The College of Engineering offers baccalaureate degrees in chemical, civil, environmental, electrical, computer, and 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 145). 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. Inquiry should be made to the Assistant Dean for Undergraduate Affairs (135 du Pont Hall, 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 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 Assistant Dean and Director of the RISE Program at 302-831-6315.

**ADVISEMENT**

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 also 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 curriculum in each engineering major consists of a core of required courses, a group of elective technical classes, and a group of elective 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. The general education electives are chosen 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.

**GENERAL EDUCATION PROGRAM**

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 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 p. 20). 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.
• 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.
• 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.
• 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.
• 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 20) 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.

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 (135 du Pont Hall, 302-831-2659) 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 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 which 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.

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. 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.

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. MASC 302 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 Program. Other materials courses may be approved as appropriate. For further information, contact the Materials Science Program Office at 302-831-2062.

CHEMICAL ENGINEERING

Chemical Engineering is the combination of the sciences biology, chemistry, mathematics and physics with the art and creativity of engineering. The department has much more inclusive descriptions of the profession 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 opportunities 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 unless the science requirements, especially in chemistry, have been met. Students may enter Chemical Engineering after completing the eight credit freshman Chemistry sequence. CHEM 103/104 may not be adequate preparation for CHEM 443/444. 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 provided by the 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 uncertain that you are ready for MATH 242, you should start with MATH 242. In this case, it is easier to drop back to MATH 241 during the first two weeks of MATH 242 if that is where you belong. If you need additional mathematics, at least one Winter and/or Summer session will be required to complete the four year program on schedule. To remain on schedule with the CHEG courses, you must be on schedule in mathematics by the start of your sophomore year. Students should also note that the program is highly sequential and that many required courses are taught but once per year.

DEGREE: BACHELOR OF CHEMICAL ENGINEERING

MAJOR: CHEMICAL ENGINEERING

CURRICULUM

Superior figures indicate semester (fall or spring) and/or year or years in which the course should be taken, e.g., 1st year or 2nd year, etc.

UNIVERSITY REQUIREMENTS

ENGL 110 Critical Reading and Writing (minimum grade C-): 3 credits
Three credits in an approved course or courses stressing multicultural, ethnic, and/or gender-related content (see p. 20)
CHEMICAL ENGINEERING • COLLEGE OF ENGINEERING

COLLEGE REQUIREMENTS

General Education Program 18-14

See pp. 129-130: College General Education Program.

MAJOR REQUIREMENTS

External to the College

Chemistry
CHEM 111 General Chemistry 3.1F
CHEM 119 Quantitative Chemistry I 3.1F
CHEM 112 General Chemistry 3.1F
CHEM 443 Physical Chemistry 3.2F
CHEM 444 Physical Chemistry 3.25
CHEM 445 Physical Chemistry Laboratory I 3.25
CHEM 331 Organic Chemistry 3.3F
CHEM 333 Organic Chemistry Laboratory I (lecture only) 3.3F
CHEM 332 Organic Chemistry 3.3F

Mathematics
MATH 242 Analytic Geometry and Calculus B 4.1F
MATH 243 Analytic Geometry and Calculus C 4.1F
MATH 302 Ordinary Differential Equations 4.2F
MATH 305 Applied Math for Chemical Engineering 3.25

Physics
PHYS 207 Fundamentals of Physics I 4.1F
PHYS 208 Fundamentals of Physics II 4.2F

General Education Program 3-14

An additional three-credit general education course must be taken in the humanities or social sciences. Furthermore, 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 Sciences may not be used to fulfill this requirement.

Within the College

MASC 302 Materials Science for Engineers 4.3F

Within the Department

CHEG 009 Chemical Engineering Freshman Seminar 0.1F
CHEG 112 Introduction to Chemical Engineering 3.1S
CHEG 231 Chemical Engineering Thermodynamics 3.2F
CHEG 325 Thermal Engineering Thermodynamics 3.25
CHEG 332 Chemical Engineering Kinetics 3.3F
CHEG 341 Fluid Mechanics 3.3F
CHEG 320 Engineering Economics and Risk Assessment 3.3S
CHEG 345 Chemical Engineering Laboratory I 3.35
CHEG 342 Heat and Mass Transfer 3.4S
CHEG 443 Mass Transfer Operations 3.4F
CHEG 445 Chemical Engineering Laboratory II 3.4F
CHEG 473 Chemical Engineering Projects (requires advisor's approval) 3.4F
CHEG 473 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 UNIV 401-402 is equivalent to CHEG 473-474.
CHEG 401 Chemical Process Dynamics and Control 3.4S
CHEG 432 Chemical Process Analysis 4.4S

Technical Electives

General Technical Electives 9.25-4.5

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 300-600). 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.

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 advisors 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.

Biology
BISC 207 Introductory Biology I 4
BISC 208 Introductory Biology II 4
BISC 301/311 Molecular Biology of the Cell 4/3
BISC 302 Genet. and Evolut. 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 advisor 3-4
CHEG 595 Patent Law for Engineers and Scientists 3

Chemistry
CHEM 333 Organic Chemistry Lab II 2
CHEM 437 Inorganic Chemistry 3
CHEM 437 Introductory Biochemistry 3
CHEM 8xx Chemistry course chosen with the approval of the advisor 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 366 Computer Graphics 3

Mathematics
MATH 349 Elements of Linear Systems 3
MATH 389 Graph Theory 3
MATH 426 Introduction to Numerical Analysis and Algorithmic Computation 3
MATH 428 Algorithmic and Numerical Solution of Differential Equations 3
MATH 5xx Mathematics course chosen with the approval of the advisor 3
MATH 6xx Mathematics course chosen with the approval of the advisor 3

Mechanical Engineering Applied Mathematics
MEEG 361 Applied Engineering Analysis 3
MEEG 863 Engineering Analysis I 3
MEEG 864 Engineering Analysis II 3

Physics
PHYS 209 Fundamentals of Physics III 3
PHYS 313 Physical Optics 3
PHYS 419 Classical Mechanics I 3
PHYS 6xx Physics course chosen with the approval of the advisor 3

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

Electronic Materials
CPEG 202 Introduction to Digital Systems 4
CPEG 210 Introduction to Combinatorial Logic 2
CPEG 211 Introduction to Sequential Circuits 2
ELEG 311 Linear Circuit Theory 4
ELEG 314 Electronics and Instrumentation 4
ELEG 340 Solid State Electronics 4
ELEG 423 Electrical Properties of Matter I 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 advisor 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 112 Statics 3
MEEG 214 Principles of Mechanics II 3
MEEG 313 Strength of Materials 4
MEEG 413 Advanced Mechanics of Materials 3
MEEG 415 Finite Elements Analysis 3

Environmental Engineering
CIEG 432 Wastewater Engineering 3
CIEG 433 Hazardous Waste Management 3
CIEG 453 Industrial Wastes Management 3
CIEG 457 Water and Wastewater Quality 3

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 a chemical engineering program at the advanced level. Students should decide with their advisors 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 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.

Biology
BISC 301 Molecular Biology of the Cell 4.35
CHEM 527 Introductory Biochemistry 3.4\nCHEG 620 Biochemical Engineering 3.45
CHEG 650 Biomedical Engineering 3.4\n
Chemistry
CHEG 457 Inorganic Chemistry 3.35
CHEG 527 Introductory Biochemistry 3.4\nCHEG 606 Introduction to Catalysis 3.45
CHEG 610 Industrial and Engineering Chemistry 3.45
CHEG 836 Applied Chemical Kinetics 3.4

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

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 p.
30). 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.

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.
2) A minimum grade of C- in CHEG 325.
3) A minimum grade of C- in MATH 302.

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 443.

Admission to CHEG 445:
1) A minimum grade of C- in CHEG 345.
2) A minimum grade of C- in CHEG 332.
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.

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 Engineer-
ing 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 experi-
ence, 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
Traditionally, civil engineering has been identified with the planning
and design of constructed facilities such as dams, bridges, buildings,
rails, 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 struc-
tures. Areas concerned with pollution control, water supply, and water
resource management are now considered to comprise the distinct disci-
pline of 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. The Civil Engineering
program includes specialization options in structural engineering,
geotechnical engineering, environmental engineering, hydraulic and
ocean engineering, and transportation engineering as shown by the
listed Technical Electives. The Environmental Engineering curricu-
ulum 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.

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 111 and CHEM 112.

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 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

CURIUM

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  15
These credits in an approved course or courses stressing multicultural, ethnic, and/or gender-related content (see p. 20)

CREDIT TO TOTAL A MINIMUM OF •••••••••••••••••••••••••••••

COLLEGE REQUIREMENTS

General Education Program

See pp 129-130: College General Education Program.

CIVIL AND ENVIRONMENTAL ENGINEERING • COLLEGE OF ENGINEERING

MAJOR REQUIREMENTS

External to the College

ENGL 410  Technical Writing  3  45

Chemistry

CHEM 103  General Chemistry  4  17
CHEM 104  General Chemistry  4  15
CISC 106  General Computer Science for Engineers  3  21
GEOL 107  General Geology I  4  24
STAT 450  Statistics for the Engineering and Physical Sciences  3  25

Mathematics

MATH 241  Analytic Geometry and Calculus A  4  17
MATH 242  Analytic Geometry and Calculus B  4  15
MATH 243  Analytic Geometry and Calculus C  4  24
MATH 302  Ordinary Differential Equations  3  25

Physics

PHYS 207  Fundamentals of Physics I  4  24
PHYS 208  Fundamentals of Physics II  4  25

Within the College

EGGG 132  Engineering Graphics/Analysis  3  17
MASC 302  Materials Science for Engineers  3  24
MECH 305  Fluid Mechanics  3  17
MECH 306  Fluid Mechanics Laboratory  3  17

Within the Department

CIEG 125  Introduction to Engineering (CE)  3  17
CIEG 211  Statics  3  24
CIEG 212  Strength of Materials  3  24
CIEG 214  Materials Laboratory I  3  24
CIEG 233  Environmental Engineering Processes  3  24
CIEG 301  Analysis of Structures  3  24
CIEG 311  Dynamics  3  24
CIEG 351  Transportation Engineering  3  24
CIEG 381  Civil Engineering Analysis  3  24
CIEG 420  Soil Mechanics  3  24
CIEG 461  Senior Design Project  3  24
CIEG 482  System Design and Operation  3  24

One of:

CIEG 402  Steel Design  3  24
or
CIEG 403  Concrete Design  3  24

or

One of:

CIEG 431  Water Supply Engineering  3  24
or
CIEG 432  Wastewater Engineering  3  24

or

One of:

CIEG 441  Hydrology  3  24
or
CIEG 442  Hydraulic Engineering  3  24

Technical Electives

Four courses giving a total of at least four additional design points must be satisfied; see current department technical elective listing. This 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.

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

TECHNICAL ELECTIVES

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 Engineering.

In addition, four 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 223  Surveying  3  24
CIEG 401  Computer Methods of Structural Engineering  3  24
CIEG 402  Steel Design  3  24
CIEG 403  Concrete Design  3  24
CIEG 421  Foundations and Substructures  3  24
CIEG 431  Water Supply Engineering  3  24
CIEG 432  Wastewater Engineering  3  24
CIEG 441  Hydrology  3  24
CIEG 442  Hydraulic Engineering  3  24
CIEG 452  Transportation Facilities Design  3  24
CIEG 471  Introduction to Coastal Engineering  3  24
EGGG 432  Principles of Computer-Aided Drawing  3  24

Environmental Engineering

CIEG 403  Concrete Design  3  24
CIEG 421  Foundations and Substructures  3  24
CIEG 431  Water Supply Engineering  3  24
CIEG 432  Wastewater Engineering  3  24
CIEG 433  Hazardous Waste Management  3  24
CIEG 435  Industrial Wastes Management  3  24
CIEG 437  Water and Wastewater Quality  3  24
CIEG 441  Hydrology  3  24
CIEG 442  Hydraulic Engineering  3  24
BISC 371  Introduction to Microbiology  4  24
BISC 472  Principles of Infectious Diseases  3  24
BISC 641  Microbial Ecology  3  24
BREG 628  Land Application of Wastes  3  24
CHEM 213  Elementary Organic Chemistry  4  24
CHEM 224  Elementary Biochemistry  4  24
CHEM 220  Quantitative Analysis  3  24
CHEM 418  Introduction to Physical Chemistry  3  24
ELEG 411  Remote Sensing in Environmental  3  24
GEOL 413  Fundamentals of Well Logging  3  24
GEOL 421  Environmental and Applied Geology  3  24
GEOL 428  Hydrogeology  3  24
MEEG 357  Thermodynamics I  3  24

Hydraulic and Ocean Engineering

CIEG 441  Hydrology  3  24
CIEG 421  Foundations and Substructures  3  24
CIEG 422  Earth Structures Engineering  3  24
CIEG 431  Water Supply Engineering  3  24
CIEG 401  Computer Methods of Structural Engineering  3  24
CIEG 403  Concrete Design  3  24
CIEG 471  Introduction to Coastal Engineering  3  24
CIEG 442  Hydraulic Engineering  3  24
MEEG 361  Applied Engineering Analysis  3  24

Structures and Geotechnical Engineering

CIEG 223  Surveying  3  24
CIEG 401  Computer Methods of Structural Analysis  3  24
CIEG 402  Steel Design  3  24
CIEG 403  Concrete Design  3  24
CIEG 404  Prestressed Concrete Design  3  24
CIEG 405  Matrix Structural Analysis  3  24
CIEG 406  Structural Materials  3  24
CIEG 411  Structural Dynamics Design  3  24
CIEG 415  Reliability Design  3  24
CIEG 416  Random Vibration  3  24

131
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. 30).
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, and before being admitted to the minor, the student must have successfully completed CHEM 103, 104, MATH 242, 243, 302, PHYS 207 and 208. A grade point average of at least 2.0 is required in the 21 credits of engineering courses of the minor and in the mathematics and science courses listed above.

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

<table>
<thead>
<tr>
<th>Course</th>
<th>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>Strength of Materials, (lab optional)</td>
<td>3</td>
</tr>
<tr>
<td>CIEG 311</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>MECH 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 or higher level. 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 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, 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.
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 mathemat-
ics. 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 ......................... 4
CIEG 403 Concrete Design .................................. 3
Additional Related Technical Electives
CIEG 402 Steel Design .................................. 3
CIEG 404 Prestressed Concrete Design ......................... 3
CIEG 421 Foundations and Substructures ......................... 3
CIEG 486 Engineering Management ......................... 3
MASC 302 Materials Science ............................. 4

Pollution Transport and Control Processes
Core Technical Electives
CHEG 332 Chemical Engineering Kinetics ......................... 3
CHEG 342 Heat and Mass Transfer ......................... 4
CHEM 443 Physical Chemistry .......................... 3
Additional Related Technical Electives
CIEG 433 Hazardous Waste Management ......................... 3
CIEG 435 Industrial Waste Management ......................... 3
MEEG 424 Air Pollution Processes ......................... 3

Additional Recommended Technical Electives
BISC 371 Introduction to Microbiology ......................... 4
BREG 428 Land Application of Wastes ......................... 3
CHEM 331 Organic Chemistry .......................... 3
CHEM 444 Physical Chemistry .......................... 3
CIEG 482 Systems Design and Operation ......................... 3
GEOL 421 Environmental and Applied Geology .......... 3
GEOL 446 General Geochmistry .......................... 3
PLSC 608 Soil Chemistry .................................. 3

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
p. 30). Graduate courses approved for this purpose by the depart-
ment 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 which lead to the degrees of Bachelor of Electrical Engi-
neering and Bachelor of Computer Engineering. The Electrical En-
ingineering curriculum prepares graduates to enter the broad pro-
fession of modern electrical engineering. The Computer Engineer-
ing 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 engi-
neering: (1) a core group of courses; (2) an elective group of technical
courses in an area of concentration; and (3) a "general education"
component that includes six courses in the humanities and social sci-
ences and two in written communications.

The core group includes four courses in mathematics, two in
physics, one in chemistry, two in computer science, and sixteen in elec-
trical engineering. 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 cer-
tain that you are ready for MATH 242, start with MATH 242. In this
case it is easier to drop back to MATH 241 during the first two weeks
of MATH 242 if this is where you belong. If you need additional math-
ematics, 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.

The technical electives must be chosen to form an area of con-
centration. 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 181, PHYS 207, and CPEG 210-
211 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 stu-
dents follow as closely as possible the course sequence outlined
below.

DEGREE: BACHELOR OF ELECTRICAL ENGINEERING
MAJOR: ELECTRICAL ENGINEERING

CURRICULUM
Superior figures indicate semester (fall or spring) and/or year or years
in which the course should be taken, i.e. 1 fall of freshman year,
2 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
multicultural, ethnic, and/or gender-related content (see p. 20)

COLLEGE REQUIREMENTS
General Education Program ................................ 18
See p. 129-130: College General Education Program

MAJOR REQUIREMENTS
External to the College
ECON 151 Introduction to Microeconomics ......................... 3
ENGL 301 Expository Writing .................................. 3
PHIL 341 Ethics of Engineering Profession ......................... 1
Technical Electives—Concentration in Systems and Signals

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CISC 220 Data Structures</td>
<td>3.25</td>
</tr>
<tr>
<td>MATH 426 Numerical Analysis</td>
<td>3.3F</td>
</tr>
<tr>
<td>ELEG 403 Communications Systems</td>
<td>3.4F</td>
</tr>
<tr>
<td>ELEG 428 System Analysis and Control</td>
<td>3.45</td>
</tr>
</tbody>
</table>

Technical Program Electives

- 6

Technical Electives—Concentration in Devices and Materials

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 209 Fundamentals of Physics</td>
<td>3.3S</td>
</tr>
<tr>
<td>PHYS 331 Physical Optics</td>
<td>3.4S</td>
</tr>
<tr>
<td>ELEG 423 Electronic Properties of Matter</td>
<td>3.4F</td>
</tr>
<tr>
<td>ELEG 440 Optoelectronics</td>
<td>3.4F</td>
</tr>
<tr>
<td>ELEG 450 Semiconductor Device Design and Fab</td>
<td>4.4S</td>
</tr>
</tbody>
</table>

Technical Electives—Concentration in Power Systems

- 6.3F


design courses.

Design Requirement

In addition to the design content of the normal program, every student must take at least one course in the senior year in which one design project is at least 50% of the coursework. Regularly offered courses that presently meet this requirement are ELEG 420, 422, 450, and 464. Other special courses are offered that will meet this requirement. The design requirement may also be met with special projects carried out in conjunction with faculty research with the prior approval of the Departmental Undergraduate Representative. Students must consult with their advisors for the proper selection of design courses.

Technical Electives

Each student must select a concentration to structure his/her technical elective program. Four concentrations are defined: computer engineering, systems and signals engineering, electronic devices and materials engineering, and power systems engineering. Each Electrical Engineering student must take seven courses totaling a minimum of 21 credits in technical electives within the chosen concentration. Students with a special interest may define their own concentrations in conjunction with their advisor. With some exceptions, upper-level engineering, computer science, physics, science and mathematics courses are acceptable technical electives. However, students planning their own programs of concentration should realize that there must be a theme holding together at least most of the courses chosen. Any special concentrations must be approved by the Departmental Undergraduate Representative prior to the start of the senior year. Each of the four regular concentrations specifies 5 of the 7 technical elective courses. Students should note that the requirement for a senior design project will, in some cases, further constrain the choice of technical electives. The technical electives must be chosen from an area of concentration. 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. The four concentrations follow:

Technical Electives—Concentration in Computer Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CISC 220 Data Structures</td>
<td>3.2F</td>
</tr>
<tr>
<td>CPEG 323 Intro: Computer System Eng</td>
<td>3.3F</td>
</tr>
<tr>
<td>CPEG 324 Computer System Design I</td>
<td>3.3S</td>
</tr>
<tr>
<td>Technical Program Electives</td>
<td>6</td>
</tr>
<tr>
<td>and at least one of:</td>
<td></td>
</tr>
<tr>
<td>CPEG 419 Computer Communication Networks</td>
<td>3.4S</td>
</tr>
<tr>
<td>CISC 361 Operating Systems</td>
<td>3.3S</td>
</tr>
<tr>
<td>CPEG 422 Computer System Design II</td>
<td>4.4F</td>
</tr>
</tbody>
</table>

Technical Electives—Concentration in Systems and Signals

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CISC 220 Data Structures</td>
<td>3.25</td>
</tr>
<tr>
<td>MATH 426 Numerical Analysis</td>
<td>3.3F</td>
</tr>
<tr>
<td>ELEG 403 Communications Systems</td>
<td>3.4F</td>
</tr>
<tr>
<td>ELEG 428 System Analysis and Control</td>
<td>3.45</td>
</tr>
</tbody>
</table>

Technical Program Electives

- 6

Technical Electives—Concentration in Devices and Materials

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 209 Fundamentals of Physics</td>
<td>3.3S</td>
</tr>
<tr>
<td>PHYS 331 Physical Optics</td>
<td>3.4S</td>
</tr>
<tr>
<td>ELEG 423 Electronic Properties of Matter</td>
<td>3.4F</td>
</tr>
<tr>
<td>ELEG 440 Optoelectronics</td>
<td>3.4F</td>
</tr>
<tr>
<td>ELEG 450 Semiconductor Device Design and Fab</td>
<td>4.4S</td>
</tr>
</tbody>
</table>

Technical Electives—Concentration in Power Systems

- 6.3F

Appendices

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 p. 30). Graduate courses approved for this purpose by the department may be counted as Honors courses.

DEGREE: BACHELOR OF COMPUTER ENGINEERING

MAJOR: COMPUTER ENGINEERING

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.

CURRICULUM

UNIVERSITY REQUIREMENTS

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 110 Critical Reading and Writing (minimum grade C)</td>
<td>3.1S</td>
</tr>
<tr>
<td>ENG 301 Expository Writing</td>
<td>3.1F</td>
</tr>
<tr>
<td>PHI 341 Ethics in the Engineering Profession</td>
<td>1.4F</td>
</tr>
</tbody>
</table>

Mathematics

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 210 Discrete Mathematics</td>
<td>3.1F</td>
</tr>
<tr>
<td>MATH 242 Analytical Geometry and Calculus B</td>
<td>4.1F</td>
</tr>
<tr>
<td>MATH 243 Analytical Geometry and Calculus C</td>
<td>4.1S</td>
</tr>
<tr>
<td>MATH 341 Differential Equations &amp; Linear Alg I</td>
<td>3.2F</td>
</tr>
<tr>
<td>MATH 342 Differential Equations &amp; Linear Alg II</td>
<td>3.2S</td>
</tr>
</tbody>
</table>

Students not prepared to start with MATH 242 should start with MATH 241 and use the winter and/or summer terms to get caught up before the sophomore year.
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.S.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 program 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 can be selected with the approval of the departmental faculty.

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 advisor early in the junior year and to develop an agreed selection of technical electives.

DEGREE: BACHELOR OF MECHANICAL ENGINEERING

MAJOR: MECHANICAL ENGINEERING

CURRICULUM

Superior figures indicate semester (fall or spring) and/or year or years in which the course should be taken, i.e. 1st year, 1st fall or spring, 2nd year, 1st fall, etc.

UNIVERSITY REQUIREMENTS

ENGL 110 Critical Reading and Writing (minimum grade C) 3.15
Three credits in an approved course or courses stressing multicultural, ethnic, and/or gender-related content (see p. 20)

COLLEGE REQUIREMENTS

General Education Program

See pp. 129-130: College General Education Program

MAJOR REQUIREMENTS

External to the College

Chemistry

CHEM 103 General Chemistry 3.15

Mathematics

MATH 242 Analytic Geometry and Calculus B 3.15
MATH 243 Analytic Geometry and Calculus C 3.15
MATH 302 Ordinary Differential Equations 3.15
MATH 3xx Engineering Mathematics I 3.15
MATH 3xx Engineering Mathematics II 3.15
MATH 3xx Numerical Methods 3.15
STAT 450 Statistics 3.15

Physics

PHYS 207 Fundamentals of Physics I 3.15
PHYS 210 Introduction to Thermal Physics 3.15
PHYS 345 Introduction to Electricity and Electronics 3.15

Within the College

MASC 302 Materials Science for Engineers 3.15

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.

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 p. 30). Graduate courses approved for this purpose by the department may be counted as Honors courses.

CREDITS TO TOTAL A MINIMUM OF 126

MECHANICAL ENGINEERING

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.S.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 program 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 can be selected with the approval of the departmental faculty.

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 advisor early in the junior year and to develop an agreed selection of technical electives.

DEGREE: BACHELOR OF MECHANICAL ENGINEERING

MAJOR: MECHANICAL ENGINEERING

CURRICULUM

Superior figures indicate semester (fall or spring) and/or year or years in which the course should be taken, i.e. 1st year, 1st fall or spring, 2nd year, 1st fall, etc.

UNIVERSITY REQUIREMENTS

ENGL 110 Critical Reading and Writing (minimum grade C) 3.15
Three credits in an approved course or courses stressing multicultural, ethnic, and/or gender-related content (see p. 20)

COLLEGE REQUIREMENTS

General Education Program

See pp. 129-130: College General Education Program

MAJOR REQUIREMENTS

External to the College

Chemistry

CHEM 103 General Chemistry 3.15

Mathematics

MATH 242 Analytic Geometry and Calculus B 3.15
MATH 243 Analytic Geometry and Calculus C 3.15
MATH 302 Ordinary Differential Equations 3.15
MATH 3xx Engineering Mathematics I 3.15
MATH 3xx Engineering Mathematics II 3.15
MATH 3xx Numerical Methods 3.15
STAT 450 Statistics 3.15

Physics

PHYS 207 Fundamentals of Physics I 3.15
PHYS 210 Introduction to Thermal Physics 3.15
PHYS 345 Introduction to Electricity and Electronics 3.15

Within the College

MASC 302 Materials Science for Engineers 3.15

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.
Within the Department

MEEG 101 Introduction to Mechanical Engineering 49
MEEG 112 Statics 25
MEEG 2xx CAD/CAM Lab 25
MEEG 2xx Dynamics 25
MEEG 2xx Mechanics of Solids 25
MEEG 3xx Kinematics 25
MEEG 3xx Machine Design 25
MEEG 3xx Vibration/Control 25
MEEG 3xx Materials Engineering 25
MEEG 3xx Fluids I 25
MEEG 3xx Fluids II 25
MEEG 3xx Heat Transfer 25
MEEG 3xx Thermodynamics 25
MEEG 3xx Thermodynamics Laboratory 25
MEEG 4xx Product Development 25

Technical Electives

400 level or above courses in engineering, science or mathematics selected by the student with the approval of the advisor

CREDITS TOTAL A MINIMUM OF 121

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. 30) Graduate courses approved for this purpose by the department may be counted as Honors courses.

DEPARTMENT OF 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. Questions concerning applicant qualifications should be directed to the unit's admission officer.

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 complete for entry into the POC. If accepted, they must attend four weeks of 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. Pilot and navigator candidates incur an additional obligation because of specialized training following commissioning. All students under contract receive approximately $1,500 tax free annually.

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 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 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 communications 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, non-taxable 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 $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.
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. Within these 30 credits, 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 be initially 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.

**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**

<table>
<thead>
<tr>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 110 Critical Reading and Writing (minimum grade C)</td>
</tr>
<tr>
<td>Three credits in an approved course or courses stressing multicultural, ethnic, and/or gender-related content (see p. 20)</td>
</tr>
</tbody>
</table>

**UNIVERSITY REQUIREMENTS**

<table>
<thead>
<tr>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing: (minimum grade C)</td>
</tr>
<tr>
<td>A 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 (See list of courses approved for second writing requirement, page 59)</td>
</tr>
</tbody>
</table>

**ARTS AND SCIENCE COLLEGE REQUIREMENTS**

**Skill Requirements**

| FOREIGN LANGUAGE: | 0-12 |
| Completion of the intermediate-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 60)

**Group A**
Understanding and appreciation of the creative arts and humanities. Twelve credits representing at least two areas.

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

**Group C**
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:**
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.

---

**Arts-Science Courses Completed**

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 in the College of Engineering section.

**CREDITS TO TOTAL A MINIMUM OF**

151-162

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