The College of Engineering offers baccalaureate degrees in chemical, civil, environmental, electrical, computer, and mechanical engineering and minors in biochemical engineering, civil engineering, and materials science. 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 215). Additionally, the College of Engineering and the College of Business and Economics offer a joint five-year program that leads to a baccalaureate degree in an engineering major and a Master of Business Administration degree from the College of Business and Economics. Inquiry should be made to the Assistant Dean for Undergraduate Affairs (302-831-8659) by March 1 of the sophomore year of engineering study. 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 groups who are underrepresented in engineering. The program begins with a pre-freshman Summer Academy and continues to graduation. Interested individuals should contact the Assistant Dean and Director of the RISE Program at 302-831-6315.

ADVICE

Undergraduate student advisement begins during New Student Orientation and continues through graduation. All engineering students are assigned faculty advisors, and students are required to consult with their advisors during the advanced registration periods. Students must also obtain approval from their advisor for courses taken during the Winter or Summer Sessions and when adding or dropping courses. Students are also encouraged to meet with their engineering faculty advisors at other times to learn more about undergraduate academic options, the engineering profession, and graduate school opportunities.

The College Undergraduate Affairs Office provides advisement to students who experience academic difficulties or who require additional guidance. The Assistant Dean for Undergraduate Affairs conducts a preliminary degree checkout with each engineering student early in his or her senior year to help identify any impediments to graduation.

CURRICULUM ORGANIZATION

The undergraduate curriculum in each engineering major consists of a core of required courses, a group of elective technical classes, and a group of general education courses. The core group includes courses in mathematics, chemistry, physics, computer science, and engineering. The technical electives courses allow students to investigate the sciences in more depth and to develop a concentration within their engineering discipline. Most of the general education courses are taken from the humanities and social sciences to provide a well-rounded education. The College's general education requirements are described in the following section. Additional requirements specified by individual engineering departments are given in the appropriate departmental sections.

DEAN'S SCHOLAR PROGRAM

The Dean's Scholar Program exists to serve the needs of students whose clearly defined educational goals cannot be effectively achieved by pursuing the standard curricula for all
existing majors, minors, and interdepartmental majors
sponsored by the University. Driven by an overarching
passion or curiosity that transcends typical disciplinary
boundaries and curricula, a Dean’s Scholar’s intellectual interests
may lead to broad interdisciplinary explorations of an issue or
to more intense, in-depth studies in a single field at a level
akin to graduate work. However, it is important to note that
because engineering degrees are professionally accredited, it
is difficult for a Dean’s Scholar to complete an engineering
degree within four years. In consultation with faculty advisors
and the Associate or Assistant Dean of their college, Dean’s
Scholars design an imaginative and rigorous individual plan
of study to meet the total credit hours required for graduation.
Contact the Assistant/Associate Dean in the college or go to
www.udel.edu/deansscholar for more information and the
application.

GENERAL EDUCATION REQUIREMENTS

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 advisor. 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. Detailed guidelines, which include a list of
courses that may be used to satisfy the program’s
requirements, may be obtained from the Assistant Dean for
Undergraduate Affairs.

1. At least two courses (minimum of six credits) must be in
the humanities. Humanities include courses in areas such
as Art History, English Literature, Foreign Languages
other than the student’s native language, History, and
Philosophy.

2. At least two courses (minimum of six credits) must be in
the social sciences. The social sciences include courses in
areas such as Economics, Political Science, Psychology,
and Sociology.

3. At least two courses (minimum of six credits) must be
above the introductory level. These courses must build
upon the content of a previous course, as approved by the
faculty advisor. Courses which fulfill this requirement are
normally at the 300-level or above.

4. At least two of the six courses (minimum of six credits)
must be thematically related. Courses which fulfill this
requirement are typically in the same department or
program.

Courses in mathematics, science, or engineering may not
be used to satisfy any General Education Program
requirement. Students must consult their faculty advisors and
the guidelines published by the College of Engineering for the
proper classification of general education courses.

ACADEMIC STANDARDS

The engineering departments have established minimum
standards for certain courses and for progression to the
sophomore or junior level for each of their majors. These
standards are given in the appropriate departmental sections.
In order to graduate, engineering students must satisfy the
general University requirements for a baccalaureate degree
(see page 43) as well as all the requirements of their
engineering major. 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. Credit from courses taken pass/fail cannot be
used to complete any engineering degree requirement.

TRANSFER STUDENTS

The engineering curricula are very demanding, and
transfer applicants must have a good record in mathematics
and science. Thus, all students who wish to transfer into the
College of Engineering should contact the Assistant Dean for
Undergraduate Affairs (302-831-8659) to discuss curriculum
requirements and transfer policies before beginning the
application process.

Students at the University of Delaware who wish to
transfer into a major within the College of Engineering must
make a formal request to the appropriate engineering
department. This request may be made using a web-based
form.

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.

AIR FORCE ROTC

The Air Force Reserve Officer Training Corps
(AFROTC) provides a program for qualified college men and
women to earn commissions as Second Lieutenants in the
United States Air Force while completing their University
course requirements. Commissioning follows the award of a
University bachelor’s degree. Those who have bachelor’s
degrees and are enrolled in graduate courses are also eligible.
Questions concerning applicant qualifications should be
directed to the unit’s admission officer.

Telephone: (302) 831-2863

www.udel.edu/afrotc

PROGRAMS OFFERED

FOUR-YEAR PROGRAM.
The four-year program is composed of a General Military
Course (GMC) and a Professional Officer Course (POC). The
first two years, the GMC, provide a general introduction to
the Air Force and the various career fields. Students
enrolled in the GMC who are not receiving an Air Force
Scholarship incur no reserve or active duty service
obligation to the Air Force and may elect to discontinue the
program at any time. The final two years, the POC,
concentrate on developing leadership and management
skills and on a study of American defense policy. Students
must compete for entry into the POC. If accepted, they
must attend field training at a designated Air Force base
during the summer following their sophomore year of
college. When they return to the University in the Fall, they
are placed under contract with the Air Force to complete
the program and serve a minimum of four years on active
duty. Pilots and navigator candidates incur an additional
obligation because of specialized training following
commissioning.

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.
ONE-YEAR PROGRAM.
The one-year program is sometimes offered to senior or graduate students. The academic requirements for this program are identical to the final year of the four-year program. Students in this program will normally attend field training after graduation, for those finishing undergraduate degree requirements, and after one year program attendance, for those in a graduate program.

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 Foundations of the USAF I and II, AFSC 110 (fall) and AFSC 111 (spring). Each of these one-credit courses consists of 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.

Sophomore year: U.S. Air/Space Power I and II – AFSC 210 (fall) and AFSC 211 (spring). Each of these one-credit courses consists of one hour of academic class each week. These two GMC courses survey the history of air power from the 18th century to the present.

GMC courses are open to all freshman 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 two hours each week.

PROFESSIONAL OFFICER COURSE (POC)
Junior year: Leadership Studies I and 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 Affairs I and 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. Enlisted experience 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 two 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 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 POC cadet. These students receive $1,500 per semester towards tuition, plus $225 per semester for books, plus a monthly stipend. 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.

CHEMICAL ENGINEERING
The Department of Chemical Engineering offers a program leading to the Bachelor of Chemical Engineering, including an Honors Degree option, as well as a combined Bachelor’s - Master’s Program. Chemical Engineering is a combination of biology, chemistry, mathematics and physics with the art and creativity of engineering. The department has much more inclusive descriptions of the professions for those interested.

The curriculum for chemical engineering provides an early start in the discipline. In the first 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 at many other schools, enabling much of the chemical engineering science component to be completed by the end of the third undergraduate year. As a result, the fourth year provides an opportunity for in-depth pursuit of technical topics of special interest. A student can choose the three technical electives and the three chemical engineering technical electives to concentrate or minor in a special area. Examples of these concentrations are given below.

The early introduction to the discipline enables the student who has made an inappropriate choice to transfer out of the chemical engineering without loss of status. However, it also makes it difficult for students to transfer into the program during the sophomore or junior years. Students may transfer into Chemical Engineering after completing CHEG 112, CHEM 111, CHEM 112, CHEM 119 (or CHEM 103/104), MATH 242, MATH 243 and PHYS 207. Admission is competitive and is based on the grade point index in the required courses as listed.

Telephone: (302) 831-2399
E-mail: shearer@che.udel.edu
www.che.udel.edu

DEGREE: BACHELOR OF CHEMICAL ENGINEERING
MAJOR: CHEMICAL ENGINEERING

CURRICULUM

DEGREE REQUIREMENTS

MAJOR REQUIREMENTS

General Education Program

See p. 206: College General Education Program. 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. One of the General Education courses must fulfill the University multicultural requirement.

CHEM 111 General Chemistry .......................... 3
CHEM 119 Quantitative Chemistry I .................. 2
CHEM 112 General Chemistry .......................... 3
CHEM 331 Organic Chemistry .......................... 3
CHEM 333 Organic Chemistry Laboratory I (lecture only) .......................... 1
CHEM 445 Physical Chemistry Laboratory I ............. 1
CHEM 444 Physical Chemistry .......................... 3
CHEM 332 Organic Chemistry or CHEM 527 Introductory Biochemistry .................. 3
MATH 242 Analytic Geometry and Calculus B .......... 4
MATH 243 Analytic Geometry and Calculus C .......... 4
MATH 305 Applied Math for Chemical Engineering ..... 3
PHYS 207 Fundamentals of Physics I ................. 4
PHYS 208 Fundamentals of Physics II ................ 4
SEG 302 Materials Science for Engineers ............. 3
CHEG 009 Chemical Engineering Freshman Seminar .................. 0
CHEG 112 Introduction to Chemical Engineering ..... 3
CHEG 231 Chemical Engineering Thermodynamics ........ 3
CHEG 325 Chemical Engineering Thermodynamics ........ 3
CHEG 332 Chemical Engineering Kinetics .......... 3
CHEG 341 Fluid Mechanics ............................ 3
CHEG 320 Chemical Engineering Economics and Risk Assessment .......... 3
CHEG 342 Heat and Mass Transfer ..................... 3
CHEG 345 Chemical Engineering Laboratory I ........ 3
CHEG 401 Chemical Process Dynamics and Control .......... 3
CHEG 443 Mass Transfer Operations ................ 3
CHEG 445 Chemical Engineering Laboratory II or CHEG 473 Chemical Engineering Projects ........ 3
CHEG 432 Chemical Process Analysis ................ 3
CHEG 444 Physical Chemistry .......................... 3

**TECHNICAL ELECTIVES**

**General Technical Electives** .......................... 15

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 fifteen credits taken from the College of Engineering and the College of Arts and Sciences (see below). At least three of these courses (nine credits) must be at the intermediate level (generally 300-499). 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 advisor.

The technical elective program is under constant review by the faculty. An updated list is available in the department office, and a formal mechanism exists to make substitutions for technical electives. The Technical Electives may be coupled with the Chemical Engineering Technical Electives to obtain a technical concentration.

**Chemical Engineering Technical Electives** .... 9

The curriculum provides three chemical engineering technical electives in the senior year. These courses are intended to provide some flexibility in selecting the chemical engineering program at the advanced level. Students should decide with the assistance of their advisor 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 to 474; 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 with 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 grouping below is an example of this approach.

**Chemistry**

CHEM 457 Inorganic Chemistry
CHEM 527 Introductory Biochemistry
CHEG 606 Introduction to Catalysis
CHEG 616 Chemistry and Physics of Surfaces and Interfaces
CHEG 617 Colloid Science and Engineering

**CREDITS TO TOTAL A MINIMUM OF ........ 125**

**HONORS BACHELOR OF CHEMICAL ENGINEERING**

A recipient of the Honors Bachelor of Chemical Engineering must satisfy the following:

1. All requirements for the Bachelor of Chemical Engineering degree.
2. All generic University requirements for the Honors Degree (see page xxx). Graduate courses approved for this purpose by the department may be counted as Honors courses.

**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. Please read the course descriptions for the specific prerequisites and corequisites.

**Graduation Requirements:**

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

**MINOR IN BIOCHEMICAL ENGINEERING**

A minor in Biochemical Engineering may be earned by a student in any University bachelor's degree program through successful completion of a minimum of 19 credits as described below. This degree provides students with an opportunity to study new advances in biochemistry and the biological sciences integrated with engineering analysis. Before beginning these courses the student must meet the required course prerequisites. A minimum grade of C- is required in all of the courses completed for the minor.

To obtain a Minor in Biochemical Engineering the student must take the following four required courses:
UNDERGRADUATE  CIVIL AND ENVIRONMENTAL ENGINEERING  •  ENGINEERING

CHEMICAL ENGINEERING CURRICULUM - MASTER'S - BACHELOR'S PROGRAM

Under unusual circumstances, a highly qualified student may earn a Bachelor of Chemical Engineering and a Master of Chemical Engineering in four years. This program assumes that the student enters with advanced sophomore standing and is able to cope with at least one term of a substantial overload. Interested students should contact the department for further information and a sample schedule. It should be noted that, in order to ensure a broad educational experience, the Department does not admit Delaware undergraduates to its Ph.D. program unless they have at least three years of industrial experience or have earned a master's degree at another institution.

CIVIL AND ENVIRONMENTAL ENGINEERING

The Civil and Environmental Engineering Department offers programs which lead to the degrees of Bachelor of Civil Engineering and Bachelor of Environmental Engineering, both with Honors Degree options, as well as a minor in Civil Engineering.

Traditionally, civil engineering has been identified with the planning and design of constructed facilities such as dams, bridges, buildings, roads, waterways, and tunnels. Modern civil engineering now addresses larger segments of societal infrastructure such as mass transportation systems, water resource exploration and management, environmental protection, coastal management, and off-shore structures. The Civil Engineering curriculum includes specialization options in structural engineering, geotechnical engineering, environmental engineering, hydraulic and ocean engineering, and transportation and construction engineering as shown by the listed Technical Electives. Areas concerned with pollution control, water supply, and water resource management are now considered to comprise the distinct discipline of Environmental Engineering. The Environmental Engineering curriculum is focused on causes, control, and prevention of environmental contamination, environmental facilities design and construction, and pollution transport and control processes. Each of these degrees is described separately below.

DEPARTMENT POLICIES

In general, 300- and 400-level courses 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 may 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.

The Department has developed standards that require minimum grades in certain courses. These standards are intended to promote success in the sequential development of the curriculum. The requirements for the civil and environmental engineering majors are as follows:

Civil Engineering

Admission to 300- and 400-level civil engineering and mechanics courses requires:
- A minimum grade of C- in MATH 241 and MATH 242.
- A minimum grade of C- in CHEM 103.
- A minimum grade of C- in PHYS 207.

Environmental Engineering

Admission to 300- and 400-level civil engineering and mechanics courses requires:
- A minimum grade of C- in CHEG 111 and CHEG 112.
- A minimum grade of C- in PHYS 207.

Admission to CHEG 231 requires:
- A minimum grade of C- in MATH 243.

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

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

Admission to CHEG 342 requires:
- A minimum grade of C- in CIEG 305 and CIEG 306.

Telephone: (302) 831-2442
www.ce.udel.edu

DEGREE: BACHELOR OF CIVIL ENGINEERING MAJOR: CIVIL ENGINEERING

CURRICULUM CREDITS

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.

UNIVERSITY REQUIREMENTS

ENGL 110  Critical Reading and Writing  (minimum grade C-)  3 *

MAJOR REQUIREMENTS

See p. 206: College General Education Program. One of the general education courses must fulfill the University multicultural requirement (see p. 66-77).
The required course curriculum gives students a broad introduction to all 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 and Construction Engineering.

In addition, three technical elective courses in the Civil Engineering curriculum give students the opportunity to complete their education by concentrating in an area of special interest. The technical electives can also be chosen to provide a more general civil engineering education.

The following is a list of departmental technical electives approved for a concentration in one of the above-mentioned areas or in general civil engineering. Some of these courses may not be offered a particular year. A current list is available in the department office. Some courses offered in other departments may also be approved as technical electives. Students should check with their advisors before selecting courses.

**General Civil Engineering**
- CIEG 401 Introduction to the Finite Element Method
- CIEG 407 Building Design
- CIEG 409 Forensic Engineering
- CIEG 438 Water and Wastewater Engineering
- CIEG 452 Transportation Facilities Design
- CIEG 471 Introduction to Coastal Engineering
- CIEG 486 Construction Methods and Management

**Environmental and Water Resources Engineering**
- CIEG 407 Building Design
- CIEG 433 Hazardous Waste Management
- CIEG 437 Water and Wastewater Quality
- CIEG 438 Water and Wastewater Engineering
- BISC 371 Introduction to Microbiology
- BISC 641 Microbial Ecology
- BREG 628 Land Application of Wastes
- CHEM 213 Elementary Organic Chemistry
- CHEM 214 Elementary Biochemistry
- CHEM 220 Quantitative Analysis
- CHEM 418 Introduction to Physical Chemistry
- CISC 681 Introduction to Remote Sensing
- GEOL 421 Environmental and Applied Geology
- GEOL 428 Hydrogeology

**Hydraulic and Ocean Engineering**
- CIEG 401 Introduction to the Finite Element Method
- CIEG 407 Building Design
- CIEG 422 Earth Structures Engineering
- CIEG 437 Water and Water Quality
- CIEG 471 Introduction to Coastal Engineering
- MEEG 361 Applied Engineering Analysis

**Structures and Geotechnical Engineering**
- CIEG 401 Introduction to the Finite Element Method
- CIEG 405 Matrix Structural Analysis
- CIEG 407 Building Design
- CIEG 408 Introduction to Bridge Design
- CIEG 409 Forensic Engineering
- CIEG 410 Experimental Mechanics of Composites
- CIEG 411 Structural Dynamics Design
- CIEG 417 Advanced Structural Analysis
- CIEG 418 Continuously Supported Structures
- CIEG 422 Earth Structures Engineering
- CIEG 425 Environmental Engineering
- CIEG 459 Railroad Engineering
- CIEG 486 Construction Management and Methods

**Transportation and Construction Engineering**
- CIEG 452 Transportation Facilities Design
- CIEG 454 Urban Transportation Planning
- CIEG 459 Railroad Engineering
HONORS BACHELOR OF CIVIL ENGINEERING

A recipient of the Honors Bachelor of Civil Engineering must satisfy the following:

1. All requirements for the Bachelor of Civil Engineering degree.
2. All generic University requirements for the Honors Degree (see p. 49). Graduate courses approved for this purpose by the department may be counted as Honors courses.
3. The Honors Thesis must be within the disciplines of Civil and Environmental Engineering. It must be supervised by a faculty member from the Department of Civil and Environmental Engineering and successfully presented orally in front of a committee approved by the department Undergraduate Committee.

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. Before beginning the civil engineering courses, the student must meet the required mathematics and physics prerequisites. A grade of C- or better is required in all of the courses completed for the minor.

The required civil engineering and engineering mechanics courses are the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIEG 211</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 212</td>
<td>Solid Mechanics (Lab optional)</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 311</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 305</td>
<td>Fluid Mechanics (Lab optional)</td>
<td>3</td>
</tr>
</tbody>
</table>

Further, an additional 9 credits (3 courses) in civil engineering must be taken of which at least 6 credits must be at the 300-level or higher. Those courses shall be selected with the specific advice of an advisor in the Civil and Environmental Engineering Department to meet each student's objectives. For students oriented toward earth sciences these might include CIEG 320, 323 and 321; for those interested in the environment, CIEG 233 and 331; for those interested in urban topics, CIEG 331 and 351; for those with interests in construction and structures, CIEG 301 and 302; for those interested in the oceans, CIEG 440 and 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

CURRICULUM CREDITS

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIEG 486</td>
<td>Construction Management and Methods</td>
<td></td>
</tr>
<tr>
<td>GEOL 328</td>
<td>Transportation Geography</td>
<td></td>
</tr>
<tr>
<td>STAT 420</td>
<td>Data Analysis and Nonparametric Statistics</td>
<td></td>
</tr>
</tbody>
</table>

CREDITS TO TOTAL A MINIMUM OF 125

MAJOR REQUIREMENTS

General Education Program 18

See p. 206: College General Education Program. One of the general education courses must fulfill the University multicultural requirement (see p. 66-77).

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 410</td>
<td>Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 111</td>
<td>General Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 119</td>
<td>Quantitative Chemistry I</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 112</td>
<td>General Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>MATH 241</td>
<td>Analytic Geometry and Calculus A</td>
<td>4</td>
</tr>
<tr>
<td>MATH 242</td>
<td>Analytic Geometry and Calculus B</td>
<td>4</td>
</tr>
<tr>
<td>MATH 243</td>
<td>Analytic Geometry and Calculus C</td>
<td>4</td>
</tr>
<tr>
<td>MATH 302</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 207</td>
<td>Fundamentals of Physics I</td>
<td>3</td>
</tr>
<tr>
<td>BISC 321</td>
<td>Environmental Biology</td>
<td>3</td>
</tr>
<tr>
<td>CISC 106</td>
<td>General Computer Science for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>MATH 450</td>
<td>Statistics for Engineering and</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Physical Sciences</td>
<td></td>
</tr>
<tr>
<td>CIEG 211</td>
<td>Chemical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 231</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 325</td>
<td>Chemical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 305</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 306</td>
<td>Fluid Mechanics Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>CIEG 434</td>
<td>Air Pollution Control</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 135</td>
<td>Introduction to Environmental</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
<td></td>
</tr>
<tr>
<td>CIEG 211</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 212</td>
<td>Solid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 213</td>
<td>Solid Mechanics Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 333</td>
<td>Environmental Engineering Processes</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 337</td>
<td>Environmental Engineering Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 438</td>
<td>Water and Wastewater Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 437</td>
<td>Water &amp; Wastewater Quality</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 436</td>
<td>Solid Waste Management</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 440</td>
<td>Water Resources Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 461</td>
<td>Senior Design Project</td>
<td>2</td>
</tr>
<tr>
<td>CIEG 461</td>
<td>Senior Design Project</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Earth Science Elective</td>
<td>3</td>
</tr>
</tbody>
</table>
|             | One course taken at the 300-level or above from geology, soil science, or hydrology. Technical Electives 18
|             | Six courses chosen from the current list of approved technical electives. 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 advisors before selecting courses and should be aware that a formal mechanism exists to provide additional flexibility in the selection of their technical elective courses.

ENGL 110 Critical Reading and Writing (minimum grade C-) 3
The core technical electives and additional technical electives for the environmental engineering concentrations are shown below.

**Environmental Facilities Design and Construction**

**Required Technical Electives**
- CIEG 301 Structural Analysis
- CIEG 302 Structural Design
- CIEG 320 Soil Mechanics
- CIEG 323 Soil Mechanics Laboratory

**Pollution Transport and Control Processes**

**Required Technical Electives**
- CHEG 332 Chemical Engineering Kinetics
- CHEG 342 Heat and Mass Transfer
- CHEM 443 Physical Chemistry I

**Environmental Biotechnology**

**Required Technical Electives**
- CHEM 331 Organic Chemistry
- CHEM 333 Organic Chemistry Lab
- PLSC 319 Environmental Soil Microbiology
- BISC 300 Introduction to Microbiology
- CHEM 342 Introduction to Biochemistry

**Additional Recommended Technical Electives**
- CHEM 444 Physical Chemistry
- CIEG 321 Geotechnical Engineering
- CIEG 407 Building Design
- CIEG 433 Hazardous Waste Management
- CIEG 482 Systems Design and Operation
- GEOL 421 Environmental and Applied Geology
- GEOL 446 General Geochemistry
- MEED 424 Air Pollution Processes
- MSEG 302 Materials Science
- BISC 301 Molecular Biology of Cells
- BISC 311 Molecular Biology for Engineers
- BISC 641 Microbial Ecology
- CIEG 636 Biological Aspects of Environmental Engineering
- PLSC 619 Soil Microbiology

Note: This list is not exhaustive. Consult your advisor.

### HONORS BACHELOR OF ENVIRONMENTAL ENGINEERING

A recipient of the Honors Bachelor of Environmental Engineering must satisfy the following:

1. All requirements for the Bachelor of Environmental Engineering degree.
2. All generic University requirements for the Honors Degree (see page 49). Graduate courses approved for this purpose by the department may be counted as Honors courses.
3. The Honors Thesis must be within the disciplines of Civil and Environmental Engineering and successfully presented orally in front of a committee approved by the department Undergraduate Committee.

### ELECTRICAL AND COMPUTER ENGINEERING

The Department of Electrical and Computer Engineering offers programs that lead to the degrees of Bachelor of Electrical Engineering and Bachelor of Computer Engineering, both with Honors Degree Options. The Electrical Engineering curriculum prepares graduates to enter the broad profession of modern electrical engineering. The Computer Engineering curriculum is more focused on the application of electrical engineering principles to the design of computers, networks of computers, or sometimes systems that include computers.

Coursework in electrical and computer engineering starts with the first term of the freshman year, with successive years building on prerequisite courses and including an unusually high number of courses with laboratories.

There are three basic parts to the Delaware curriculum in engineering: (1) a core group of courses, (2) an elective group of technical courses, and (3) a "general education" component that includes six courses in the humanities and social sciences and two in written communications.

The core group consists of required courses in mathematics, chemistry, computer science, and electrical and computer engineering.

Technical electives are chosen from a set of approved courses in the fields of engineering, mathematics, natural science, and computer science. These electives provide the student with the opportunity to study a particular area of interest at a greater depth. The technical elective courses chosen by the student must follow the specific guidelines for the student's major and be approved by the departmental academic advisor. Students must take at least four credits in courses designated as "design."

The general education program must include courses from the humanities and from the social sciences, including courses at an advanced level. Electrical and Computer Engineering students must include a course in microeconomics and two writing courses (ENGL 110 and ENGL 301).

Any deviation from these requirements must be approved by the ECE Department Chair or his/her designee.

### DEPARTMENTAL REQUIREMENTS

To qualify for sophomore standing, students must have satisfactorily completed MATH 241, MATH 242, CISC 181, PHYS 207, and CPEG 202 by the end of the summer session of their freshman year. With few exceptions, students are expected to complete this program in eight regular semesters. With electrical and computer engineering courses being offered only once each year, it is imperative that students follow as closely as possible the course sequences outlined below.

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www.ece.udel.edu

| DEGREE: BACHELOR OF ELECTRICAL ENGINEERING |
| MAJOR: ELECTRICAL ENGINEERING |
| CURRICULUM |
| CREDITS |

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.

### UNIVERSITY REQUIREMENTS

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 110</td>
<td>Critical Reading and Writing (minimum grade C+)</td>
</tr>
</tbody>
</table>
MAJOR REQUIREMENTS

General Education Program ........................................... 18 1/4
See p. 206: College General Education Program. One of the
general education courses must fulfill the University multi-
cultural requirement (see p. 66-77). ECON 151 is also
required within the General Education program.

ENGL 301 Expository Writing ........................................... 3 1/4
MATH 241 Analytic Geometry and Calculus A .......... 4 1/4
MATH 242 Analytic Geometry and Calculus B .......... 4 1/4
MATH 243 Analytic Geometry and Calculus C .......... 4 1/4
MATH 341 Differential Equations with
Linear Algebra I .................................................. 3 1/4
MATH 342 Differential Equations with
Linear Algebra II .................................................. 3 1/4
CHEM 103 General Chemistry ........................................ 4 1/4
PHYS 207 Fundamentals of Physics I ..................... 4 1/4
PHYS 208 Fundamentals of Physics II ..................... 4 1/4
CISC 105 Introduction to Computer Science I ........... 3 1/4
CISC 181 Introduction to Computer Science II ........... 3 1/4
CISC 220 Data Structures .......................................... 2 1/4
CPEG 202 Introduction to Digital Systems ............... 4 1/4
CPEG 222 Microprocessor Based Systems ................. 4 1/4
ELEG 205 Analog Circuits I ........................................ 2 1/2
ELEG 212 Signals and Communications ..................... 4 1/4
ELEG 240 Physical Electronics ..................................... 4 1/4
ELEG 305 Signal Processing I ........................................ 3 1/4
ELEG 309 Electronic Circuit Analysis I ................. 4 1/4
ELEG 310 Random Signals and Noise ....................... 3 1/4
ELEG 340 Solid State Electronics ......................... 3 1/4
ELEG 370 Engineering Electromagnetics ..................... 4 1/4

Design Requirement .................................................. 4 1/4
In addition to the content of the normal program, every
student must take at least four credits in ELEG courses
designated as "design." Regularly offered design courses
include ELEG 410, ELEG 430, ELEG 438, and ELEG 450.
Other courses may be offered irregularly which satisfy the
design requirement. Students should consult with their
advisors before selecting their design course or courses.

Technical Electives .................................................. 21
In addition to the design requirement, each student, in
consultation with their advisor, must select a program of
technical electives satisfying the following: (1) With some
exceptions, technical electives consist of 300-level or above
engineering, mathematics, natural sciences, and computer
science courses. With the permission of the student's
advisor, certain 200-level courses, such as PHYS 209, are
permitted. (2) At least 21 technical elective credits must be
taken. (3) Of the 21 technical elective credits, at least 12
must be in ELEG or CPEG courses. (4) Of the 12 credits
in ELEG or CPEG, at least 6 must be in 400-level or above ELEG
or CPEG courses.

CREDITS TO TOTAL A MINIMUM OF ........... 125

HONORS BACHELOR OF ELECTRICAL
ENGINEERING

A recipient of the Honors Bachelor of Electrical Engineering
must satisfy the following:
1. All requirements for the Bachelor of Electrical
Engineering degree.
2. All generic University requirements for the Honors
Degree (see page 49). Graduate courses approved
for this purpose by the department may be counted as
Honors courses.

DEGREE: BACHELOR OF COMPUTER
ENGINEERING

MAJOR: COMPUTER ENGINEERING

CURRICULUM CREDITS
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.

UNIVERSITY REQUIREMENTS

ENGL 110 Critical Reading and Writing
(minimum grade C-) ........................................... 3 1/4

MAJOR REQUIREMENTS

General Education Program ........................................... 18
See p. 206: College General Education Program. One of the
general education courses must fulfill the University multi-
cultural requirement (see p. 66-77). ECON 151 is also
required within the General Education program.

ENGL 301 Expository Writing ........................................... 3 1/4
MATH 241 Analytical Geometry and Calculus A ........ 4 1/4
MATH 242 Analytical Geometry and Calculus B ........ 4 1/4
MATH 243 Analytical Geometry and Calculus C ........ 4 1/4
MATH 341 Differential Equations with
Linear Algebra I .................................................. 3 1/4
CHEM 103 General Chemistry ........................................ 4 1/4
CISC 105 General Computer Science ....................... 4 1/4
CISC 181 Introduction to Computer Science I ........... 3 1/4
CISC 220 Data Structures .......................................... 3 1/4
CISC 361 Operating Systems ....................................... 3 1/4

Students with adequate programming experience may
substitute the CISC 181, CISC 220 and CISC 280 sequence
for the CISC 105, CISC 181 and CISC 220 sequence.

CPEG 202 Introduction to Digital Systems ............... 4 1/4
CPEG 222 Microprocessor Systems ......................... 4 1/4
CPEG 323 Introduction to Computer System Engineering ........ 3 1/4
CPEG 324 Computer Systems Design I .................... 3 1/4
ELEG 205 Linear Circuit Theory ............................... 4 1/4
ELEG 212 Signals and Communications ..................... 4 1/4
ELEG 240 Physical Electronics ..................................... 4 1/4
ELEG 305 Signal Processing I ........................................ 3 1/4
ELEG 309 Electronic Circuit Analysis I ................. 4 1/4
ELEG 310 Random Signals and Noise ....................... 3 1/4
ELEG 370 Engineering Electromagnetics ..................... 4 1/4

Design Requirement .................................................. 4 1/4
In addition to the normal program, every student must take
at least four credits in a CPEG course designated as
"design." Regularly offered CPEG design courses include
CPEG 422 and CPEG 460. Other courses may be offered
irregularly which satisfy the design requirement. Students
should consult with their advisors before selecting their
design course or courses.

Technical Electives .................................................. 21
In addition to the design requirement, each student, in
consultation with their advisor, must select a program of
technical electives satisfying the following: (1) With some
exceptions, technical electives consist of 300-level or above
engineering, mathematics, natural sciences, and computer
science courses. With the permission of the student's
advisor, certain 200-level courses, such as PHYS 209, are
permitted. (2) At least 15 technical elective credits must be
taken. (3) Of the 15 technical elective credits, at least 9
must be in CPEG or ELEG courses. (4) Of the 9 credits in ELEG or CPEG, at least 6 must be in 400-level or above ELEG or CPEG courses.

**CREDITS TO TOTAL A MINIMUM OF . . . . 125**

**HONORS BACHELOR OF COMPUTER ENGINEERING**

A recipient of the Honors Bachelor of Computer Engineering must satisfy the following:
1. All requirements for the Bachelor of Computer Engineering degree.
2. All generic University requirements for the Honors Degree (see page 49). Graduate courses approved for this purpose by the department may be counted as Honors courses.

**MATERIALS SCIENCE AND ENGINEERING**

Although the Materials Science and Engineering Department offers no degrees at the undergraduate level, undergraduate students study the basic concepts associated with the engineering properties of materials in undergraduate courses taught by the Materials Science and Engineering faculty. In addition, the College offers a minor in materials science, and 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.

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www.udel.edu/mse

**REQUIREMENTS FOR A MINOR IN MATERIALS SCIENCE**

A minor in materials science requires the completion of 15 credits with a minimum grade of C- in all courses. MSEG 402 is a required course, and the remaining may be drawn from a wide variety of materials science, engineering, physics, and chemistry courses up to the 600-level. All courses used to fulfill the requirements of the minor must be approved by a materials science advisor. A listing of commonly offered courses is maintained by the Chair of the Materials Science and Engineering Department. Other materials courses may be approved as appropriate. For further information, contact the Materials Science and Engineering Department at 302-831-2062.

**MECHANICAL ENGINEERING**

The Department of Mechanical Engineering offers an ABET-accredited program leading to the Bachelor of Mechanical Engineering, including a University of Delaware Honors Degree Option. 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.

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 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 program 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 which may involve the use of state-of-the-art instrumentation, electronics and networked computers.

**TECHNICAL ELECTIVES**

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 from other departments and colleges are available with the approval of the departmental faculty.

Students can choose towards the end of sophomore or early junior year to pursue one of two concentrations: Aerospace or Biomedical Engineering to focus their upperclass studies. For those pursuing the degree without a concentration, there are three suggested focus areas: Fluids and Thermal Engineering, Solid Mechanics and Materials, and Design (Dynamic Design and Manufacturing). However, the technical elective program can also be structured to meet individual interests and students are encouraged to discuss their educational objectives with their advisor early in the junior year and to develop an agreed selection of technical electives.

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www.me.udel.edu

**DEGREE: BACHELOR OF MECHANICAL ENGINEERING**

**MAJOR: MECHANICAL ENGINEERING**

**CURRICULUM**

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 110</td>
<td>3</td>
</tr>
</tbody>
</table>

Critical Reading and Writing (minimum grade C-)

**UNIVERSITY REQUIREMENTS**

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 103</td>
<td>4</td>
</tr>
<tr>
<td>MATH 241</td>
<td>4</td>
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<tr>
<td>MATH 242</td>
<td>4</td>
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<tr>
<td>MATH 243</td>
<td>4</td>
</tr>
<tr>
<td>MATH 351</td>
<td>3</td>
</tr>
<tr>
<td>MATH 352</td>
<td>3</td>
</tr>
<tr>
<td>MATH 353</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 207</td>
<td>4</td>
</tr>
</tbody>
</table>

**GENERAL EDUCATION PROGRAM**

See p. 206: College General Education Program. One of the general education courses must fulfill the University multicultural requirement (see p. 66-77).
**DEGREE: BACHELOR OF MECHANICAL ENGINEERING**

**MAJOR: MECHANICAL ENGINEERING**

**CONCENTRATION: BIOMEDICAL ENGINEERING**

Students may add this Concentration to their Bachelor of Mechanical Engineering Major starting as early as the end of their sophomore year. To qualify for a Concentration in Biomedical Engineering, Mechanical Engineering students must complete all requirements for the Bachelor of Mechanical Engineering degree. In addition, the student is required to complete at least 12 credits in accord with the following requirements. (Note that all of these courses may also be used to satisfy technical elective requirements for the BME degree.)

**CREDITS TOTAL A MINIMUM OF ............ 122**

**CREDITS**

**MAJOR REQUIREMENTS**

**Basic Biology Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HESC 220</td>
<td>Anatomy and Physiology</td>
<td>3</td>
</tr>
<tr>
<td>HESC 420</td>
<td>Functional Human Anatomy</td>
<td>4</td>
</tr>
</tbody>
</table>

Advanced courses in Biomedical Engineering

Two of the following three-credit courses must also be taken:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEEG 483</td>
<td>Orthopaedic Biomechanics</td>
<td>3</td>
</tr>
<tr>
<td>MEEG 482</td>
<td>Clinical Biomechanics</td>
<td>3</td>
</tr>
<tr>
<td>MEEG 484</td>
<td>Biomaterials and Tissue Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MEEG 612</td>
<td>Biomechanics of Human Movement</td>
<td>3</td>
</tr>
</tbody>
</table>

*Independent study, Senior Research and additional courses for satisfying this requirement can be approved by the Department.

**DEGREE: BACHELOR OF MECHANICAL ENGINEERING**

**MAJOR: MECHANICAL ENGINEERING**

**CONCENTRATION: AEROSPACE ENGINEERING**

Students may add this Concentration to their Bachelor of Mechanical Engineering Major starting as early as the end of their sophomore year. To qualify for a Concentration in Aerospace Engineering, Mechanical Engineering students must complete all requirements for the Bachelor of Mechanical Engineering degree. In addition, the student is required to complete at least 12 credits in accord with the following requirements. (Note that all of these courses may also be used to satisfy technical elective requirements for the BME degree.)

**CREDITS**

**MAJOR REQUIREMENTS**

**Required Course**

All students must take the following course:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEEG 432</td>
<td>Aerodynamics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Advanced courses in Aerospace Engineering**

Three of the following three-credit courses must also be taken:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEEG 411</td>
<td>Structural Mechanics for Mechanical and Aerospace Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MEEG 423</td>
<td>Vibrations</td>
<td>3</td>
</tr>
<tr>
<td>MEEG 441</td>
<td>Combustion</td>
<td>3</td>
</tr>
<tr>
<td>MEEG 481</td>
<td>Computer Solution of Engineering Problems</td>
<td>3</td>
</tr>
<tr>
<td>MEEG 624</td>
<td>Control of Dynamic Systems</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 401</td>
<td>Introduction to the Finite Element Method</td>
<td>3</td>
</tr>
</tbody>
</table>

*Independent study, Senior Research and additional courses for satisfying this requirement can be approved by the Department.

**HONORS BACHELOR OF MECHANICAL ENGINEERING**

A recipient of Honors Bachelor of Mechanical Engineering must satisfy the following:

1. All requirements for the Bachelor of Mechanical Engineering degree.
2. All generic University requirements for the Honors Degree (see p. 49). Graduate courses approved for this purpose by the department may be counted as Honors courses.

**ARTS AND SCIENCE - ENGINEERING DOUBLE DEGREE**

The Arts and Science—Engineering program is a five-year curriculum which leads to a Bachelor of Arts from the College of Arts and Science and a Bachelor of Chemical, Civil, Computer, Electrical, Environmental, or Mechanical Engineering from the College of Engineering. Students who elect to complete this program must fulfill all the requirements of their four-year engineering major as well as a minimum of 30 additional credit hours in Arts and Science courses. Students must complete the college-level requirements of the College of Arts and Science and earn 15 credits of electives in an Arts and Science area of concentration. All elective courses are chosen in consultation with advisors in both colleges so as to take every advantage of situations where a course can fulfill requirements of both the Engineering and Arts and Science degrees.

Students who wish to pursue the five-year Arts and Science—Engineering program must initially be admitted to a
major within the College of Engineering. Engineering students who are interested in this special curriculum should meet with the Assistant Dean during their first year because it may not be possible to complete this curriculum in five years if the change is made after the freshman year. Once admitted to the five-year curriculum, a student may switch back to a normal four-year Engineering program or change to an Arts and Science major for which they are academically qualified.

Area of Concentration. The 15 credit hours which compose the Arts and Science area of concentration are chosen by the student in order to acquire some depth of knowledge in a particular field. In most cases, these 15 credits will not be sufficient to complete a major in an Arts and Science department. An Arts-Engineering student whose Arts and Science area of concentration falls short of the requirements for a specific major will graduate with a Bachelor of Arts from the College of Arts and Science. With careful planning, however, it is sometimes possible to obtain a second major in Arts and Science by taking more than the minimum of 30 credit hours or by specializing in a scientific or mathematical field which has a number of course requirements in common with the engineering major.

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DEGREE: BACHELOR OF ARTS - BACHELOR OF [CHEMICAL, CIVIL, COMPUTER, ELECTRICAL, ENVIRONMENTAL, OR MECHANICAL] ENGINEERING

MAJOR: NONE REQUIRED - [CHEMICAL, CIVIL, COMPUTER, ELECTRICAL, ENVIRONMENTAL, OR MECHANICAL] ENGINEERING

CURRICULUM CREDITS

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.

UNIVERSITY REQUIREMENTS
ENGL 110 Critical Reading and Writing (minimum grade C-) .......................... 3

Three credits in an approved course or courses stressing multi-cultural, ethnic, and/or gender-related course content (see p. 66-77) ............................................ 3

These credits may also fulfill some of the breadth requirements.

ARTS AND SCIENCE COLLEGE REQUIREMENTS
Writing: (minimum grade C-) ........................................ 3
A three-credit writing course involving significant writing experience including two papers with a combined minimum of 3,000 words to be submitted for extended faculty critique of both composition and content. These credits may also fulfill some of the breadth requirements.
(See list of courses approved for second writing requirement, page 100-102.)

Foreign Language: Completion of the intermediate . . . 0-12 level course (107 or 112) in a given language. Students with four or more years of high school work in a single foreign language may attempt to fulfill the requirement in that language by taking an exemption examination.

Breadth Requirements (See page 102-111)
Group A ........................................ 12
Understanding and appreciation of the creative arts and humanities. Twelve credits representing at least two areas.

Group B ........................................ 12
The study of culture and institutions over time. Twelve credits representing at least two areas.

Group C ........................................ 12
Empirically based study of human beings and their environment. Twelve credits representing at least two areas.

The above groups differ from the General Education groups of the College of Engineering. This requires careful course selection in order to have courses that satisfy both curricula simultaneously.

AREA OF CONCENTRATION REQUIREMENTS
Area of Concentration: ........................................ 15
Fifteen credits of Arts and Science electives to be used for acquiring some depth of knowledge in a field chosen in consultation with an Arts and Science advisor. These credits may also fulfill some of the breadth requirements.

Art and Science Requirements ........................................ 45-51
The liberal arts component is listed as 51 credit hours. The absolute minimum required to satisfy the requirements listed above is 45; this assumes that the foreign language requirement is satisfied from high school work, the writing course is in one of the Groups A, B, or C, and that nine credits of the Area of Concentration are also from one of the Groups A, B, or C. Thus, students without language skills and concentrating in science or mathematics will need more than 51 credit hours to complete all of these requirements.

ENGINEERING COLLEGE REQUIREMENTS
For a degree in the College of Engineering, the student must fulfill all the requirements of the chosen engineering major, including the College of Engineering General Education Program. Requirements for degrees in each of the engineering disciplines are described earlier in this chapter.

CREDITS TO TOTAL A MINIMUM OF . . . 152-156

Minimum total credit hours will vary, dependent upon the engineering major selected.