Engineering is a profession which combines mathematics and science with creativity and design to serve the technological needs of society. The solutions provided by engineers must be technically sound, economically viable, and socially responsible. Thus, the training engineers receive is extensive and rigorous.

A sound high school preparation in mathematics, science, and English is an essential foundation for any undergraduate engineering curriculum. Prospective engineering students should take advantage of high school honors and advanced placement courses when they are available and seek to apply mathematics and computer programming in their science courses. All engineers must be skilled in reading and composition. Therefore, students should begin the study of engineering with a good high school preparation in critical reading and writing. Additionally, although a foreign language is not required for an engineering major, proficiency in a foreign language can be valuable in an engineering profession, and there are opportunities to continue foreign language study in an engineering curriculum.

ENGINEERING PROGRAMS

The standard four-year undergraduate curricula of the College of Engineering lead to the degrees of Bachelor of Chemical Engineering, Bachelor of Civil Engineering, Bachelor of Electrical Engineering, Bachelor of Environmental Engineering, and Bachelor of Mechanical Engineering. The College of Engineering and the College of Arts and Science also offer a joint five-year program which leads to a bachelor’s degree in one of the engineering majors as well as a bachelor’s degree from the College of Arts and Science. (See page 165.) Additionally, the College of Engineering and the College of Business and Economics offer a joint five-year program which leads to a baccalaureate degree in an engineering major and a Master of Business Administration degree from the College of Business and Economics. Admission to this program is by application to the Dean of Engineering during the third year of engineering study. All engineering programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). The University’s Air Force ROTC program is also administered through the College of Engineering.

In addition to academic programs, the College of Engineering also maintains the Resources to Insure Successful Engineers (RISE) Program. RISE provides financial assistance, counseling, and social support to students from minority groups which are underrepresented in engineering. The program begins with a pre-freshman Summer Academy and continues to graduation. Interested individuals should contact the RISE Program Director in the Office of the Dean of Engineering.

CURRICULUM ORGANIZATION

The curriculum in each engineering major consists of three basic parts: (1) a core group of technical courses, (2) an elective group of technical courses, and, (3) an elective group of general education courses.

The core group generally includes courses in mathematics, chemistry, physics, computer science, and engineering. The engineering courses begin in the first year and culminate in design-oriented courses in the senior year. Because the technical courses build upon one another, it is very important that a good foundation is established in prerequisite mathematics, science, and engineering courses before the follow-on technical courses are attempted.

The technical elective courses allow students to investigate the sciences in more depth and to develop a concentration within their own discipline. Technical electives also allow students to broaden their perspective in related areas outside their primary field of study.

The general education courses are chosen from the liberal arts to provide a well-rounded education. The complete general education program consists of 24 or 25 credit hours that include the University freshman writing and multicultural course requirements, the College of Engineering requirement for 18 credits chosen from the humanities and social sciences, and 3 or 4 additional credits required by the
individual engineering departments. The College's humanities and social sciences requirements are described in the following section. The specific requirements of each engineering department are given in the appropriate departmental section.

COLLEGE GENERAL EDUCATION PROGRAM

A broad outline of the College of Engineering General Education Program is given below. Detailed guidelines, which include a list of courses which may be used to satisfy the program's requirements, may be obtained from the Office of the Dean of Engineering.

The College of Engineering requires that six courses (minimum of 18 credits) be chosen from the humanities and social sciences subject to the constraints listed below and the approval of the student's faculty adviser. The courses selected must provide both breadth and depth and not be limited to a selection of unrelated introductory courses. The University's multicultural course requirement may be included in this set of six courses. (See page 21)

a) At least two courses (minimum of six credits) must be in the humanities. Humanities include Art History, English (except ENGL 110 and other writing skills courses), Foreign Languages and Literatures (except introductory skills courses), Foreign Languages (except the student's native language and introductory skills courses), History, Music (except skills and performance courses), Philosophy, and Theatre (except skills and performance courses).

b) At least two courses (minimum of six credits) must be in the social sciences. The social sciences include Economics (EE majors require ECON 151 or another approved course), Linguistics (except introductory skills courses), Political Science, Psychology, and Sociology.

c) At least two courses (minimum of six credits) must be above the introductory level, and each must build upon the content of a previous course, as approved by the faculty adviser.

d) At least two of the six courses (minimum of six credits) must be thematically related, typically in the same department or program. (Chemical Engineering majors have an additional requirement.)

Courses classified as "Group D" (mathematics and science) by the College of Arts and Science may not be used to satisfy any General Education Program requirement. Students must consult their faculty advisers and the guidelines published by the College of Engineering for the proper classification of general education courses.

COLLEGE REGULATIONS

The College requires each engineering student to consult with his or her academic adviser at least twice a year during the designated University advanced registration periods. Students must also obtain approval from their advisers to take courses during the Winter or Summer Sessions and when adding or dropping courses.

Each of the four engineering departments has established minimum academic standards for certain courses and for progression to the sophomore or junior level. The specific standards for each department are given in the appropriate departmental section.

To graduate, all students must satisfy the University's requirements for graduation as stated on page 21. Additionally, engineering students must have at least a 2.0 average in all engineering, mathematics, and science courses used to fulfill graduation requirements. If a course is repeated, only the last grade will be used to compute the engineering grade-point average; however, all grades are used to compute the University's cumulative grade-point index.

CLASS OPENINGS FOR NONMAJORS

Most courses in the College of Engineering are closed to nonmajors because of limited classroom and laboratory space. Nonmajors with special reasons for enrolling in engineering courses must contact the department chairperson (not the course instructor) to obtain permission to enroll in closed courses. Students who successfully complete closed engineering courses in which they have enrolled without the prior permission of the department chairperson will not automatically be admitted into the engineering major.

Some engineering courses are open to nonmajors. These courses do not need special permission to take engineering courses that are part of their curriculum. Students minoring in Civil Engineering are admitted to a large number of civil engineering courses. The requirements for this minor are described in the Civil Engineering section of this chapter.

TRANSFER STUDENTS

The College of Engineering admits a small number of transfer students each year during the fall and spring semesters. Because enrollment in engineering courses is normally restricted to departmental majors, prospective transfer students may not register for engineering courses without prior approval from the chairperson of the appropriate engineering department. The need to control class size and total enrollment in each of the departments frequently requires that nonmajors be administratively removed from class lists following the registration period. Students who transfer into other colleges at the University with the intention of transferring into the College of Engineering at a later time should be aware that the same evaluation process will be used to determine their eligibility to transfer into engineering from within the University.

The engineering curriculum at the University of Delaware is rigorous and has relatively little flexibility. Engineering courses begin in the first semester of the freshman year. Once a freshman class has been admitted, only a limited number of spaces become available within that cohort as it moves through to graduation. Transfer students from outside the University who wish to enter the programs of the College of Engineering are considered along with freshman applicants unless it is judged that they have completed sufficient work to be able to finish their engineering program in three years or less. Candidates for admission as sophomores or juniors will be considered in competition with students transferring internally at the University of Delaware. Since the number of openings is limited in each engineering department, selection for transfer into the College is very competitive. Successful transfer applicants will have a good record in mathematics, science, and engineering courses taken during their last year as a full-time student.

University of Delaware students who wish to transfer into a department of the College of Engineering must make a formal request to the appropriate chairperson by May 1 for entrance in the fall semester or by December 1 for entrance in the spring semester. The student should contact the department office well in advance of these deadlines to determine the specific information that must be included in the application.

Students from outside the University of Delaware who wish to transfer into the College of Engineering must make a formal application through the University Admissions Office by March 1 for entrance in the fall semester or by November 15 for entrance in the spring semester.

All students who wish to transfer into the College of Engineering should contact the Assistant Dean (135 du Pont Hall, (302) 831-8659) to discuss curriculum requirements and transfer policies before beginning the application process.
MATERIALS SCIENCE PROGRAM

Although the Materials Science Program offers no degrees at the undergraduate level, undergraduate students study the basic concepts associated with the engineering properties of materials in courses taught by the Materials Science Program faculty. The introductory course MASC 302 is required by chemical, civil, and mechanical engineering majors, and is a prerequisite for the interdepartmental advanced offerings that are available as technical electives. Students in mechanical engineering may elect a Solid Mechanics and Materials option that consists of twelve credits in the area of mechanics and materials. In addition, all engineering departments offer senior projects concerned with the properties of materials. These technical elective courses are strongly recommended for students intending later to pursue Master's or Doctoral degrees in Materials Science and Engineering.

CHEMICAL ENGINEERING

Chemical engineering is particularly identified with applied and physical chemistry, materials science, and increasingly with biology. Engineering occurs when these basic sciences are transformed into quantitative models and reliable systems are built. Chemical engineering is in the forefront of many areas of current technology, including genetic engineering, the development of artificial organs, and the development of nanometer-scale materials. Other areas in which the BS chemical engineer is involved include process development, product development, manufacturing, research and development, process design, and sales. Many research opportunities, however, require an advanced degree.

Chemical engineering analysis is creative, quantitative, applied, and specific. A high degree of creativity is needed to express problems in chemical engineering in ways that give new and effective solutions. It is quantitative, with solutions that state "how much," "how many," and "at what cost." Chemical engineering is applied in the work product almost always is aimed toward problems that are to be solved within five years and typically lead to commercial products. Chemical engineering models apply to a specific configuration of equipment or to a defined product.

Delaware's curriculum in chemical engineering reflects a strong commitment to an early start in the profession. In the freshman year, the course CHEG 112 applies the student's background in science and mathematics to the solution of several engineering problems. Physical Chemistry is introduced earlier than in many other schools, enabling much of the chemical engineering science background to be completed by the end of the third undergraduate year. As a result, the fourth year provides opportunities for in-depth pursuit of technical topics of special interest.

This early encounter with the discipline enables the student who has made an inappropriate choice to transfer out of chemical engineering. However, it makes it difficult for students to transfer into this curriculum during their sophomore or junior years unless the science requirements, especially in chemistry, have been met. Students should note that the course CHEG 112 is a prerequisite for CHEG 231, which in turn is a prerequisite for the courses CHEG 325 and 341. These courses are available only in the semesters indicated in the curriculum outlined below.

DEGREE: BACHELOR OF CHEMICAL ENGINEERING

MAJOR: CHEMICAL ENGINEERING

CURRICULUM

UNIVERSITY REQUIREMENTS

ENGL 110  Critical Reading and Writing**

CHEM 111  General Chemistry***

CHEG 009  Chemical Engineering Freshman Seminar

CHEG 112  Introduction to Chemical Engineering

CHEG 231  Chemical Engineering Thermodynamics

CHEG 325  Chemical Engineering Thermodynamics

CHEG 332  Chemical Engineering Kinetics

CHEG 341  Fluid Mechanics

CHEM 331  Organic Chemistry

CHEG 333  Organic Chemistry Laboratory I (lecture only)

CHEG 332  Organic Chemistry

MATH 242  Analytic Geometry and Calculus B:

MATH 243  Analytic Geometry and Calculus C

MATH 302  Ordinary Differential Equations I

MATH 303  Ordinary Differential Equations Lab

MATH 305  Applied Math for Chemical Engineering

PHYS 207  Fundamentals of Physics I

PHYS 208  Fundamentals of Physics II

General Education Program

An additional three-credit general education course must be taken in the humanities or social sciences. Furthermore, three of the general education courses (minimum of nine credits) must be in the same department or program, and at least one of these three courses must be above the introductory level. Courses classified as "Group D" by the College of Arts and Science may not be used to fulfill this requirement.

Within the College

MASC 302  Materials Science for Engineers

CHEG 473  Chemical Engineering Projects

CHEM 401  Chemical Process Dynamics and Control

CHEG 472  Chemical Process Analysis

DEGREE REQUIREMENTS

See page 152: College General Education Program

MAJOR REQUIREMENTS

External to the College

Chemistry

CHEM 111  General Chemistry***

CHEM 112  General Chemistry

CHEM 119  Quantitative Chemistry I

CHEM 122  General Chemistry

CHEM 341  Organic Chemistry

CHEM 441  Organic Chemistry Laboratory I

MATERIALS SCIENCE PROGRAM

The College of Engineering offers a Materials Science Program that provides courses in the field of materials science and engineering. These courses are designed to provide students with a strong foundation in the principles of materials science and to prepare them for careers in the materials industry or further study in the field.

The Materials Science Program offers a variety of courses, including those in materials science, materials engineering, and materials processing. Students have the opportunity to take courses in areas such as materials research, materials characterization, and materials design. The program also offers students the opportunity to work on research projects with faculty members, gaining hands-on experience in the field.

In addition to the course work, students in the Materials Science Program have the opportunity to participate in extracurricular activities, such as the Materials Science Society, which provides a network for students interested in the field.

The program is designed to provide students with the knowledge and skills necessary to succeed in the materials science and engineering field. Students who complete the program will be well-prepared for careers in a variety of industries, including aerospace, automotive, and healthcare, as well as for graduate study in the field.

This program is open to all students, regardless of their major. Students who are interested in the field of materials science and engineering are encouraged to explore the program and to take advantage of the resources available to them.
Technical Electives†

General Technical Electives

The purpose of the technical electives is to advance the scientific or engineering background of the chemical engineers. The technical electives program consists of a minimum of nine credits taken from courses in the following list, normally three courses. At least two of these courses (six credits) must be at the intermediate level (generally 300-400). Students should select their technical electives in the spring of sophomore year to avoid scheduling conflicts. Students should formulate an academic plan for their technical and chemical engineering electives with the assistance of their academic advisers.

Biology

BISC 207 Introductory Biology *** 4
BISC 208 Introductory Biology II *** 4
BISC 301/311 Molecular Biology of the Cell 4/3
BISC 303 Genetics and Evolutionary Biology 4
BISC 305 Cell Physiology 4
BISC 306 General Physiology 4
BISC 371 Introduction to Microbiology 4
BISC 4xx Biology course chosen with the approval of the adviser 3-4

Chemistry

CHEM 334 Organic Chemistry Lab II 2
CHEM 457 Instrumentation Methods 3
CHEM 457 Inorganic Chemistry 3
CHEM 527 Introductory Biochemistry 3
CHEM 5xx Chemistry course chosen with the approval of the adviser 3
CHEM 6xx Chemistry course chosen with the approval of the adviser 3

Computer Science

CISC 181 Introduction to Computer Science *** 3
CISC 220 Data Structures 3
CISC 260 Machine Organization and Microcomputers 3
CISC 310 Logic and Programming 3
CISC 360 Computer Architecture 3
CISC 361 Operating Systems 3
CISC 640 Computer Graphics 3

Mathematics

MATH 334 Elements of Linear Systems 3
MATH 389 Graph Theory 3
MATH 425 Introduction to Numerical Analysis and 3
Algorithmic Computation 3
MATH 428 Algorithmic and Numerical Solution of Differential Equations 3
MATH 5xx Mathematics course chosen with the approval of the adviser 3
MATH 6xx Mathematics course chosen with the approval of the adviser 3

Mechanical Engineering Applied Mathematics

MEEG 361 Applied Engineering Analysis 3
MEEG 663 Engineering Analysis I 3
MEEG 664 Engineering Analysis II 3

Physics

PHYS 209 Fundamentals of Physics III *** 3
PHYS 313 Classical Mechanics I 3
PHYS 6xx Physics course chosen with the approval of the adviser 3

Statistics

STAT 450 Statistics for the Engineering and Physical Sciences 3
STAT 6xx Statistics course chosen with the approval of the adviser 3

Electronic Materials

[please note prerequisites]
ELEG 205 Linear Circuit Theory *** 4
ELEG 210 Introduction to Combinatorial Logic *** 2
ELEG 211 Introduction to Sequential Circuits *** 2
ELEG 314 Electronics and Instrumentation 4
ELEG 340 Solid State Electronics 3
ELEG 623 Electrical Properties of Materials I 3
ELEG 626 Integrated Circuits 3
ELEG 629 Digital Structures 3

Materials Science/Engineering

MASC 406 Corrosion and Protection 3
MASC 6xx (except for courses that are cross-listed with CHEG) 3
MASC 8xx With approval of adviser 3

MEEG 316 Materials Engineering 3
MEEG 410 Experimental Mechanics for Composite Materials 3
MEEG 617 Composite Materials 3

Mechanics

CIEG 301 Analysis of Structures *** 3
CIEG 311 Dynamics *** 3
MEEG 213 Principles of Mechanics I *** 3
MEEG 214 Principles of Mechanics II *** 3
MEEG 313 Strength of Materials 4
MEEG 413 Advanced Mechanics of Materials 3
MEEG 415 Finite Element Analysis 3

Environmental Engineering

CIEG 432 Water and Wastewater Quality 3
CIEG 433 Hazardous Waste Management 3
CIEG 435 Industrial Waste Management 3
CIEG 457 Water and Wastewater Quality 3

Chemical Engineering Technical Electives

The curriculum provides three chemical engineering technical electives in the junior year. These courses are intended to provide some flexibility in selecting a chemical engineering program at the advanced level. Students should decide with the assistance of their adviser if they should conduct a program of independent research and then choose their course elective(s). Chemical engineering technical electives are defined as follows:

Any Chemical Engineering course numbered 466 and above; UNIV 401-UNIV 402 Senior Thesis directed by a Chemical Engineering Faculty; any 600- or 800-level course in Chemical Engineering Courses at the 600 and 800 level are graduate courses open, with the consent of the instructor, to students in senior standing.

Concentrations

The technical electives and the chemical engineering electives can be coupled to provide a more intense concentration in an area of interest. The groupings below are some examples of this approach.

Biological Applications

CHEG 325 Introduction to Biochemistry 3
CHEG 320 Biochemical Engineering 3
CHEG 610 Industrial and Engineering Chemistry 3

Environmental Applications

CHEG 311 Dynamics *** 3
CHEG 301 Introduction to Catalysis 3
CHEG 437 Water and Wastewater Quality 3

Physical Applications

CHEG 325 Introduction to Biochemistry 3
CHEG 320 Biochemical Engineering 3
CHEG 610 Industrial and Engineering Chemistry 3

CHEG 836 Advanced Chemical Engineering 3

CREDITS TO TOTAL A MINIMUM OF............................... 128

DEPARTMENTAL STANDARDS

The department has rigorous standards for admission into the courses in the department. These standards have evolved over time and are intended to promote success in the sequential development of the material. In general, students must have a minimum grade of C- in all chemical engineering prerequisite courses to qualify for admission to the next course.

Admission to CHEG 231:
1) A minimum grade of C- in CHEG 112.
2) A minimum grade of C- in MATH 243.

Admission to CHEG 320:
1) A minimum grade of C- in MATH 302.

Admission to CHEG 325:
1) A minimum grade of C- in CHEG 231.

Admission to CHEG 332:
1) A minimum grade of C- in CHEG 325.
2) A minimum grade of C- in MATH 302.

†Note: The technical elective program is under constant review by the faculty. An updated list is available in the department office. Students should check with their advisers before selecting courses and should be aware that a formal mechanism exists to provide additional flexibility in selection of their Technical Elective courses. Students should select their technical electives during the spring of the sophomore year to avoid scheduling conflicts. The Technical Electives may be coupled with the Chemical Engineering Technical Electives to obtain a technical concentration.

**These courses are introductory.

Any three-credit combination of CHEM 333 (1 credit when the 2 credit option is chosen) 334, 438, 446, and 458 may be used as an upper level technical elective.
Admission to CHEG 341:
1) A minimum grade of C- in CHEG 231.
2) A minimum grade of C- in MATH 302.

Admission to CHEG 342:
1) A minimum grade of C- in CHEG 341.

Admission to CHEG 345:
1) A minimum grade of C- in CHEG 325.
2) Admission to CHEG 342.

Admission to CHEG 443:
1) A minimum grade of C- in CHEG 332.

Admission to CHEG 445:
1) A minimum grade of C- in CHEG 341.
2) A minimum grade of C- in CHEG 342.
3) Admission to CHEG 443.

Admission to CHEG 401:
1) A minimum grade of C- in CHEG 443.

Admission to CHEG 432:
1) A minimum grade of C- in CHEG 320.
2) A minimum grade of C- in CHEG 332.
3) A minimum grade of C- in CHEG 443.

Graduation Requirements:
1) A "P" (pass) in CHEG 009.
2) A minimum grade of C- in all other Chemical Engineering courses counted towards graduation.

TRANSFER STUDENTS
Students within the University who wish to transfer as sophomores in the fall semester should make a formal request to the Chair by May 1. Unless the case is exceptional, a change-of-major application will only be considered after completion of the following minimum requirements:
1) An overall grade-point index of 2.0.
2) A minimum grade of C- in CHEG 112, Introduction to Chemical Engineering, is required if the course has been taken.
3) A minimum grade of C- in each of the following groups of courses: CHEM 111, CHEM 112, General Chemistry; MATH 242 and 243, Analytic Geometry and Calculus; and PHYS 207, Fundamentals of Physics I.

Completion of these minimum requirements does not guarantee admission as a chemical engineering major.

Prospective students who contemplate beginning the program in Chemical Engineering in February, rather than in September, should consult with the Chemical Engineering Department.

Chemical Engineering courses designated by the CHEG prefix are closed to nonmajors. Students seeking exception should contact the Chemical Engineering Department.

CHEMICAL ENGINEERING CURRICULUM—MASTER'S-BACHELOR'S PROGRAM
This four-year program is designed to enable exceptional students with excellent high school backgrounds to obtain a Bachelor of Chemical Engineering degree and a Master of Chemical Engineering degree in four years. This allows students to take maximum advantage of their high school education, gives them a considerable jump over students going the normal bachelor's degree-master's degree route, including a year gained, and reduces redundancy in the total educational program. The program is designed for each individual; the following is considered typical.

The requirements and procedures of the program are:
1) The student is assumed to be qualified for a sufficient amount of credit by advanced placement to omit the entire freshman year on the basis of demonstrated ability in mathematics, chemistry, physics, English and humanities. Certification of the level of the advanced standing is made in the usual way on the basis of CEEB or departmental examinations. CHEG 112, Introduction to Chemical Engineering, is waived upon evidence of suitable self-study.
2) Formal admission to the program and provisional admission to graduate school are provided to students upon request at the end of their second year in the program, or to those who have attained the status of such students, provided an overall grade-point average of at least 3.25 has been attained.
3) If differences exist between graduate and undergraduate fees for a particular student, the undergraduate fee structure applies through the end of the first semester of the third year.
4) Credit toward the B.Ch.E. degree for two technical electives is provided by the graduate-level work. The omitted technical electives would normally be the two senior project (thesis) courses. Thus, the combined program represents a contraction of 9 credits from the normal sequence of a B.Ch.E. degree followed by enrollment in the usual 30-credit graduate program; 6 credits are saved by the student's carrying out only one thesis and the other 3 from waiving CHEG 112, as noted earlier.
5) The program involves a light course load in the final year to enable the student to meet the demands of the graduate thesis at that time.
6) It is desirable for purposes of professional registration that a student be graduated from an accredited undergraduate program and for this reason both degrees (B.Ch.E. and M.Ch.E.) are to be awarded. The student will receive the B.Ch.E. degree upon completion of the third year of the sample program below with a grade-point average at least 2.0. (This program exceeds the normal credit requirements for a B.Ch.E. degree.)

A student who elects to return to a standard B.Ch.E. program and to omit the M.Ch.E. degree will be awarded the B.Ch.E. upon completion of the regular requirements for that degree.
7) To obtain the M.Ch.E. degree the student must meet a grade-point average of at least 3.0 in the 30 credits of graduate work.

DEGREE: BACHELOR OF CHEMICAL ENGINEERING and MASTER OF CHEMICAL ENGINEERING

MAJOR: CHEMICAL ENGINEERING

CURRICULUM

UNIVERSITY REQUIREMENTS
ENGL 110 Critical Reading and Writing** 3 15
Three credits in an approved course or courses stressing multicultural, ethnic, and/or gender-related content #

COLLEGE REQUIREMENTS
General Education Program
See page 152: College General Education Program

MAJOR REQUIREMENTS
External to the College
Chemistry
CHEM 443 Physical Chemistry 3 15
CHEM 444 Physical Chemistry 3 15

*Superior figures indicate semester (fall or spring) and/or year or years in which the course should be taken, i.e. 1 1/2 of freshman year, 2 1/2 of sophomore year, etc.
**Minimum grade of C- required.
#This requirement may be fulfilled through a course or courses taken to complete other degree requirements; it cannot be fulfilled by a course taken pass/fail. See page 21.
†This curriculum assumes that the following courses have been granted by advanced placement or the equivalent. It is necessary to have 28-30 credits of advanced placement to participate in the program outlined above. The schedule will be adjusted for the accomplishments of the student by the faculty advisor.
AP Chemistry—8 credits, AP Calculus—8 credits, AP Physics—4 credits, AP English—6 credits, AP Humanities—6 credits.

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The Civil and Environmental Engineering Department offers programs which lead to the degrees of Bachelor of Civil Engineering and Bachelor of Environmental Engineering. The civil engineering curriculum prepares graduates to enter the broad profession of modern civil engineering with the opportunity for more in-depth study in a special area of interest through the choice of technical electives. The environmental engineering curriculum is more narrowly focused to prepare graduates to deal with the causes, control, and prevention of environmental contamination and also offers opportunities for more in-depth study in the areas of environmental facilities design and construction and pollution transport and control processes.

**DEPARTMENTAL POLICIES**

To be enrolled in 300 or 400-level civil engineering or mechanics courses, civil and environmental engineering majors must have attained at least a C- grade in MATH 241, MATH 242, and PHYS 207. Furthermore, civil engineering majors must attain at least a C- in CHEM 103 and CHEM 104, and environmental engineering majors must earn at least a C- in CHEM 11 and CHEM 112.

Engineering students must have a minimum grade point average of 2.0 for all required courses in mathematics, science, and engineering in order to earn a degree. If courses are retaken to meet this requirement, only the most recent grade received in any repeated course will be used by the department in computing the average.

In general, 300 and 400-level course in civil engineering are open only to students majoring in civil or environmental engineering. Students who have declared a civil engineering minor and students enrolled in other departments of the College of Engineering can be enrolled in 300 and 400-level civil engineering courses with the approval of their home department advisor. In some instances, other students may be permitted to enroll in selected 300 and 400-level courses, but they must have the permission of both the course instructor and the chair of the Civil and Environmental Engineering Department.

**DEGREE: BACHELOR OF CIVIL ENGINEERING**

**MAJOR: CIVIL ENGINEERING**

**CURRICULUM**

**UNIVERSITY REQUIREMENTS**

- ENGL 110 Critical Reading and Writing** 3

**Three credits in an approved course or courses stressing multicultural, ethnic, and/or gender-related content #** 3

**COLLEGE REQUIREMENTS**

**General Education Program**

See page 152: College General Education Program.

**MAJOR REQUIREMENTS**

External to the College

- ENGL 410 Technical Writing 3

**Chemistry**

- CHEM 103 General Chemistry 4

**Mathematics**

- MATH 241 Analytic Geometry and Calculus A 4

**Physics**

- PHYS 207 Fundamentals of Physics I 4

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*Superior figures indicate semester (fall or spring) and/or year or years in which the course should be taken, i.e. 15 fall of freshman year, 25 spring of sophomore year, etc.

**Minimum grade of C- required.

#This requirement may be fulfilled through a course or courses taken to complete other degree requirements; it cannot be fulfilled by a course taken pass/fail. See page 21

#CHEG 472 Chemical Engineering Projects can be substituted for CHEG 445 with advisor's approval. This option is only available for students who received a minimum grade of B in CHEG 345

Note that UNV 401-402 is equivalent to CHEG 473-474

Credit value for CHEG 432 changes from 3 to 4, effective in term 97F
The technical elective program is under constant review by the faculty. An updated list is available in the department office. Students should check with their advisers before selecting courses and should be aware that a formal mechanism exists to provide additional flexibility in the selection of their technical elective courses.

## TECHNICAL ELECTIVES

The Civil Engineering curriculum contains four technical elective courses that give students the opportunity to complete their education by concentrating in an area of special interest. The required course curriculum provides the basis in mathematics, science, the applied engineering sciences, and engineering design that students need for future work and enhances their general education background. However, it only gives students an introduction to each of the major areas of civil engineering offered by the program: Structural and Geotechnical Engineering, Environmental Engineering and Water Resources, Hydraulics and Ocean Engineering, and Transportation Engineering.

The following are suggestions for courses to choose from if the student wants to concentrate in one of the above mentioned areas or wants a general civil engineering degree that further supports the breadth of the required course curriculum.

### General Civil Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIEG 223</td>
<td>Surveying</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 401</td>
<td>Computer Methods of Structural Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 402</td>
<td>Steel Design</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 403</td>
<td>Concrete Design</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 421</td>
<td>Foundations and Substructures</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 431</td>
<td>Water Supply Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 432</td>
<td>Wastewater Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 441</td>
<td>Hydrology</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 442</td>
<td>Hydraulic Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 471</td>
<td>Introduction to Coastal Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EGGG 432</td>
<td>Principles of Computer-Aided Drawing</td>
<td>3</td>
</tr>
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</table>

### Environmental Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIEG 403</td>
<td>Concrete Design</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 421</td>
<td>Foundations and Substructures</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 431</td>
<td>Water Supply Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 432</td>
<td>Wastewater Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 433</td>
<td>Hazardous Waste Management</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 435</td>
<td>Industrial Waste Management</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 437</td>
<td>Water and Wastewater Quality</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 441</td>
<td>Hydrology</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 442</td>
<td>Hydraulic Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 471</td>
<td>Introduction to Chemical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 478</td>
<td>Remote Sensing in Environment</td>
<td>3</td>
</tr>
<tr>
<td>GEOL 413</td>
<td>Fundamentals of Well Logging</td>
<td>3</td>
</tr>
<tr>
<td>GEOL 421</td>
<td>Environmental and Applied Geology</td>
<td>3</td>
</tr>
<tr>
<td>GEOL 428</td>
<td>Hydrogeology</td>
<td>3</td>
</tr>
<tr>
<td>MEEG 307</td>
<td>Thermodynamics I</td>
<td>3</td>
</tr>
</tbody>
</table>

### Hydraulic and Ocean Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIEG 441</td>
<td>Hydrology</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 421</td>
<td>Foundations and Substructures</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 422</td>
<td>Earth Structures Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 431</td>
<td>Water Supply Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 401</td>
<td>Computer Methods of Structural Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 403</td>
<td>Concrete Design</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 471</td>
<td>Introduction to Coastal Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 442</td>
<td>Hydraulic Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MEEG 361</td>
<td>Applied Engineering Analysis</td>
<td>3</td>
</tr>
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</table>

### Structures and Geotechnical Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIEG 223</td>
<td>Surveying</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 401</td>
<td>Computer Methods of Structural Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 402</td>
<td>Steel Design</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 403</td>
<td>Concrete Design</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 404</td>
<td>Prestressed Concrete Design</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 405</td>
<td>Matrix Structural Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 406</td>
<td>Structural Materials</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 411</td>
<td>Structural Dynamics Design</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 415</td>
<td>Reliability Design</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 416</td>
<td>Random Vibration</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 417</td>
<td>Advanced Structural Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 418</td>
<td>Continuously Supported Structures</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 421</td>
<td>Foundations and Substructures</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 422</td>
<td>Earth Structures Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 459</td>
<td>Railroad Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 467</td>
<td>Introduction to Bridge Design</td>
<td>3</td>
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</table>

### Transportation Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIEG 223</td>
<td>Surveying</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 452</td>
<td>Transportation Facilities Design</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 454</td>
<td>Urban Transportation Planning</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 459</td>
<td>Railroad Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 486</td>
<td>Engineering Management</td>
<td>3</td>
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<tr>
<td>GEOL 328</td>
<td>Transportation Geography</td>
<td>3</td>
</tr>
<tr>
<td>STAT 420</td>
<td>Data Analysis and Nonparametric Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>

### MINOR IN CIVIL ENGINEERING

A minor in civil engineering may be earned by a student in any University bachelor’s degree program through successful completion of a minimum of 21 credits in civil engineering and engineering mechanics in accord with the following list and requirements. In addition, before beginning the civil engineering courses, the student must have credit for MATH 241, 242 and PHYS 207; must meet the usual course prerequisites; must complete successfully, CHEM 103, 104, MATH 243, 302 and PHYS 208 before being certified for the minor in civil engineering; and must have a 2.0 average in the 21 credits of the civil engineering minor and in the eight mathematics and science courses listed above.
The required engineering courses are:

- Statics, CIEG 211 ........................................ 3
- Strength of Materials, CIEG 212 (lab optional) ....... 3
- Dynamics, CIEG 213 ..................................... 3
- Fluid Mechanics, MECH 305 (lab optional) .......... 3

Further, an additional 9 credits (3 courses) in civil engineering must be taken of which at least 6 credits must be at the 300 or higher level. These courses shall be selected with the specific advice of an adviser in the Civil and Environmental Engineering Department to meet each student’s objectives. For students oriented toward earth sciences these might include CIEG 420 and CIEG 421; for those interested in the environment, CIEG 331 and 431; for those interested in urban topics, CIEG 331 and 351; for those with interests in construction and structures, CIEG 301, 303 and 402 or 403; for those interested in the oceans, CIEG 442, and CIEG 471.

Accomplishment of a minor in civil engineering has many advantages for students who are earning degrees in other sciences such as geology or in other professional areas such as business administration, but it must be understood that meeting the requirements for a minor in civil engineering without fulfilling the remaining requirements for an accredited engineering degree does not provide the breadth and depth of knowledge required to be a civil engineer.

**DEGREE: BACHELOR OF ENVIRONMENTAL ENGINEERING**

**MAJOR: ENVIRONMENTAL ENGINEERING**

<table>
<thead>
<tr>
<th>CURRICULUM</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIVERSITY REQUIREMENTS</td>
<td></td>
</tr>
<tr>
<td>ENGL 110 Critical Reading and Writing**</td>
<td>3 1F</td>
</tr>
<tr>
<td>Three credits in an approved course or courses stressing multicultural, ethnic, and/or gender-related content #</td>
<td>3 14</td>
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<thead>
<tr>
<th>COLLEGE REQUIREMENTS</th>
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<tbody>
<tr>
<td>General Education Program</td>
<td>18 14</td>
</tr>
<tr>
<td>See page 152: College General Education Program</td>
<td></td>
</tr>
</tbody>
</table>

**MAJOR REQUIREMENTS**

External to the College

- ENGL 410 Technical Writing ........................................ 3 45

**Chemistry**

- CHEM 111 General Chemistry ......................................... 3 1F
- CHEM 119 Quantitative Chemistry I ................................. 2 1F
- CHEM 122 General Chemistry .......................................... 3 15
- CHEM 120 Quantitative Chemistry II ............................... 3 15

**Mathematics**

- MATH 241 Analytic Geometry and Calculus A ...................... 4 1F
- MATH 242 Analytic Geometry and Calculus B ...................... 4 15
- MATH 243 Analytic Geometry and Calculus C ...................... 4 2F
- MATH 302 Ordinary Differential Equations ....................... 3 25

**Physics**

- PHYS 207 Fundamentals of Physics I ................................ 4 15
- PHYS 208 Fundamentals of Physics II .............................. 4 2F

**Other**

- BISC 321 Environmental Biology ..................................... 3 25
- CISC 106 General Computer Science for Engineers ............... 3 25
- STAT 450 Statistics for Engineering .............................. 3 3F

**Within the College**

- CIEG 231 Chemical Engineering Thermodynamics ................ 3 3F
- CIEG 235 Chemical Engineering Thermodynamics ................ 3 3F
- MECH 305 Fluid Mechanics ........................................... 3 35
- MECH 306 Fluid Mechanics Laboratory ............................. 1 35
- MEEG 436 Air Pollution Control .................................... 3 45

**Within the Department**

- CIEG 1xx Introduction to Environmental Engineering ........... 1 1F
- CIEG 211 Statics .................................................... 3 25
- CIEG 212 Strength of Materials .................................... 3 25
- CIEG 213 Materials Laboratory I .................................. 1 25
- CIEG 2xx Environmental Engineering Processes .................. 3 2F
- CIEG 3xx Environmental Engineering Laboratory ................ 3 3S
- CIEG 431 Water Supply Engineering ............................... 3 35
- CIEG 432 Wastewater Engineering .................................. 3 3F
- CIEG 437 Water & Wastewater Quality Lab ....................... 3 4F
- CIEG 433 Solid Waste Management ................................. 3 4F
- CIEG 434 Hydrology .................................................. 3 4F
- CIEG 442 Hydraulic Engineering .................................... 3 4F
- CIEG 461 Senior Design ............................................. 3 4F
- CIEG 461 Senior Design ............................................. 3 4F

**Technical Electives†**

Six courses chosen from the current list of approved technical electives .............................................. 18 3 4

**CREDITS TO TOTAL A MINIMUM OF.......................... 131**

**TECHNICAL ELECTIVES**

Six courses, totaling eighteen credit hours, are provided to allow the student flexibility at the intermediate and advanced levels of the program. An area of concentration is first determined, defined by a set of three specific core technical electives as given below. The remaining three technical electives can then be chosen to further pursue this direction of study, or to provide a more diversified environmental engineering education. All technical electives must be upper level courses in engineering, the sciences, computer science, or mathematics. Students should select their area of concentration and desired technical electives with the assistance of their academic advisor. It is advisable to select these courses in the spring of the sophomore year to avoid scheduling conflicts and to insure that prerequisite courses are taken.

The core technical electives and additional technical electives for the environmental engineering concentrations are shown below.

**Environmental Facilities Design and Construction**

- Core Technical Electives
  - CIEG 301 Analysis of Structures .................................. 3
  - CIEG 403 Concrete Design ......................................... 3
  - CIEG 420 Soil Mechanics ............................................ 4
  - Additional Related Technical Electives
    - CIEG 402 Steel Design ............................................ 3
    - CIEG 404 Prestressed Concrete Design ......................... 3
    - CIEG 421 Foundations and Substructures ....................... 3
    - CIGE 301 Engineering Management .............................. 3
    - MASC 302 Materials Science .................................... 3

**Pollution Transport and Control Processes**

- Core Technical Electives
  - CIEG 332 Chemical Engineering Kinetics ......................... 3
  - CIEG 342 Heat and Mass Transfer ................................... 4
  - CHEM 443 Physical Chemistry ..................................... 3
  - Additional Related Technical Electives
    - CIEG 333 Hazardous Waste Management ............................ 3
    - CIEG 335 Industrial Waste Management ......................... 3
    - CIEG 437 Waste and Wastewater Quality ......................... 3
    - MEEG 424 Air Pollution Processes ............................... 3

**Additional Recommended Technical Electives**

- AGEG 628 Land Application of Wastes ............................. 3
- BISC 371 Introduction to Microbiology ........................... 3
- CHEM 331 Organic Chemistry ....................................... 3
- CHEM 444 Physical Chemistry ..................................... 3

*Superior figures indicate semester (fall or spring) and/or year or years in which the course should be taken, i.e. 1F fall of freshman year, 2F spring of sophomore year, etc
**Minimum grade of C required
#This requirement may be fulfilled through a course or courses taken to complete other degree requirements; it cannot be fulfilled by a course taken pass/fail. See page 21
†The technical elective program is under constant review by the faculty. An updated list is available in the department office. Students should consult with their advisers before selecting courses and should be aware that a formal mechanism exists to provide additional flexibility in the selection of their technical elective courses.
The core group includes four courses in mathematics (starting with the second calculus course, MATH 242), two in physics, one in chemistry, two in computer science, and sixteen in electrical engineering.

The technical electives must be chosen to form an area of concentration. Four examples of acceptable concentrations (emphasizing computer engineering, systems and signals, devices and materials, and power systems) are shown on the following pages. In planning their technical elective programs, students must also consider the requirement for a design course in the senior year in which one design project is at least 50% of the course work.

The general education program must include courses from the humanities and from the social sciences, including courses at an advanced level. Electrical engineering students must include a course in microeconomics, two writing courses (ENGL 110 and ENGL 301), and a one-credit course in ethics (PHIL 341).

DEPARTMENTAL REQUIREMENTS
To qualify for sophomore standing, students must have satisfactorily completed MATH 242-243, CISC 180-181, CHEM 103, PHYS 207, and ELEG 210-211 by the end of the summer session of their freshman year. With few exceptions, electrical engineering students are expected to complete the program in eight regular semesters. With electrical engineering courses being offered only once each year, it is imperative that students follow as closely as possible the course sequence outlined in the following pages.

DEGREE: BACHELOR OF ELECTRICAL ENGINEERING
MAJOR: ELECTRICAL ENGINEERING

CURRICULUM

CREDITS*

UNIVERSITY REQUIREMENTS
ENGL 110 Critical Reading and Writing** 3
Three credits in an approved course or courses stressing multicultural, ethnic, and/or gender-related content # 3

COLLEGE REQUIREMENTS
General Education Program
See page 152: College General Education Program.

MAJOR REQUIREMENTS
External to the College
ENGL 301 Expository Writing 3
PHIL 341 Ethics of Engineering Profession 1

Mathematics
MATH 242 Analytic Geometry and Calculus C 4
MATH 243 Analytic Geometry and Calculus C. 4
MATH 341 Differential Equations with Linear Algebra I 3
MATH 342 Differential Equations with Linear Algebra II 3

Chemistry
CHEM 103 General Chemistry 4

Physics
PHYS 207 Fundamentals of Physics I 4
PHYS 208 Fundamentals of Physics II 4

Computer Science
CISC course to be approved by advisor 1
CISC 181 Introduction to Computer Science 3

Within the Department
ELEG 210 Introduction to Combinatorial Logic 2
ELEG 211 Introduction to Sequential Circuits 2

* Superior figures indicate semester (fall or spring) and/or year or years in which the course should be taken, i.e. fall of freshman year, spring of sophomore year, etc.
** Minimum grade of C required.
# This requirement may be fulfilled through a course or courses taken to complete other degree requirements; it cannot be fulfilled by a course taken pass/fail. See page 21
† MATH 242 is the first mathematics course in the regular program. It is the incoming student’s responsibility to assess his/her own mathematics background and proficiency. (Using materials supplied by our Math Department). If you are not ready to start with MATH 242, you must take MATH 241 (and possibly other earlier mathematics courses). If you have had some calculus, but are not certain that you are ready for MATH 242, start with MATH 241. In this case it is easy to drop back to MATH 241 after a few weeks of MATH 242 if this is where you belong. If you need additional mathematics, at least one Winter and/or Summer sessions course will be required to complete the four year electrical engineering program on schedule. To remain on schedule with your program, you must be on schedule in mathematics by the start of the sophomore year.
**Courses must be taken as a sequence ELEG64, ELEG642 or ELEG626 and ELEG650.**

PHYS 209 Fundamentals of Physics III 32S

Students whose primary interest is in the Devices and Materials Engineering concentration should take:

- ELEG 640 Optoelectronics 3 4F
- ELEG 642 Special Topics in Optoelectronics 3 4F

Students whose primary interest is in electronic devices should take:

- ELEG 626 Integrated Circuits 3 4F
- ELEG 650 Semiconductor Device Design and Fabrication 3 4F

Technical electives chosen with the approval of an adviser 6 4F

**Technical Electives—Power Systems Concentration**

MEEG 307 Thermodynamics 3 4F
- ELEG 412 Introduction to Power Systems Analysis 4 4F
- ELEG 414 Electrical Machines, Motors and Generators 4 4F
- ELEG 618 Modern Control Engineering 4 4F
- MEEG 408 Power Generation System Design 3 3F
- or
- ELEG 323 Digital Systems Design 3 3F

Technical electives chosen with the approval of an adviser 6 4F

**CREDITS TO TOTAL A MINIMUM OF 128**

**TRANSFER STUDENTS**

Transfer students fall into two categories. Regular transfer students are those who have obtained college or university course credits after completion of high school, but who cannot be expected to complete their degrees in less than four years. These students will be considered for admission along with normal applicants for the freshman class and will be selected by the Admissions Office. The criteria for admission will be the same as used for all other freshmen applicants.

Transfer students with advanced standing in electrical engineering are those students with enough appropriate math, science and engineering transfer credits who can be expected to complete their degrees with three or fewer years of additional study. This group includes both students from other programs at the University as well as those from other colleges and universities. The admission of these students will be decided by the faculty of the electrical engineering department and will be determined by the number of student slots available and the student's record in math, science and engineering courses as well as his or her overall academic record.

Students in other disciplines within the College of Engineering will be automatically transferred into electrical engineering provided they have met the following requirements:

1. They have completed at least one year in their original major.
2. They have achieved cumulative and engineering GPA's of at least 2.5

The above guidelines are provided as general information for transfer applicants. The department's detailed transfer policy is available from the departmental office in 140 Evans Hall.

**MECHANICAL ENGINEERING**

Mechanical engineers receive one of the broadest educations of any of the modern engineering disciplines and consequently are well prepared to apply basic engineering principles to a wide variety of society's needs. Challenging fields requiring the talents of mechanical engineers in both the design and development of new technology are energy, environmental engineering, manufacturing, materials engineering, structural mechanics, dynamics, bio-mechanical engineering, transportation, and exploration and use of the space environment and the oceans.
Since many technologies will reach their zenith and wane in less than the duration of an individual's career, mechanical engineers must have a firm foundation in the more basic and durable engineering sciences to be able to adapt and contribute to new and evolving fields. The educational program is structured around a basic core program that will enable the Bachelor of Mechanical Engineering graduate to follow many career paths, including research, development, design, production, maintenance, management, patent law, or education. The curriculum nevertheless also allows a student to select engineering fields of particular interest for study, such as aerospace, materials, biomechanics, controls, design and systems, robotics, energy, and fluids.

The degree course is designed to serve not only those students who go into industry or government directly after the B.M.E. degree, but also those who go on to a graduate program in engineering or continue their education in other professions such as medicine, law or business administration. Undergraduates are encouraged to participate in research projects with faculty and graduate students involving the use of state-of-the-art instrumentation, electronics and networked computers.

**TECHNICAL ELECTIVE PROGRAM**

Technical electives in the senior year of the Bachelor of Mechanical Engineering curriculum provide the student with an opportunity to pursue areas of particular interest. The technical electives are taken after much of the basic engineering science has been mastered and comprise four coordinated courses (a minimum of 12 credits). Although the majority of the available electives are drawn from the Mechanical Engineering department, courses at the 400-level and above from other departments and colleges can be selected with the adviser's approval.

There are four suggested major areas of concentration, Aerospace Engineering, Fluids and Thermal Engineering, Solid Mechanics and Materials, and Design, Dynamics and Manufacturing. However, technical elective programs can be structured to meet individual interests and students are encouraged to discuss their educational objectives with their adviser early in the junior year and to develop an agreed selection of technical electives.

**DEGREE: BACHELOR OF MECHANICAL ENGINEERING**

**MAJOR: MECHANICAL ENGINEERING**

**CURRICULUM**

**UNIVERSITY REQUIREMENTS**

**ENGL 110** Critical Reading and Writing**

Three credits in an approved course or courses stressing multicultural, ethnic, and/or gender-related content #

13

**COLLEGE REQUIREMENTS**

**General Education Program**

See page 152: College General Education Program

18

**MAJOR REQUIREMENTS**

External to the College

An additional course (minimum of three credits) that can be either Air Force ROTC or a course outside the College of Engineering (not including mathematics or science or courses in the "Group D" classification of the College of Arts and Science)

3

**Chemistry**

**CHEM 103** General Chemistry

1

**CHEM 104** General Chemistry

1

**Computer and Information Sciences**

**CISC 106** General Computer Science for Engineers

2

**Mathematics**

**MATH 241** Analytic Geometry and Calculus A

1

**MATH 242** Analytic Geometry and Calculus B

1

**MATH 243** Analytic Geometry and Calculus C

1

**MATH 302** Ordinary Differential Equations

1

**Physics**

**PHYS 207** Fundamentals of Physics I

1

**PHYS 208** Fundamentals of Physics II

1

**Within the College**

**EGGG 132** Engineering Graphics/Analysis

1

**MASC 302** Materials Science for Engineers

1

**MECH 305** Fluid Mechanics

1

**MECH 306** Fluid Mechanics Laboratory

1

**ELEG 314** Electronics and Instrumentation

1

**Within the Department**

**MEEG 125** Introduction to Mechanical Engineering

1

**MEEG 213** Principles of Mechanics I

1

**MEEG 214** Principles of Mechanics II

1

**MEEG 307** Thermodynamics I

1

**MEEG 308** Thermodynamics II

1

**MEEG 313** Strength of Materials

1

**MEEG 316** Materials Engineering

1

**MEEG 347** Mechanical Design I

1

**MEEG 434/634** Air Pollution Processes

1

**MEEG 445** Senior Research

1

**MEEG 448** Design and Systems Synthesis II

1

**MECH 306** Fluid Mechanics Laboratory

1

**MECH 307** Thermodynamics I

1

**MECH 308** Thermodynamics II

1

**MECH 313** Strength of Materials

1

**MECH 316** Materials Engineering

1

**MECH 347** Mechanical Design I

1

**MECH 434/634** Air Pollution Processes

1

**MECH 445** Senior Research

1

**MECH 448** Design and Systems Synthesis II

1

**Technical Electives**

**Technical Electives**

4

**400-level or above courses in engineering, science or mathematics selected by the student with the approval of their adviser**

**CREDITS TOTAL A MINIMUM OF**

131

**TECHNICAL ELECTIVES**

There are four suggested areas of concentration in the technical elective offerings. Students should select a minimum of 12 credits from the following courses or substitute other courses in consultation with their adviser.

**I. Aerospace Engineering**

**MEEG 411** Structural Mechanics for Mechanical and Aerospace Engineering

1

**MEEG 413** Advanced Mechanics of Materials

1

**MEEG 415** Finite Element Analysis

1

**MEEG 432** Aerodynamics

1

**MEEG 435** Fluid Machinery

1

**MEEG 445** Senior Research

1

**MEEG 614** Fracture of Materials

1

**MEEG 615** Mechanical Properties of Materials

1

**MEEG 616** Composite Materials Structures

1

**II. Fluids and Thermal Engineering**

**MEEG 408** Power Generation System Design

1

**MEEG 432** Aerodynamics

1

**MEEG 434/634** Air Pollution Processes

1

**MEEG 435** Fluid Machinery

1

**MEEG 445** Senior Research

1

**MEEG 606** Fluid Mechanics Measurements

1

**MEEG 652** Flow of Viscous Materials

1

**MEEG 653** Manufacturing Processes

1

**III. Solid Mechanics and Materials**

**MEEG 411** Structural Mechanics for Mechanical and Aerospace Engineering

1

**MEEG 413** Advanced Mechanics of Materials

1

**MEEG 415** Finite Element Analysis

1

---

* Superior figures indicate semester (fall or spring) and/or year or years in which the course should be taken, i.e. 1F fall of freshman year, 2F spring of sophomore year, etc.
** Minimum grade of C required.
# This requirement may be fulfilled through a course or courses taken to complete other degree requirements; it cannot be fulfilled by a course taken pass/fail. See page 21.

Students are encouraged to develop a technical elective program that meets their own interests and career plans, but all technical elective selections must be approved by an adviser.
The Air Force Reserve Officer Training Corps (AFROTC) provides admission counseling concerning applicant qualifications should be directed to the unit's follow the award of a University bachelor's degree. Questions concerning applicant qualifications should be directed to the unit's counseling concerning applicant qualifications should be directed to the unit's admissions counselor.


courses are instructed not to admit non-majors during the drop/add process. This general transfer policy should be reviewed carefully by all applicants.

Control of the class for which the student is applying. Generally, the guidelines specified by the College Transfer Policy will be followed to initiate the program, all candidates must complete a six-week field training session at a designated Air Force base.

Two-Year Program. The two-year program is normally offered to prospective juniors and graduate students. The academic requirements for this program are identical to the final two years of the four-year program. During the summer preceding entry into the two-year program, all candidates must complete a six-week field training session at a designated Air Force base.

General Requirements for POC Acceptance. Students competing for acceptance as POC cadets must complete the four-year or two-year program prerequisites, pass the Air Force Officer Qualifying Test, be physically qualified, meet certain age requirements, be in good academic standing, and be able to meet all Air Force enlistment standards.

THE CURRICULUM

General Military Course (GMC)

Freshman year: The Development of Air Power I/II—AFSC 100 (fall) and AFSC 101 (spring). Each of these one-credit courses consists of approximately one hour of academic class each week. These two GMC courses survey the history of air power from the 18th century to the present.

Sophomore year: The Air Force Today I/II—AFSC 200 (fall) and AFSC 201 (spring). Each of these one-credit courses consists of approximately one hour of academic class each week. In combination, these two courses survey the roles of the Department of Defense and the U.S. Air Force in our society.

GMC courses are open to all freshmen and sophomore students. Leadership activities are open to students who are members of the Reserve Officer Training Corps or are eligible to pursue a commission as determined by the Professor of Aerospace Studies. Leadership activities are scheduled for one-and-a-half hours each week.

Professional Officer Course (POC)

Junior year: Leadership and Management I/II—AFSC 310 (fall) and AFSC 311 (spring). Each of these three-credit courses consists of two-and-a-half hours of academic classes each week. Here the student is introduced to leadership and management concepts. The courses are designed to provide a foundation for basic leadership and management skills, with emphasis on communications.

Senior year: National Security Forces in U.S. Society I/II—AFSC 410 (fall) and AFSC 411 (spring). Each of these three-credit courses consists of two-and-a-half hours of academic classes...
each week. These courses focus on our national security policy—its evolution, actors, processes, and current issues. Emphasis is also given to military professionalism, military justice, and communication skills.

POC courses are open to all juniors and seniors. Leadership activities are open to students who are members of the Reserve Officer Training Corps or are eligible to pursue a commission as determined by the Professor of Aerospace Studies. Leadership activities are scheduled for one-and-a-half hours each week.

Scholarships Available. The AFROTC College Scholarship Program provides four- to eight-semester scholarships to students on a competitive basis. Scholarships are available in technical and non-technical fields and are based on the whole-person concept and certain age restrictions. Any University of Delaware student may apply for these scholarships. Opportunity for scholarship selection is enhanced by enrolling in AFROTC. Those selected may receive full tuition, lab expenses, incidental and textbook fees, plus a $150 monthly, nontaxable allowance during the school year. Students who accept a scholarship enter the AFROTC program as a contract cadet.

Professional Officer Course Incentive (POCI) Scholarships are available for all students who meet certain age and academic requirements and are under contract as a POCI cadet. These students receive $850 per semester towards tuition, plus $150 per semester for books. All majors are eligible to receive the POCI scholarship.

Air Force ROTC Nurse Program. Air Force ROTC makes it possible for qualified nursing school applicants to enroll in its programs and, upon completion of all academic requirements, receive a commission as a Second Lieutenant in the United States Air Force Medical Corps. Four- to eight-semester scholarships are available to highly qualified applicants.