructor in Industrial Engineering and Engineering Drawing, 1957
B.S. in M.E., Texas Tech

HERMAN ALVIN CARDWELL, JR., Instructor in Electrical Engineering, 1957
B.S. in E.E., Texas Tech

JAMES ALLEN CARTER, Instructor in Petroleum Engineering, 1957
B.S., Texas Tech

JAMES I. CLARK, Assistant Professor of Architecture, 1958
B.S. in Arch., U. of Michigan, Reg. Arch. (Texas, Missouri, Oklahoma, Kansas, Montana, Utah)

JOHN PAUL CRAIG, Assistant Professor of Electrical Enginering, 1957
B.S. in E.E., Texas Tech

DUANE AUSTIN CRAWFORD, Assistant Professor of Petroleum Engineering, 1958
B.S., Missouri School of Mines; M.S., Pennsylvania State

MONTY EARL DAVENPORT, Instructor in Mechanical Engineering, 1956*
B.S. in M.E., Texas Tech

CHARLES GARFIELD DECKER, Professor of Civil Engineering, 1938, 1956
B.S. in C.E., M.S. in E., Michigan; Reg. Prof. Engr. (Texas)

JOE DENNIS, Professor and Head Department of Chemistry and Chemical Engineering, 1938, 1950
B.A., Austin College; M.A., Ph.D., Texas

WILLIAM LYON DUCKER, Professor and Head Department of Petroleum Engineering, 1948
B.S., Oklahoma; Reg. Prof. Engr. (Texas, Oklahoma)

RICHARD ALBERT DUDEK, Professor of Industrial Engineering, Head of Department of Industrial Engineering and Engineering Drawing, 1958
B. S. in M.E., U. of Nebraska; M.S. in I.E., and Ph.D., U. of Iowa; Reg. Prof. Engr. (Iowa)

CHARLES LEO DUMIS, Instructor in Mechanical Engineering, 1958
B.S. in M.E., Texas Tech

RICHARD DURAN, Associate Professor of Architecture, 1951, 1956
B.A., Florida; M.S., Illinois Institute of Technology; Reg. Arch. (Texas)

BILLY HOWARD EASTER, Assistant Professor of Electrical Engineering, 1955
B.S., Texas Tech; S.M., M.I.T.: Reg. Prof. Engr. (Texas)

ANDREW JOSEPH EDMONDSON, Instructor in Mechanical Engineering, 1957
B.S., Texas Tech

BERNARD EMMITT FARRELL, Instructor in Architecture and Allied Arts, 1956
B.F.A., M.F.A., Cranbrook Academy of Art

ZELDA CLARKSON FARRELL, Part-time Instructor in Architecture and Allied Arts, 1956
B.F.A., M.F.A., Cranbrook Academy of Art

BILL WELDON FELTY, Instructor in Architecture (Part-time), 1958
B. Arch., Texas Tech; Reg. Arch. (Texas)

*On leave, 1958-1959

RAYMOND KENNETT FLEGE, Professor and Head Department of Textile Engineering, Associate Director for Textile Research Laboratories, 1954
A.B., M.S., Kentucky; M.S., in Chem. Engr., M.I.T.

STANLEY DALE FOREMAN, Instructor in Civil Engineering, 1956
B.S., Texas Tech

JIMMY GALE GENTRY, Instructor in Mechanical Engineering, 1958
B.S. in M.E., Texas Tech

HARRY FREDERICK GODEKE, Professor of Mechanical Engineering, Emeritus, 1930, 1958**
B.S. in M.E., M.E., M.S., Illinois; Reg. Prof. Engr. (Texas)

BOB FRANK GOODSON, Instructor in Electrical Engineering, 1956, 1957
B.S., in E.E., Texas Tech; Reg. Prof. Engr. (Texas, New Mexico)

L. M. GRAHAM, JR., Instructor in Engineering Drawing, 1956
B.S., M.S., North Texas State

PAUL GENE GRIFFITH, Associate Professor of Electrical Engineering, 1959
B.S. in E.E., Texas Tech; M.S. in E.E., M.I.T.; Ph.D., Stanford

LEONARD LEE GRIGSBY, Instructor in Electrical Engineering, 1957
B.S. in E.E., Texas Tech

DAVID MICHAEL GROVES, Instructor in Chemical Engineering, 1958
B.S. in Chem. E., B.A. in Chemistry, Texas Tech; M.S. in Nuc. Engr., Okla. State

EDWARD CLEGG HART, Instructor in Electrical Engineering, 1957
B.S. in E.E., Texas Tech

JAMES MONROE HARTSFIELD, Assistant Professor of Electrical Engineering, 1956
B.S. in E.E., Rice; Reg. Prof. Engr. (Texas)

DONALD JACOB HELMERS, Associate Professor of Mechanical Engineering, 1948, 1957
B.S., Texas Tech; M.S., Michigan; Reg. Prof. Engr. (Texas)

LYLE EDWARD HESSLER, Research Associate and Professor, Textile Research Laboratories, 1949, 1951
B. of Chem., M.S., Ph.D., Minnesota

EDNA NAWANNA HOUGHTON, Associate Professor of Architecture, 1932, 1957
B.S. in A.E., Texas Tech; B.A. in F.A., U.S.C.

CHARLES ERNEST HOUSTON, Professor of Electrical Engineering, 1932, 1957
B.S. in E.E., M.A., Texas Tech

JAMES D. HOWZE, Instructor in Architecture and Allied Arts, 1958
B.A. in Art, Austin College; M.S. in Design, U. of Michigan

WILLIAM LOYD JENKINS, Assistant Professor of Industrial Engineering, 1946, 1956
B.S., Texas Tech; M.S. in S.E., Georgia Tech

JACK B. JOHNSON, Instructor in Electrical Engineering, 1958
B.S. in E.E., Texas Tech

PHILIP JOHNSON, Associate Professor of Petroleum Engineering, 1947, 1957
B.S., Texas Tech; Reg. Prof. Engr. (Texas)

CLIFF HUTCHINSON KEHO, Associate Professor of Civil Engineering, 1957
B.S., Swarthmore; M.S., Harvard

ERNST WILLIE KIESLING, Instructor in Civil Engineering, 1956*
B.S. in M.E., Texas Tech

FLORIAN ARTHUR KLEINSCHMIDT, Professor of Architecture and Allied Arts, 1928, 1953
B.S. in Arch., Minnesota; M. in Arch., Harvard; Reg. Arch. (Texas)

JAMES HAROLD LAWRENCE, JR., Instructor in Mechanical Engineering, 1956
B.S. in M.E., Texas Tech

E. WALTER LEFEVRE, Instructor in Civil Engineering, 1958
B.S., M.S. in C.E., Texas A. & M.

LEE CLAIR LINDENMEIER, Associate Professor of Engineering Drawing, 1957
B.S. in C.E., Colorado State; M.A. in Ed., Colorado State College of Education

ROBERT IVAN LOCKARD, Professor of Architecture, 1935, 1953
B.S., M.S., Kansas State; Reg. Arch. (Texas)

CHARLES VERNIE LOFTON, Part-time Instructor in Textile Engineering and Research Principal in the Textile Engineering Laboratories, 1956, 1957
B.S., Texas Tech

RICHARD LOREN LOWERY, Instructor in Mechanical Engineering, 1957*
B.S., Texas Tech; M.S., Oklahoma State

EDMOND MacCOLLIN, Professor of Architecture, 1958
B. Arch., Yale; M.Arch., Cornell; Reg. Arch. (Oregon)

FRANCES MacCOLLIN, Instructor in Architecture and Allied Arts (Part-time), 1958
B.F.A., Yale

*On leave, 1958-1959
**Deceased Dec. 19, 1958

HORACE JURS MacKENZIE, Associate Professor of Industrial Engineering, 1949, 1956
B.S. in I.E., Texas Tech; M.S., Oklahoma Staae; Reg. Prof. Engr. (Texas)

KEITH ROBERT MARMION, Assistant Professor of Civil Engineering, 1955, 1957
B.S. in C.E., Denver; Reg. Prof. Engr. (Texas)

HILBERT GRADY MARTIN, Assistant Professor of Engineering Drawing, 1958
B.S., M.S., East Texas State

ROBERT E. MARTIN, Associate Professor of Mechanical Engineering, 1957
B.S., Texas Tech; M.S., Wisconsin; Reg. Prof. Engr. (Texas)

ROBERT LOUIS MASON, Associate Professor of Mechanical Engineering and College Engineer, 1942, 1957
B.S. in M.E., Texas Tech; M.S. in M.E., Kansas State; Reg. Prof. Engr. (Texas)

JAMES R. McDONALD, Instructor in Civil Engineering, 1958
B.S. in Pet. E., Texas Tech

ROBERT DOSHER MEEKS, Instructor in Electrical Engineering, 1959
B.S. in E.E., Texas Tech

CHARLES A. MGEBROFF, Instructor in Architecture and Allied Arts, 1958
B.A., B.S. in Arch., Rice; M. Arch., Columbia

ALFRED OTTO MONASCH, Assistant Professor of Mechanical Engineering, 1949
Diplom-Ingenieur, Technical Univ. of Berlin-Charlottenburg**

JAMES HAROLD MURDOUGH, Professor and Head Department of Civil Engineering, 1925, 1927
S.B., M.I.T.; M.S.E., Michigan; Reg. Prof. Engr. (Texas)

ROBERT LEE NEWELL, Professor of Mechanical Engineering and Assistant Dean of Engineering, 1941, 1956
B.S. in M.E., Texas Tech; M.S. in M.E., Georgia Tech; Reg. Prof. Engr. (Texas)

AARON GUSTAF OBERG, Professor of Chemical Engineering, 1936, 1949
B.S., M.S., Ph.D., Colorado

RODERICK PARKINSON, Assistant Professor of Architecture, 1948, 1954
B.S., M.S. in Ed., Texas Tech

CLIFFORD MARION PARRISH, Part-time Assistant Professor of Civil Engineering, 1949, 1957
B.S. in C.E., Texas Tech; M.S., Illinois

L. E. PARSONS, Professor of Textile Engineering, 1942, 1945
B.S., Texas Tech; Reg. Prof. Engr. (Texas)

CONNER COLUMBUS PERRYMAN, Professor of Engineering Drawing, 1929, 1947
B.S., North Texas State; Reg. Prof. Engr. (Texas)

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B.S. in T.E., Texas Tech; M.S. in Textile Technology, M.I.T.

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B.S. in M.E., Texas Tech; M.S. in E.M., Texas; Reg. Prof. Engr. (Texas)

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B.S. in Gen. Engr., Texas A. & I.

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B.S. in C.E., New Mexico; M.S., Oklahoma State

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Licencie en Sciences Chimiques, Universite Paul Pastur, Belgium; Ingenieur-Chimiste, Universite de Nancy, France

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B.S. in M.E., Texas; Reg. Prof. Engr. (Texas, New Mexico)

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B.S. in Pet. E., Louisiana State; M.S. in Pet. E., U. of Texas

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B.S., Texas Tech

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B. S. in E.E., Illinois Institute of Technology; Reg. Prof. Engr. (Texas)

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B.F.A., M.A., Ph.D., Ohio State

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B.S. in C.E., M.S. in Traffic Engr., Texas A. & M.

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B.F.A., Alfred

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B.S., M.S., Ph.D., Washington

## TEACHING FELLOWS

DON AVERY DUENKEL, 1958
B.S. in Chem. E., Texas Tech

LEE THEODORE HANNAH, 1958
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GEORGINA CONNER, Administrative Assistant, Office of the Dean of Engineering, 1932
B.A., New Mexico

CAROL CROUCH GATLIN, Secretary, Office of the Dean of Engineering, 1958

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BETTY IRBY JONES, Secretary, Office of the Dean of Engineering, 1958

ILOR CLIVE LANKFORD, JR., Technician, Department of Electrical Engineering, 1953