College of Engineering

Sarah Rajala, Dean for College of Engineering
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Gary Mirka, Associate Dean for Undergraduate and Graduate Education
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Departments of the College

For information on undergraduate options refer to the following curriculum sections, and for graduate specializations or certificate programs, refer to the Courses and Programs section of the catalog.

• Aerospace Engineering
• Agricultural and Biosystems Engineering
• Chemical and Biological Engineering
• Civil, Construction and Environmental Engineering
• Electrical and Computer Engineering
• Industrial and Manufacturing Systems Engineering
• Materials Science and Engineering
• Mechanical Engineering

Degree Programs

Aerospace Engineering
Agricultural Engineering
Biological Systems Engineering
Chemical Engineering
Civil Engineering
Computer Engineering
Construction Engineering
Electrical Engineering
Engineering Mechanics
Industrial Engineering
Materials Engineering
Materials Science and Engineering
Mechanical Engineering
Software Engineering
Systems Engineering

Minors

Bioengineering
Energy Systems
Engineering Sales
Non-Destructive Evaluation Engineering
Nuclear Engineering
Wind Energy

Engineering

Aligning Education in Engineering with the University Mission

The problem-solving skills learned from an engineering education at Iowa State University also provide an excellent launching pad for careers not only in engineering, but also medicine, law, business, and many other fields.

Registration as a professional engineer, which is granted by each individual state, is required for many types of positions. The professional curricula in engineering at Iowa State University are designed to prepare a graduate for subsequent registration in all states.

Seniors in accredited curricula of the College of Engineering are encouraged to take the Fundamentals of Engineering Examination toward professional registration during their final academic year. Seniors in engineering curricula who have obtained at least 6 semester credits in surveying may take the Fundamentals Examination for professional registration as land surveyors.

Concurrent Graduate/Undergraduate Programs

Several engineering programs offer the opportunity for well-qualified undergraduate juniors and seniors to pursue a graduate degree in their program while finishing the undergraduate requirements. The programs offering concurrent undergraduate/graduate degrees are: agricultural engineering, biological systems engineering, chemical engineering, civil engineering, computer engineering, construction engineering, electrical engineering, industrial engineering, materials engineering, and mechanical engineering.

Programs offering concurrent bachelor of science/master of business administration degrees are: aerospace engineering, agricultural engineering, civil engineering, computer engineering, electrical engineering, industrial engineering, and mechanical engineering. For more information, refer to the graduate study sections for each engineering program. Advanced work in engineering is offered in the post-graduate programs. See the Graduate College section of this catalog.

Joint Undergraduate Programs

A bachelor of science degree in software engineering is offered in the College of Engineering and the College of Liberal Arts and Sciences. This program is jointly administered by the Department of Electrical and Computer Engineering and the Department of Computer Science.

Accreditation

Ten engineering programs are accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. These ten programs are: aerospace, agricultural, chemical, civil, computer, construction, electrical, industrial, materials, and mechanical engineering. Accreditation status is indicated in the Courses and Programs section for each engineering program.

Organization of Curricula

All curricula in engineering are designed as four-year programs. They are structured in two phases: a basic program and a professional program. The basic program consists primarily of subjects fundamental and common to all branches of engineering and includes chemistry, physics, mathematics, engineering computations, and English. The professional phase of a curriculum includes intensive study in a particular branch of engineering, as well as a continuation of supporting work in mathematics, basic sciences, humanities, and social sciences. Students should complete the requirements of the basic program before proceeding to a professional program.

Preparation for the Engineering Curricula

In addition to the standard university admission requirements, the college also requires 2 years of a foreign language. Other high school credits particularly important to students wishing to study engineering include:

• 2 years of algebra,
• 1 year of geometry
• 1/2 year of trigonometry
• 1/2 year of pre-calculus
• 1 year each of chemistry, biology, and physics
• 3 years of social science
• 4 years of English

See Index for specific admission requirements.
Placement in mathematics, English, and chemistry will generally be based on high school preparation and test scores. Advanced placement is possible for exceptionally well-prepared students. Students who are not adequately prepared may be encouraged or required to take additional preparatory coursework and should expect to spend more than the customary time to complete the engineering program. Any coursework which is preparatory or remedial in nature cannot be used to satisfy credit requirements for graduation in any of the engineering curricula.

**Basic Program for Professional Engineering Curricula**

The first year program is much the same for all professional curricula in the College of Engineering. Students normally enroll in the majority of the basic program courses during their first year. The basic program is a set of courses common to all engineering curricula. Since students may also begin curriculum designated requirements during their first year, they will want to select a curriculum as soon as possible. This will enable them to receive the bachelor’s degree in a minimum time.

Entering undergraduates must demonstrate proficiency in trigonometry based on test scores, or by having transfer credits from a college trigonometry course, or by passing either MATH 141 Trigonometry or MATH 142 Trigonometry and Analytic Geometry before enrolling in MATH 166 Calculus II or C E 160 Engineering Problems with Computational Laboratory.

The Department of English may recommend placement in one or more sections of ENGL 101 English for Native Speakers of Other Languages if the placement test administered to students whose first language is not English indicates a deficiency in reading or writing. Satisfactory completion of the recommended course(s) will be required of students in the College of Engineering.

**Basic Program**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 165</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 166</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 150</td>
<td>Critical Thinking and Communication</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 250</td>
<td>Written, Oral, Visual, and Electronic Composition</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 167</td>
<td>General Chemistry for Engineering Students *</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 160</td>
<td>Engineering Problems with Computer Applications</td>
<td>3</td>
</tr>
</tbody>
</table>

Or one of the following in place of ENGR 160**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>AER E 160</td>
<td>Aerospace Engineering Problems With Computer Applications Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>C E 160</td>
<td>Engineering Problems with Computational Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>CH E 160</td>
<td>Chemical Engineering Problems with Computer Applications Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>CPR E 185</td>
<td>Introduction to Computer Engineering and Problem Solving I</td>
<td>3</td>
</tr>
<tr>
<td>E E 185</td>
<td>Introduction to Electrical Engineering and Problem-Solving I</td>
<td>3</td>
</tr>
<tr>
<td>I E 148</td>
<td>Information Engineering</td>
<td>1</td>
</tr>
<tr>
<td>M E 160</td>
<td>Mechanical Engineering Problem Solving with Computer Applications</td>
<td>1</td>
</tr>
<tr>
<td>S E 185</td>
<td>Problem Solving in Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 221</td>
<td>Introduction to Classical Physics I</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 101</td>
<td>Engineering Orientation *** R</td>
<td>1</td>
</tr>
<tr>
<td>LIB 160</td>
<td>Information Literacy</td>
<td>1</td>
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</table>

Total Credits: 27

ENGL 250 Written, Oral, Visual, and Electronic Composition is normally taken in the second year. However, students who advance place into this course may be able to enroll during their first year. Credit for ENGL 150 Critical Thinking and Communication is earned upon successful completion of ENGL 250 Written, Oral, Visual, and Electronic Composition, but only when ENGL 250 Written, Oral, Visual, and Electronic Composition is completed at Iowa State. In addition to the basic program courses listed above, curriculum designated courses normally taken the first year of each engineering curricula are listed below.

**Curriculum Designated Requirements**

**Aerospace Engineering**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>AER E 161</td>
<td>Numerical, Graphical and Laboratory Techniques for Aerospace Engineering</td>
<td>4</td>
</tr>
<tr>
<td>AER E 192</td>
<td>Aerospace Seminar</td>
<td>R</td>
</tr>
<tr>
<td>GenEd Electives</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

**Agricultural Engineering**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHEM 167L</td>
<td>Laboratory in General Chemistry for Engineering</td>
<td>1</td>
</tr>
<tr>
<td>A E 110</td>
<td>Experiencing Agricultural and Biosystems Engineering</td>
<td>1</td>
</tr>
<tr>
<td>A E 170</td>
<td>Engineering Graphics and Introductory Design</td>
<td>3</td>
</tr>
<tr>
<td>SSH Elective</td>
<td></td>
<td>3</td>
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</tbody>
</table>

**Biological Systems Engineering**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHEM 167L</td>
<td>Laboratory in General Chemistry for Engineering</td>
<td>1</td>
</tr>
<tr>
<td>BSE 110</td>
<td>Experiencing Biological Systems Engineering</td>
<td>1</td>
</tr>
<tr>
<td>BSE 170</td>
<td>Engineering Graphics and Introductory Design</td>
<td>3</td>
</tr>
<tr>
<td>SSH Elective</td>
<td></td>
<td>3</td>
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</table>

**Chemical Engineering**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHEM 177</td>
<td>General Chemistry I *</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 177L</td>
<td>Laboratory in General Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 178</td>
<td>General Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 178L</td>
<td>Laboratory in College Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>SSH Elective</td>
<td></td>
<td>3</td>
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**Civil Engineering**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHEM 177</td>
<td>General Chemistry I *</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 177L</td>
<td>Laboratory in General Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>C E 105</td>
<td>Introduction to the Civil Engineering Profession</td>
<td>1</td>
</tr>
<tr>
<td>C E 170</td>
<td>Graphics for Civil Engineering</td>
<td>2</td>
</tr>
<tr>
<td>C E 111</td>
<td>Fundamentals of Surveying I</td>
<td>3</td>
</tr>
<tr>
<td>SSH Elective</td>
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**Computer Engineering**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>COM S 227</td>
<td>Introduction to Object-oriented Programming</td>
<td>4</td>
</tr>
<tr>
<td>CPR E 166</td>
<td>Professional Programs Orientation</td>
<td>R</td>
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<tr>
<td>Gen Ed Elective</td>
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**Construction Engineering**

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CON E 121</td>
<td>Cornerstone Learning Community: Orientation to</td>
<td>1</td>
</tr>
<tr>
<td>CON E 122</td>
<td>Cornerstone Learning Community: Orientation to</td>
<td>1</td>
</tr>
<tr>
<td>Professional Life</td>
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**Electrical Engineering**

<table>
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<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>E E 285</td>
<td>Problem Solving Methods and Tools for Electrical Engineering</td>
<td>4</td>
</tr>
<tr>
<td>E E 166</td>
<td>Professional Programs Orientation</td>
<td>R</td>
</tr>
<tr>
<td>Gen Ed Elective</td>
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**Industrial Engineering**

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<thead>
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<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>I E 101</td>
<td>Industrial Engineering Profession</td>
<td>R</td>
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<tr>
<td>SSH Elective</td>
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<td>6</td>
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</table>
Materials Engineering

CHEM 177 General Chemistry I 4
CHEM 177L Laboratory in General Chemistry I 1
CHEM 178 General Chemistry II 3
CHEM 178L Laboratory in College Chemistry II 1
Gen Ed Elective 3
PHYS 221 Introduction to Classical Physics I (scheduled in sophomore year) 5

Mechanical Engineering

CHEM 167L Laboratory in General Chemistry for Engineering 1
M E 170 Engineering Graphics and Introductory Design 3
Gen Ed Elective 3

Software Engineering

S E 166 Careers in Software Engineering R
COM S 227 Introduction to Object-oriented Programming 4
COM S 228 Introduction to Data Structures 3

The student’s adviser may require or recommend courses in addition to those specified above if the preparation and progress of the student are such that additional courses are necessary or desirable.

*Students planning to enroll in C E, Ch E, or Mat E will find CHEM 177 General Chemistry I to be a better preparation for CHEM 178 General Chemistry II. However, CHEM 167 General Chemistry for Engineering Students is accepted as a substitute for CHEM 177 General Chemistry I for those students declaring one of these curricula after having completed CHEM 167 General Chemistry for Engineering Students.

**Recommended choices by program:

Aerospace Engineering

AER E 160 Aerospace Engineering Problems With Computer Applications Laboratory

Chemical Engineering

CH E 160 Chemical Engineering Problems With Computer Applications Laboratory (Chemical Engineering)

Civil Engineering

C E 160 Engineering Problems With Computational Laboratory

Computer Engineering

CPR E 185 Introduction to Computer Engineering and Problem Solving I

Electrical Engineering

E E 185 Introduction to Electrical Engineering and Problem-Solving I

Industrial Engineering

I E 148 Information Engineering

Mechanical Engineering

M E 160 Mechanical Engineering Problem Solving with Computer Applications

Software Engineering

S E 185 Problem Solving in Software Engineering

Credit hours for graduation will be given for any one of the following without increasing a curriculum’s minimum number of credits required for graduation:

AER E 160 Aerospace Engineering Problems With Computer Applications Laboratory 3
C E 160 Engineering Problems with Computational Laboratory 3
CH E 160 Chemical Engineering Problems with Computer Applications Laboratory 3
ENGR 160 Engineering Problems with Computer Applications Laboratory 3
I E 148 Information Engineering 3
CPR E 185 Introduction to Computer Engineering and Problem Solving I 3
E E 185 Introduction to Electrical Engineering and Problem-Solving I 3

M E 160 Mechanical Engineering Problem Solving with Computer Applications 3
S E 185 Problem Solving in Software Engineering 3

***Students enrolled in the joint software engineering degree program will take S E 101 Software Engineering Orientation. Honors students in Aer E enroll in AER E 101H Engineering Honors Orientation.

Students in the general emphasis in C E have two chemistry/physics sequence options. The environmental emphasis requires Option 1.

Option 1

CHEM 177 General Chemistry I 4
CHEM 177L Laboratory in General Chemistry I 1
CHEM 178 General Chemistry II 3
CHEM 178L Laboratory in College Chemistry II 1
PHYS 221 Introduction to Classical Physics I 5

Option 2

CHEM 177 General Chemistry I 4
CHEM 177L Laboratory in General Chemistry I 1
CHEM 178 General Chemistry II 3
CHEM 178L Laboratory in College Chemistry II 1
PHYS 221 Introduction to Classical Physics I 10 & PHYS 222 and Introduction to Classical Physics II

* Students who opt for PHYS 222 Introduction to Classical Physics II rather than CHEM 178 General Chemistry II, CHEM 178L Laboratory in College Chemistry II will increase the total number of credits required by 1.

Requirement for Entry into Professional Program

Students enrolled in the College of Engineering must satisfy the following requirements before enrolling in the professional courses (200-level and above) offered by departments in the Engineering College:

1. Completion of the basic program with a grade point average of 2.00 or better in the basic program courses.

2. A cumulative grade point average of 2.00 or better for all courses taken at Iowa State University.

3. The College of Engineering requires a grade of C or better for any transfer credit course that is applied to the Basic Program.

The following are the only exceptions to this rule:

a. Students who have completed all of their coursework while enrolled in the College of Engineering, but have not met the three basic program requirements, may enroll for not more than two semesters in 200-level or above courses offered by departments in the College of Engineering.

b. Students transferring to the College of Engineering from another college or university, or from a program outside this college, who have not met the three basic program requirements may also enroll for not more than two semesters in 200-level or above courses offered by departments in the College of Engineering.

However, they may be granted an additional semester upon review by the college.

c. Iowa State students not pursuing an engineering degree may generally take engineering courses without restrictions provided they meet the prerequisites and space is available.

d. Only the first two semesters of 200-level and above engineering courses, taken at ISU while a student is not enrolled in the College of Engineering, can be applied toward an engineering degree.

Requirement for Graduation

In order to graduate in a professional engineering curriculum, students must have a minimum GPA of 2.00 in a department-designated group of 200-level and above courses known as the Core. These courses will total no fewer than 24 semester credits.

Engineering Minors

The College of Engineering offers five undergraduate minors which are open only to students in the College of Engineering. These are minors in bioengineering, energy systems, engineering sales, nondestructive evaluation and nuclear engineering. These minors must include at least nine credits which are beyond the total used to meet curriculum requirements.
The bioengineering minor is a 16 credit interdisciplinary program that complements a student’s major discipline by providing additional insight into the interactions between various engineering disciplines and Biological systems. The minor is administered by a supervisory faculty committee. For minor course requirements, refer to Bioengineering in Courses and Programs.

The energy systems minor is a 15 credit program that provides engineering students with focused educational opportunities in the broad area of energy systems. Students will understand broad energy perspectives, the language of energy systems and the economic, environmental, and policy issues related to energy. The minor is administered by a supervisory faculty committee. For minor course requirements, refer to the Energy Systems in Courses and Programs.

The engineering sales minor is a 15 credit minor that complements the technical training in the student’s major discipline by providing the tools and knowledge required for technical (i.e. business-to-business) sales careers. The minor is administered by a supervisory faculty committee. For minor course requirements, refer to Engineering Sales in Courses and Programs.

The nondestructive evaluation minor (16 credit minimum) open to engineering students who have met the basic program requirements and are not on academic warning or probation. The minor is supervised by an inter-disciplinary Engineering faculty committee. For minor course requirements, refer to Nondestructive Evaluation Engineering in Courses and Programs.

The nuclear engineering minor is a 15 credit minor which enables engineering students to acquire a basic and fundamental knowledge of nuclear sciences and engineering. Courses are provided at Iowa State University and also through an inter-institutional distance education program offered through the Web by four of the Big 12 Engineering Consortium Schools. For minor course requirements, refer to Nuclear Engineering in Courses and Programs.

Engineering Minor (Interdisciplinary)

The College of Engineering offers an undergraduate minor in wind energy which is open to all students at ISU that meet the prerequisites. The Wind energy minor is a 15 credit minor which enables students to acquire an interdisciplinary knowledge of the wind energy industry. There are two required courses; the remaining credits are chosen from a list of elective courses that are related to wind energy. The minor is administered by a supervisory faculty committee from several departments. For minor course requirements, refer to Wind Energy Minor in Courses and Program.

Undergraduate Majors and Minors Outside the College of Engineering

In addition to the engineering degree program, students may earn majors or minors in other colleges of the university. A major or minor program must meet all requirements of the offering department or program and its college and contain credits beyond the requirements for a B.S. degree in engineering. A minimum of 15 additional credits is required for each major area of study and an additional 9 credits for each minor.

Advising System

The purpose of the advising system in the College of Engineering is to work constructively with students in developing their individual academic programs and to provide a resource contact person for students during their college careers.

The college offers an orientation program during the spring and summer for students planning to enter in the fall, and during the fall for students planning to enter in the spring. Transfer students may also complete orientation online. All entering students are encouraged to attend orientation which includes meeting with an academic adviser to register for classes. Placement assessments given during the orientation program help determine the student’s current level of proficiency which enables the academic adviser to prepare an appropriate course schedule for the student.

Special Programs

All engineering students are strongly encouraged to participate in either the cooperative education or internship programs. Students who are qualified to participate in the engineering honors program are also urged to do so. These programs are integrated into the professional engineering curricula and may require additional work. However, both these professional and academic programs offer opportunities that will enrich the standard academic experience. Engineering students are also encouraged to take advantage of study abroad opportunities available through the College of Engineering’s International Programs Office.