

# College of Engineering

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The College of Engineering offers programs leading to undergraduate and graduate degrees in biosystems and agricultural, chemical, civil and computer engineering, computer science, and electrical, materials, mechanical and mining engineering. Graduate training in biomedical engineering is also offered through the Colleges of Engineering and Medicine. The College also offers a highly multidisciplinary master of science in manufacturing systems engineering to address the growing need for enhancing manufacturing productivity and quality.

Creative accomplishment in the career of an engineer or computer scientist depends upon an education that stresses major ideas and fundamental concepts of engineering rather than specific technologies. The academic programs in engineering provide a sound background in the mathematical, physical and engineering sciences blended with the social sciences and humanities to ensure both a thorough education in engineering and a liberal education. Such an approach provides the best preparation for the engineer or computer scientist who must envisage and develop the technologies of the future and deal with scientific advances at present unknown.

The various curricula in the College of Engineering are broad, so that no student is limited to a narrow field of specialized knowledge but receives sufficient technical depth to provide a sound preparation for a professional career.

The first engineering degree from the University of Kentucky was granted in 1890. Since that time over 19,000 degrees have been awarded in the various fields of engineering. Among the alumni of the College of Engineering are those who have distinguished themselves in the major fields of industry, government and education.

Concern for the individual is a most important feature of education in the College of Engineering. Close faculty-student relationships are necessarily a meaningful part of the educational process. The faculty, in addition to their duties related to instruction and research, serve as advisors to the student in the preparation of the academic program best

*"I find the College of Engineering (CoE) is eager not only to teach you in a classroom, but also to assist in your personal and professional success. Faculty will help you with concepts and homework when your schedule allows. The staff is always ready to answer questions or track down answers for you. CoE supports thirty student organizations including honor, professional, and social societies. Many of these organizations offer meetings with industry speakers that better explain what engineers do with a degree. Other projects a student can participate in are the Concrete Canoe, Steel Bridge Design, Solar Car, and a Formula SAE. The college also provides resume reviews, interview skill building workshops, and access to job advertisements across the US. Through the co-op program, you can work alternating semesters which will help you better understand the application of your classes and fine-tune what field you want to work in after graduation. With the myriad of opportunities available, I highly recommend utilizing the College of Engineering to enhance your experience at the University of Kentucky."*

– Grace Northcutt  
Civil Engineering Junior  
President, Engineering Student Council  
Vice President, Phi Sigma Rho  
Programs Director, Society of Women Engineers  
Member of American Society of Civil Engineers,  
Concrete Canoe Team, Chi Epsilon, Engineers  
Without Borders, and Association of  
General Contractors  
Provost Scholarship, Henry Mason Lutes  
Scholarship, SWE Scholarship  
National Dean's List 2003-2005

matched to the student's needs and intellectual capabilities.

## Accreditation

All engineering undergraduate programs offered by the College of Engineering, except the new computer engineering program, are accredited by the Engineering Accreditation Commission of ABET.

## Undergraduate Programs in Engineering

The University of Kentucky grants the following degrees in the College of Engineering:

- Bachelor of Science in Biosystems and Agricultural Engineering
- Bachelor of Science in Chemical Engineering
- Bachelor of Science in Civil Engineering
- Bachelor of Science in Computer Engineering
- Bachelor of Science in Computer Science

- Bachelor of Science in Electrical Engineering
- Bachelor of Science in Materials Engineering
- Bachelor of Science in Mechanical Engineering
- Bachelor of Science in Mining Engineering

While these are the official degrees granted at the bachelor's level in the college, the prospective student is encouraged to study the wide variety of options available through technical electives, some of which are listed following the degree requirements of each department. Technical electives are included in each curriculum to allow the student to apply the fundamentals of a particular discipline to an area of special interest during the senior year.

Students in any department interested in biomedical engineering may make special arrangements to include a limited amount of such studies in the undergraduate program. The Department of Biosystems and Agricultural Engineering and the Center for Biomedical Engineering have approved an optional pro-

gram in pre-biomedical engineering. Biomedical engineering is primarily the application of engineering principles to the solution of medical problems.

The Department of Chemical Engineering has approved an optional program in premedicine or predentistry. Students majoring in chemical engineering may arrange through their advisor to take courses that will satisfy the degree requirements for this program.

In response to industry requests, the College of Engineering and the Gatton College of Business and Economics have joined to offer a coordinated Bachelor of Science in Engineering and Masters of Business Administration. The intense five-year program may require summer courses to remain on track to complete the engineering part in four years. The MBA will be taken during a student's fifth year of study beginning in July and finishing the following June. In addition, students in the program will be required to complete a study abroad program designed specifically for the engineering/business student. This program will be conducted immediately upon completion of the MBA course requirements and the majority of costs will be paid by the program. Students earning a 3.25 or better GPA and having completed their junior year will be identified and will receive a letter asking them to apply for the program. Admission is highly competitive and is limited to 15 students. Selection is based on past academic performance, communication skills, and commitment to the program.

Graduate programs in the engineering fields of study are listed in *The Graduate School* section of this Bulletin.

## ADMISSION POLICY

Admission to the University of Kentucky also provides admission to one of the pre-engineering programs in the College of Engineering. Effective Fall 2007, new admission requirements for entry into the College of Engineering will require a math ACT score of 23 or higher.

Application must be made for admission to a specific pre-engineering program. However, subsequent transfer between programs will be permitted and may be accomplished by applying and satisfying the appropriate specified criteria.

All undergraduate degree programs are divided into pre-engineering and engineering. Pre-engineering is broadly defined as the first two years of a program, while engineering is broadly defined as the last two years of the program. Every student must be admitted to engineering standing in a specific program prior to graduation.

### Engineering Standing Admission

Admission to engineering standing in a degree program is necessary in order to be granted a baccalaureate degree in engineering or com-

puter science. Students must complete at least 30 of the last 36 hours of their programs in residence at the University. Specific departmental requirements for admission to engineering standing are as follows. The same criteria are applied to transfer students with the equivalence of courses determined by the Director of Undergraduate Studies. A student must apply to the specific department for admission to engineering standing. **Note:** The cumulative grade-point average includes all college-level work taken at the University of Kentucky or elsewhere.

**Biosystems and Agricultural Engineering** – Completion of CHE 105, CHE 107, CS 221, ENG 104, EM 221, MA 113, MA 114, MA 213, MA 214, PHY 231, PHY 232, PHY 241, and PHY 242 with a minimum grade-point average of 2.25 (computed using grades from the last attempt at each course) in these courses and a minimum overall cumulative grade-point average of 2.25. University repeat options may be applied as appropriate.

**Chemical Engineering** – Completion of CHE 105, CHE 107, CHE 115, MA 113, MA 114, MA 213, MA 214, PHY 231, PHY 232, PHY 241, ENG 104 with a minimum cumulative grade-point average of 2.70 in these courses. Completion of CS 221 with a passing grade and completion of CME 200 with a grade of **C** or better. University repeat options may be applied as appropriate.

**Civil Engineering** – Applicants must have completed at least 45 semester hours acceptable towards the degree. Furthermore, applicants must have completed a group of core courses consisting of ENG 104 or the Honors Program; CHE 105, CHE 107, PHY 231, PHY 241, MA 113, MA 114, MA 213, CE 106, CE 120 and CE 211 or equivalent. A minimum cumulative grade-point average (GPA) of 2.75 in these core courses and a **C** or better in each core course are required for automatic acceptance into Engineering Standing. University repeat options may be utilized by *all* students. Students who do not meet these requirements may request a waiver of them based on a departmental review provided the core GPA is 2.25 or higher. A student may not apply for Engineering Standing more than twice.

**Computer Engineering** – Completion of EE 211, EE 280, EE 281, CS 215, CS 216, CS 275 and EE/CS 380 with a minimum cumulative grade-point average of 2.4 in these courses. University repeat options may be utilized as appropriate.

**Computer Science** – Completion of CS 100, CS 115, CS 215, CS 216, EE 280, ENG 104, MA 113, MA 114, PHY 231, and PHY 241 with a minimum cumulative GPA of 2.5 in these courses. University repeat options may be utilized as appropriate.

**Electrical Engineering** – Completion of EE 211, EE 221, EE 222, and EE 280 with a minimum cumulative GPA of 2.4 in these

courses. University repeat options may be utilized as appropriate. In addition, the Electrical and Computer Engineering Department will not permit a third admission into any of these courses.

**Materials Engineering** – Completion of ENG 104, MA 113, MA 114, MA 213, MA 214, PHY 231, PHY 232, PHY 241, CHE 105, CHE 107 and CHE 115 with a minimum cumulative GPA of 2.50 in these courses and completion of CS 221 with a passing grade. University repeat options may be utilized as necessary.

**Mechanical Engineering** – Completion of at least 50 semester hours applicable to the degree program with a minimum cumulative GPA of 2.5. Completion of ENG 104, MA 113, MA 114, MA 213, MA 214, CHE 105, CHE 107, PHY 231, PHY 241, PHY 232, and PHY 242 with a minimum cumulative GPA of 2.7 in these courses. A student may exercise official University of Kentucky repeat options as appropriate. Written request for an exception to the number of repeats should be submitted to the Director of Undergraduate Studies. **In no case** will there be an exception made to the minimum acceptable grade-point averages listed above.

**Mining Engineering** – Completion of a minimum of 50 semester hours acceptable towards the degree in mining engineering with a minimum cumulative grade-point average of 2.5. Completion of ENG 104, MA 113, MA 114, MA 213, MA 214, CHE 105, CHE 107, PHY 231, PHY 232, PHY 241, and PHY 242 with a minimum cumulative GPA of 2.50 in these courses. University repeat options may be utilized as appropriate. Students who do not meet these GPA requirements may request consideration based upon departmental review if both of these GPAs are 2.25 or greater.

## COMBINED DEGREE PROGRAM

The College of Engineering has transfer agreements with several institutions throughout the state. Some of these institutions offer a "3/2" year dual degree program. Other academic institutions choose to offer this option to their students without benefit of a formal agreement. These programs enable students to enroll in a pre-engineering curriculum for the first three years at their respective schools and then transfer to the College of Engineering for the final two years. Upon completion, they receive two degrees, one from the school at which they originally enrolled and the other a Bachelor of Science in the appropriate field of engineering from the University of Kentucky.

## COOPERATIVE EDUCATION PROGRAM

The nationally recognized engineering coop program provides students the opportunity to gain practical work experience before

graduation. By alternating semesters of academic study with semesters of salaried, full-time career-related employment, a full year of engineering work experience can be presented on a graduate resume. Students who wish to participate in the Cooperative Education program in the College of Engineering should contact the Director of Cooperative Education.

To be eligible for this program, students should have a minimum grade-point average of 2.5. In addition, they should complete all the courses in the first two semesters of the degree program prior to the first work tour. Students will remain on a full-time, continuing student status while they are at work by registering for a one-hour, pass/fail course. The grade, assigned by the director, is based on both a work report written by the student and an evaluation completed by the immediate supervisor. Six months of the year's co-op experience counts toward total experience required to sit for the Professional Engineer exam in Kentucky.

The Cooperative Education program contributes significantly to the student's academic motivation, career preparation, and success with job offers upon graduation. One-third of our students and nearly 100 employers nationwide participate in the UK program.

### CONTINUING EDUCATION AND EXTENSION

The College of Engineering recognizes the rapid changes occurring in modern engineering technology. Students in engineering are made aware of the need to continue their studies after graduation. One of the ways to keep abreast of advances in engineering is for graduates and other engineering practitioners to participate in continuing education programs now available through the engineering colleges throughout the country.

The responsibilities of the Technology Exchange Program within the Kentucky Transportation Center, the Lean Manufacturing Program within the Center for Manufacturing at the University of Kentucky and the staff of the former Office for Informational Services and Technical Liaison (OISTL), now administratively housed in the Department of Mining Engineering, are to:

1. create and manage appropriate intensive noncredit technical courses of interest to and needed by practicing engineers;
2. develop appropriate video-based courses and materials to be of interest to practicing engineers. Such activity includes taping, live satellite uplinking, and two-way video/audio of engineering-related courses and activities, Web-based instruction; and,
3. provide assistance in extension activities with other college and University units to be of assistance to engineers throughout the state.

### SCHOLARSHIPS

The College of Engineering awards merit-based scholarships to incoming freshman and transfer students as well as to students already enrolled in the College. Freshman scholarship applications are due January 15; transfer scholarship applications are due March 15; and continuing student applications are due April 15. Awards are made for the upcoming academic year; no new awards are made for the spring semester.

For further information, contact the College of Engineering Office of Student Services.

### ENGINEERING DEAN'S LIST

Students enrolled in the College of Engineering can make the Engineering Dean's List for a fall or spring semester by meeting the following requirements during the semester:

- 3.6 or better semester GPA;
- 12 or more credit hours;
- no E, I or F grades;
- no grades out; and
- no more than 3 hours pass/fail.

### MINIMUM REQUIREMENTS FOR GRADUATION

**NOTE:** The following graduation requirements apply to engineering programs only. Separate graduation requirements currently apply to the Computer Science program as described in the corresponding section.

To be awarded a Bachelor of Science degree in any field of engineering, a student must:

1. complete the University and College requirements relating to writing and University Studies.
2. complete a minimum of 128 hours, exclusive of those earned in freshman college algebra and freshman college trigonometry, with a cumulative standing of not less than 2.0 on a 4.0 scale. In all departments the course requirements exceed this 128 hour minimum.
3. be admitted to engineering standing in an engineering program for at least the final semester, and complete the requirements of that program.
4. complete a minimum of 24 credit hours of departmental courses at or above the 300 level.
5. complete all departmental courses and technical electives with a cumulative standing of 2.0 or higher.
6. complete any additional departmental graduation requirements that may be listed below.

### Additional Departmental Graduation Requirements

In the B.S. program in Civil Engineering, the student must earn a C or better in each CE prefix course, except that a maximum of one D is permitted in a CE prefix course numbered

400 or higher. In addition, a C or better must be earned in EM 221 and EM 302.

In the Mining Engineering Department, the student must have earned a grade of C or better in the following courses that are valuable for safe operation of mines: MNG 341, Mine Ventilation; MNG 551, Rock Mechanics; MNG 591, Mine Design Project I; and MNG 592, Mine Design Project II.

### Second Bachelor's Degree Requirements

A student who has earned a bachelor's degree in the College of Engineering may earn a second bachelor's degree by meeting the following three conditions on the work applicable to the second degree:

1. The student must have been admitted to engineering standing in the program leading to the second degree at least for the final semester, or equivalent terms, prior to the completion of the degree requirements, and must be enrolled as a student in that degree program during the final semester or term.
2. The student must complete a minimum of 15 credit hours of departmentally approved courses at or above the 300 level.
3. To earn a second degree, a student must complete all degree requirements in that program.

### ACADEMIC ADVISING

Sophomores, juniors, and seniors are advised by faculty in the department of the student's major. Professional staff provide academic advising and support services to entering freshman students through the Freshman Advising Center.

It is the students' responsibility to satisfy University and College requirements with consultation from their advisor.

### PROBATION AND ACADEMIC SUSPENSION

Students should refer to the *Academic Requirements* section of this Bulletin for information concerning the College of Engineering's probation and academic suspension rules.

### BACHELOR OF SCIENCE IN BIOSYSTEMS AND AGRICULTURAL ENGINEERING

Biosystems and agricultural engineering provides an essential link between the biological sciences and the engineering profession. This linkage is necessary for the development of production and processing systems involving biological materials that preserve our natural resource base. Students have the latitude to develop an area of specialization relating to environmental engineering, biotechnology, food processing, machine systems, or controlled environment engineering. The curriculum is also ideal preparation for those students

wanting to pursue a graduate or professional degree in biomedical engineering or veterinary medicine through the pre-biomedical and pre-veterinary medicine options.

Engineers completing this program of study find employment in industries related to the production and processing of biological products. Opportunities include placement with manufacturers, consulting firms, or state and federal regulatory agencies. Biosystems and agricultural engineers may work in the areas of biomedical/biotechnology; environmental engineering; agricultural equipment; heating, ventilation, and refrigeration equipment; food processing industries; livestock equipment and housing; or greenhouse structures.

The educational objectives for the biosystems and agricultural engineering program are as follows:

- educate engineers to design components and/or processes for advancement of agricultural, biological, or environmental systems; and
- prepare engineers for successful careers in industry, government, consulting firms, or academia. Successful careers begin with employment in their chosen field or admission to graduate and professional programs, continue with steady achievement, and include professional development.

## Degree Requirements

Each student must complete the following:

### University Studies Requirements Hours

See "University Studies Program" on pages 75-79 for the complete University Studies requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill University Studies areas. Students should work closely with their advisor to complete the University Studies Program requirements.

### Math

MA 113 Calculus I ..... 4

### Communication and Writing

ENG 104 Writing: An Accelerated Foundational Course ..... 4  
 COM 199 Presentational Communication Skills ..... 1  
 BAE 400 Senior Seminar ..... 1  
 BAE 402 Biosystems and Agricultural Engineering Design I (25 percent of 2-credit course) ..... 1/2  
 BAE 403 Biosystems and Agricultural Engineering Design II (25 percent of 2-credit course) ..... 1/2

### Natural Sciences

PHY 231 General University Physics ..... 4  
 PHY 232 General University Physics ..... 4

### Premajor Requirements Hours

ENG 104 Writing: An Accelerated Foundational Course ..... 4  
 ENG 2XX Writing Intensive Course ..... 3  
 CHE 105 General College Chemistry I ..... 3  
 CHE 107 General College Chemistry II ..... 3  
 MA 113 Calculus I ..... 4  
 MA 114 Calculus II ..... 4  
 MA 213 Calculus III ..... 4  
 MA 214 Calculus IV ..... 3  
 PHY 231 General University Physics ..... 4  
 PHY 241 General University Physics Laboratory .... 1  
 PHY 232 General University Physics ..... 4

PHY 242 General University Physics Laboratory .... 1  
 CS 221 First Course in Computer Science for Engineers ..... 2  
 EM 221 Statistics ..... 3

**Subtotal: Premajor Hours ..... 43**

### Major Requirements Hours

BAE 102 Introduction to Biosystems Engineering ... 1  
 BAE 103 Energy in Biological Systems ..... 2  
 BAE 201 Economic Analysis for Biosystems ..... 2  
 BAE 202 Probability and Statistics for Biosystems .. 3  
 BAE 305 DC Circuits and Microelectronics ..... 3  
 BAE 400 Senior Seminar ..... 1  
 BAE 402 Biosystems and Agricultural Engineering Design I ..... 2  
 BAE 403 Biosystems and Agricultural Engineering Design II ..... 2  
 BIO 150 Principles of Biology I ..... 3  
 BIO 152 Principles of Biology II ..... 3  
 EE 305 Electrical Circuits and Electronics ..... 3  
 EM 302 Mechanics of Deformable Solids ..... 3  
 EM 313 Dynamics ..... 3  
 CE 106 Computer Graphics and Communication ..... 3  
 CE 341 Introduction to Fluid Mechanics ..... 4  
 ME 220 Engineering Thermodynamics ..... 3  
 ME 325 Elements of Heat Transfer ..... 3  
 ME 340 Introduction of Mechanical Systems ..... 3

**Subtotal: Major Hours ..... 47**

### Electives

Biological Science Elective ..... 3  
 Free Elective ..... 3

### Core Electives (choose 3 of the following 4 courses)

BAE 417 Design of Machine Systems ..... 3  
 BAE 427 Structures and Environment Engineering .. 3  
 BAE 437 Land and Water Resources Engineering .... 3  
 BAE 447 Bioprocess Engineering Fundamentals ..... 3

**Technical Electives (chosen by the student and leading to a concentration in one area of study) ..... 12**

**Subtotal: Electives ..... 27**

**TOTAL HOURS ..... 132**

## Curriculum

The following curriculum meets the requirements for a B.S. in biosystems and agricultural engineering, provided the student satisfies the graduation requirements listed earlier.

### Freshman Year

#### First Semester Hours

BAE 102 Introduction to Biosystems Engineering ... 1  
 CHE 105 General College Chemistry I ..... 3  
 ENG 104 Writing: An Accelerated Foundational Course ..... 4  
 MA 113 Calculus I ..... 4  
 CE 106 Computer Graphics and Communication ..... 3

#### Second Semester

BAE 103 Energy in Biological Systems ..... 2  
 CHE 107 General College Chemistry II ..... 3  
 CS 221 First Course in Computer Science for Engineers ..... 2  
 MA 114 Calculus II ..... 4  
 PHY 231 General University Physics ..... 4  
 PHY 241 General University Physics Laboratory .... 1

### Sophomore Year

#### First Semester Hours

BAE 201 Economic Analysis for Biosystems ..... 2  
 BIO 150 Principles of Biology I ..... 3  
 EM 221 Statics ..... 3  
 MA 213 Calculus III ..... 4  
 PHY 232 General University Physics ..... 4  
 PHY 242 General University Physics Laboratory .... 1

## Second Semester

BAE 202 Probability and Statistics for Biosystems .. 3  
 BIO 152 Principles of Biology II ..... 3  
 ENG 2XX Writing Intensive Course or  
 USP Humanities/Cross-Cultural Elective ..... 3  
 EM 302 Mechanics of Deformable Solids ..... 3  
 MA 214 Calculus IV ..... 3  
 ME 220 Engineering Thermodynamics I ..... 3

### Junior Year

#### First Semester Hours

CE 341 Introduction to Fluid Mechanics ..... 4  
 EE 305 Electrical Circuits and Electronics ..... 3  
 EM 313 Dynamics ..... 3  
 Biological Science Elective ..... 3  
 Core\*\* or Technical Elective\*\*\* ..... 3

#### Second Semester

COM 199 Presentational Communication Skills ..... 1  
 ME 325 Elements of Heat Transfer ..... 3  
 BAE 305 DC Circuits and Microelectronics ..... 3  
 Core\*\* or Technical Elective\*\*\* ..... 3  
 Technical Elective\*\*\* ..... 3  
 University Studies\* ..... 3

### Senior Year

#### First Semester Hours

BAE 402 Biosystems and Agricultural Engineering Design I ..... 2  
 ME 340 Introduction to Mechanical Systems ..... 3  
 BAE 400 Senior Seminar ..... 1  
 Core\*\* or Technical Elective\*\*\* ..... 3  
 Free Elective† ..... 3  
 University Studies\* ..... 3

#### Second Semester

BAE 403 Biosystems and Agricultural Engineering Design II ..... 2  
 Core\*\* or Technical Elective\*\*\* ..... 3  
 Technical Electives\*\*\* ..... 6  
 University Studies\* ..... 6

\*To be selected from University Studies areas in Social Sciences, Humanities, Cross-Cultural and Electives in consultation with the academic advisor. A minimum of 15 credits in the humanities and social sciences are required.

\*\*A minimum of 9 hours are required from the biosystems and agricultural engineering core courses: BAE 417 Design of Machine Systems, BAE 427 Structures and Environment Engineering, BAE 437 Land and Water Resources Engineering, and BAE 447 Bioprocess Engineering Fundamentals.

\*\*\*A minimum of 12 hours are to be taken in addition to the 9 core hours selected by the student. The technical electives allow the student an opportunity to concentrate or gain depth in one or more of the various specialty areas of biosystems and agricultural engineering. The technical electives must be selected from the courses listed below and approved by the student's academic advisor. Other courses may be considered, each on its individual merit. In selecting technical electives students must concentrate their work in one or more of the professional areas of biosystems and agricultural engineering. These areas include: bio-environmental engineering, food and bioprocess engineering, machine systems/automation engineering and controlled environment engineering. Interested students are encouraged to contact the Department of Biosystems and Agricultural Engineering to discuss technical elective sequences.

Approved technical electives: BAE 417, 427, 435G, 437, 438G, 447, 450, 502, 513, 515, 536, 537, 545, 549, 580, 581, 599; BCH 401G; BME 481G, 501, 530; CE 351, 381, 382, 441, 451, 461G, 471G, 482, 506, 549; CHE 236; CME 425, 462, 599; EE 402G; FSC 434G, 530, 536, 538; KHP 515; ME 321, 344, 406, 440, 501, 542; PLS 366, 566, 575, 576.

†Free electives are any University course excluding more elementary versions of required courses such as pre-calculus math or PHY 211.

## BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

A foundation in mathematics, chemistry, and physics is required for the study of chemical engineering. Fundamental principles related to the transformations of matter and energy are developed in areas such as thermodynamics, mass transfer, reactor design, and chemical process design. Undergraduate elective options are available in polymers and environmental protection. A program is also available to fulfill premedical and pre dental requirements simultaneously with requirements for the B.S. in chemical engineering.

The education outcomes of the undergraduate education program are as follows:

- prepare students for successful chemical engineering practice and/or academic pursuits;
- provide a broad education as a foundation for life-long learning; and
- equip students with the ability to carry out in-depth solution strategies to chemical engineering problems.

### Degree Requirements

The following curriculum meets requirements for the B.S. in chemical engineering, provided the student satisfies the graduation requirements listed earlier.

Each student must complete the following:

**University Studies Requirements Hours**  
See "University Studies Program" on pages 75-79 for the complete University Studies requirements. Students should work closely with their advisor to complete the University Studies Program requirements.

Courses marked with an asterisk (\*) may also be used to satisfy University Studies requirements.

Premajor Requirements	Hours
*ENG 104 Writing: An Accelerated Foundational Course .....	4
*CHE 105 General College Chemistry I .....	3
*CHE 107 General College Chemistry II .....	3
*CHE 115 General Chemistry Laboratory .....	3
*CME 200 Process Principles .....	3
*CS 221 First Course in Computer Science for Engineers .....	2
*MA113 Calculus I .....	4
*MA 114 Calculus II .....	4
*MA 213 Calculus III .....	4
*MA 214 Calculus IV .....	3
*PHY 231 General University Physics .....	4
*PHY 232 General University Physics .....	4
*PHY 241 General University Physics Laboratory ..	1
<b>Subtotal: Premajor Requirements:</b> .....	<b>42</b>

Major Requirements	Hours
CME 101 Introduction to Chemical Engineering .....	1
*COM 199 Presentational Communication Skills .....	1
CHE 230 Organic Chemistry I .....	3
CHE 231 Organic Chemistry Laboratory I .....	3
CHE 232 Organic Chemistry II .....	3
CHE 446G Physical Chemistry for Engineers .....	3
CHE 441G Physical Chemistry Laboratory .....	2
MSE 201 Materials Science .....	3
EE 305 Electrical Circuits and Electronics .....	3
CME 320 Engineering Thermodynamics .....	3
CME 415 Separation Processes .....	3

CME 471 Seminar .....	1
CME 006 The Engineering Profession (3 semesters) .....	0
CME 330 Fluid Mechanics .....	3
CME 470 Professionalism, Ethics and Safety .....	1
CME 420 Process Modeling in Chemical Engineering .....	3
CME 425 Heat and Mass Transfer .....	4
CME 433 Chemical Engineering Laboratory .....	3
CME 455 Chemical Engineering Process Design I ....	3
CME 550 Chemical Reactor Design .....	3
CME 456 Chemical Engineering Process Design II .....	4
CME 462 Process Control .....	3
<b>Subtotal: Major Hours</b> .....	<b>56</b>

In addition to the premajor and major requirements, students must complete the following:

### Chemical Engineering Electives Hours

Total of 6 credit hours must be chosen. Courses recommended are listed below. Other courses may be considered, each on its individual merit.

CME 395 Special Problems in Chemical Engineering .....	3
CME 404G Polymeric Materials .....	3
CME 505 Analysis of Chemical Engineering Problems .....	3
CME 515 Air Pollution Control .....	3
CME 554 Chemical and Physical Processing of Polymer Systems .....	3
CME 580 Design of Rate and Equilibrium Processes for Water Pollution Control .....	3
CME 583 Fuel Science .....	3
CME 599 Topics in Chemical Engineering .....	3

### Technical Electives

Select one (must be a 3 or more credit hour course) from the following:

CME 395, 404G, 505, 515, 554, 558, 580, 583; CHE 226 and all above 441; CS 320 and above; MA 321, 322, 416G, 432G, 433G, 471G, 481G; PHY any above 241; STA 381 and higher; BCH 401G, 501; MSE 212, 401G, 402G, 403G, 462, 550; any BIO 150 and above; any Engineering course above that required, e.g. above ME 330.

**Chemistry Elective** (must total 3 credits)  
CHE 226 and above (if not taken as technical elective).

**Supportive Elective** (must total 3 credits)  
The supportive elective can be any course that carries college credit and is not a more elementary version of a required course. For example, college algebra would not be satisfactory because it is more elementary than the required calculus courses. The student completing 3 co-op tours (EGR 399) may count the co-op experience toward the supportive elective.

**Subtotal: Electives:** .....

### Graduation Writing Requirement

ENG 2XX Writing Intensive Course .....

**TOTAL HOURS:** .....

### Curriculum

#### Freshman Year

First Semester	Hours
CME 101 Introduction to Chemical Engineering .....	1
CHE 105 General College Chemistry I .....	3
ENG 104 Writing: An Accelerated Foundational Course .....	4
MA 113 Calculus I .....	4
University Studies* .....	3
University Studies* .....	3

#### Second Semester

CHE 107 General College Chemistry II .....	3
CHE 115 General Chemistry Laboratory .....	3

MA 114 Calculus II .....	4
CS 221 First Course in Computer Science for Engineers .....	2
COM 199 Presentational Communication Skills .....	1

#### Sophomore Year

First Semester	Hours
CME 200 Process Principles .....	3
CHE 230 Organic Chemistry I .....	3
CHE 231 Organic Chemistry Laboratory I .....	2
MA 213 Calculus III .....	4
PHY 231 General University Physics .....	4
PHY 241 General University Physics Laboratory ....	1

#### Second Semester

CME 320 Engineering Thermodynamics .....	4
CHE 232 Organic Chemistry II .....	3
MSE 201 Materials Science .....	3
MA 214 Calculus IV .....	3
PHY 232 General University Physics .....	4

#### Junior Year

First Semester	Hours
CME 415 Separation Processes .....	3
CME 471 Seminar .....	1
CHE 446G Physical Chemistry for Engineers .....	3
CME 330 Fluid Mechanics .....	3
ENG 2XX Writing Intensive Course or USP Humanities/Cross-Cultural Elective .....	3
Supportive Elective** .....	3

#### Second Semester

CME 006 The Engineering Profession (Junior and Senior) .....	0
CME 420 Process Modeling in Chemical Engineering .....	3
CME 425 Heat and Mass Transfer .....	4
CHE 441G Physical Chemistry Laboratory .....	2
CHE Elective† .....	3
University Studies* .....	3
Technical Elective*** .....	3

#### Senior Year

First Semester	Hours
CME 006 The Engineering Profession (Junior and Senior) .....	0
CME 470 Professionalism, Ethics and Safety .....	1
CME 433 Chemical Engineering Laboratory .....	3
CME 455 Chemical Engineering Process Design I ....	3
CME 550 Chemical Reactor Design .....	3
Elective (CME) .....	3
University Studies* .....	3

#### Second Semester

CME 006 The Engineering Profession (Junior and Senior) .....	0
CME 456 Chemical Engineering Process Design II ...	4
CME 462 Process Control .....	3
EE 305 Electrical Circuits and Electronics .....	3
Elective (CME) .....	3
University Studies* .....	3

\*Selected from University Studies areas in Social Science (6 credits), Humanities (6 credits), Cross-Cultural (3 credits) and Electives (3 credits/one-half the requirement) in consultation with the academic advisor to assure ABET depth and breadth requirements.

\*\*Supportive elective is to be chosen from any University course, excluding a more elementary version of a required course, such as precalculus mathematics or PHY 211.

**CME Electives:** Courses recommended as Chemical Engineering electives are listed below. Other courses will be considered, each on its individual merit.

CME 395 Special Problems in Chemical Engineering
CME 404G Polymeric Materials
CME 505 Analysis of Chemical Engineering Problems
CME 515 Air Pollution Control

CME 554 Chemical and Physical Processing of Polymer Systems  
 CME 558 Principles of Polymer Characterization and Analysis  
 CME 580 Design of Rate and Equilibrium Processes for Water Pollution Control  
 CME 583 Fuel Science  
 CME 599 Topics in Chemical Engineering  
 \*\*\*Technical elective (must be a 3 or more credit hour course) and may be selected from the following: CME 395, 404G, 505, 515, 554, 558, 580, 583; CHE 226 and all above 441; CS 320 and above; MA 321, 322, 416G, 432G, 433G, 471G, 481G; PHY any above 241; STA 381 and higher; BCH 401G, 501; MSE 212, 362, 401G, 402G, 403G, 550; any BIO 150 and above course; any engineering course above that required, e.g. above ME 330.

†CHE elective (must total 3 credits): CHE 226 and above (if not taken as technical elective).

## BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING—PADUCAH

In addition to the program on the Lexington campus, students can pursue a B.S. degree in chemical engineering through the College's Extended Campus Program in Paducah, Kentucky. The Paducah program uses the same curriculum as the main campus, but provides the opportunity for students to complete all B.S. degree requirements without having to relocate to Lexington.

Consistent with the Vision and Mission statements of the University of Kentucky, the chemical engineering program at the UK Extended Campus in Paducah strives to meet the following specific educational objectives:

- Prepare our students for successful chemical engineering practice and/or academic pursuits with a broad education as a foundation for life-long learning and with the ability to carry out in-depth solution strategies to chemical engineering problems,
- Offer a program that complies with ABET 2000 Engineering Criteria and set educational objectives that are consistent with the College of Engineering's Vision and Mission statements using input from constituencies (students, faculty, alumni, and employers), and
- Develop a process for ongoing evaluation and review of the objectives to ensure the program curriculum and processes achieve education objectives.

The Paducah chemical engineering program collaborates with West Kentucky Community and Technical College to provide the basic math and science courses, as well as the general studies course requirements. Murray State University faculty members teach upper-level non-engineering courses on the Paducah campus. On-site UK chemical engineering faculty members and jointly-appointed Murray engineering faculty members teach the upper-division engineering courses. Program admission, course registration, student advising and

other student services all can be completed at the Paducah site.

### Degree Requirements

The curriculum requirements for the B.S. degree in chemical engineering in Paducah are identical to those on the Lexington campus. Refer to those degree requirements for the Paducah degree program. Not all the technical electives listed for the Lexington program will be available in Paducah. The student must satisfy the College graduation requirements listed earlier.

## BACHELOR OF SCIENCE IN CIVIL ENGINEERING

The student of civil engineering has a broad field of study to provide a strong foundation for entry into the profession or graduate school. Major areas include construction engineering, environmental engineering, geotechnical engineering, materials engineering, structural engineering, transportation engineering, and water resources engineering.

The civil engineering program at the University of Kentucky strives to meet the following educational objectives:

- advise its students in the pursuit of academic success and monitor their progress;
- prepare its students for successful civil engineering careers; and
- provide its students with a broad education that will serve as the foundation for professional licensure and life-long learning.

### Degree Requirements

The following curriculum meets the requirements for a B.S. in civil engineering, provided the student satisfies the graduation requirements listed earlier.

Each student must complete the following:

**University Studies Requirements Hours**  
 See "University Studies Program" on pages 75-79 for the complete University Studies requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill University Studies areas. Students should work closely with their advisor to complete the University Studies Program requirements.

**Math**  
 MA 113 Calculus I ..... 4

**Inference - Logic**  
 MA 113 Calculus I ..... 4

**Oral Communication**  
 COM 252 Introduction to Interpersonal Communication  
 or  
 COM 281 Communication in Small Groups ..... 3

**Natural Sciences**  
 CHE 105 General College Chemistry I ..... 3  
 CHE 107 General College Chemistry II ..... 3

**Social Sciences**  
 ECO 201 Principles of Economics I ..... 3  
 plus one other course from USP listing ..... 3

### Humanities

HIS 107 Western Culture: Science and Technology II ..... 3  
 plus one other course from USP listing ..... 3

### USPElectives

ME 220 Engineering Thermodynamics I  
 or  
 EM 313 Dynamics ..... 3  
 Civil Engineering Technical Elective ..... 3

### Premajor Requirements Hours

CE 106 Computer Graphics and Communication ..... 3  
 CE 120 Introduction to Civil Engineering ..... 1  
 CE 211 Surveying ..... 4  
 CHE 105 General College Chemistry I ..... 3  
 CHE 107 General College Chemistry II ..... 3  
 ENG 104 Writing: An Accelerated Foundational Course ..... 4  
 MA 113 Calculus I ..... 4  
 MA 114 Calculus II ..... 4  
 MA 213 Calculus III ..... 4  
 PHY 231 General University Physics ..... 4  
 PHY 241 General University Physics Laboratory ..... 1  
**Subtotal: Premajor Hours ..... 35**

### Major Requirements Hours

CE 221 Applied Uncertainty and Risk Analysis in Civil Engineering  
 or  
 STA 381 Introduction to Engineering Statistics ..... 3  
 CE 303 Introduction to Construction Engineering ... 4  
 CE 321 Civil Engineering Systems ..... 2  
 CE 331 Transportation Engineering ..... 3  
 CE 341 Introduction to Fluid Mechanics ..... 4  
 CE 351 Introduction to Environmental Engineering ..... 3  
 CE 381 Civil Engineering Materials I ..... 3  
 CE 382 Structural Analysis ..... 3  
 CE 401 Seminar ..... 1  
 CE 429 Civil Engineering Systems Design ..... 4  
 CE 461G Hydrology ..... 3  
 CE 471G Soil Mechanics ..... 4  
 CS 221 First Course in Computer Science for Engineers ..... 2  
 EM 221 Statics ..... 3  
 EM 302 Mechanics of Deformable Solids ..... 3  
 MNG 303 Deformable Solids Laboratory ..... 1  
 GLY 220 Principles of Physical Geology ..... 4  
 MA 214 Calculus IV ..... 3  
 PHY 232 General University Physics ..... 4  
 PHY 242 General University Physics Laboratory ..... 1  
**Subtotal: Major Hours ..... 58**

### Electives Hours

CE Technical Design Elective ..... 3  
 Engineering Science Elective ..... 3  
 Structures Elective ..... 3  
 Technical Electives ..... 9  
 Supportive Elective ..... 3  
**Subtotal: Electives ..... 21**

**TOTAL HOURS: ..... 132**

### Curriculum

#### Freshman Year

**First Semester Hours**  
 CE 120 Introduction to Civil Engineering ..... 1  
 CHE 105 General College Chemistry I ..... 3  
 ENG 104 Writing: An Accelerated Foundational Course ..... 4  
 MA 113 Calculus I ..... 4  
 USP Social Sciences Elective ..... 3

**Second Semester**

CE 106 Computer Graphics and Communication .....	3
CHE 107 General College Chemistry II .....	3
GLY 220 Principles of Physical Geology .....	4
MA 114 Calculus II .....	4
ECO 201 Principles of Economics I (recommended USP social sciences course) .....	3

**Sophomore Year**

<b>First Semester</b>	<b>Hours</b>
CE 211 Surveying .....	4
CE 303 Introduction to Construction Engineering* .....	4
MA 213 Calculus III .....	4
PHY 231 General University Physics .....	4
PHY 241 General University Physics Laboratory ...	1

**Second Semester**

CE 221 Applied Uncertainty and Risk Analysis in Civil Engineering or STA 381 Introduction to Engineering Statistics .....	3
COM 252 Introduction to Interpersonal Communication or COM 281 Communication in Small Groups .....	3
EM 221 Statics .....	3
MA 214 Calculus IV .....	3
PHY 232 General University Physics .....	4
PHY 242 General University Physics Laboratory ...	1

**Junior Year**

<b>First Semester</b>	<b>Hours</b>
CE 331 Transportation Engineering* .....	3
CE 341 Introduction to Fluid Mechanics .....	4
CE 381 Civil Engineering Materials I* .....	3
EM 302 Mechanics of Deformable Solids .....	3
MNG 303 Deformable Solids Laboratory .....	1
USP Humanities Elective – choose ENG 2XX course to satisfy the second-tier writing requirement .....	3

**Second Semester**

CE 321 Civil Engineering Systems .....	2
CE 351 Introduction to Environmental Engineering* .....	3
CE 382 Structural Analysis .....	3
CE 471G Soil Mechanics* .....	4
CS 221 First Course in Computer Science for Engineers .....	2
HIS 107 Western Culture: Science and Technology II (recommended USP humanities course) .....	3

**Senior Year**

<b>First Semester</b>	<b>Hours</b>
CE 401 Seminar* .....	1
CE 461G Hydrology .....	3
Engineering Science Elective** .....	3
Structures Elective† .....	3
Technical Electives*** .....	6

**Second Semester**

CE 429 Civil Engineering Systems Design* .....	4
CE Technical Design Elective†† .....	3
Supportive Elective††† .....	3
Technical Elective*** .....	3
USP Cross-Cultural Elective .....	3

\*CE communication throughout the curriculum component.

\*\*To be chosen from ME 220 or EM 313.

\*\*\*Technical Electives are to be chosen from any of the courses at the 300-level or above that carry a CE prefix and in which a student is qualified to enroll, exclusive of required courses. CHE 230 or CHE 236 is acceptable. **Engineering elective courses are typically taught once per year.**

†To be selected from: CE 482 or CE 486G and CE 487G (one of these last two will count as a technical elective).

††Choose from: CE 403, 451, 505, 533, 539, 549, 579, or 589. (NOTE: CE 579 is a co-requisite for CE 589.)

†††Each CE area has at least one recommendation for the supportive elective; please review the Optional Specialization section in the Civil Engineering Undergraduate Handbook.

**BACHELOR OF SCIENCE IN CIVIL ENGINEERING**

**Joint-Degree Program Offered by Western Kentucky University (WKU) and the University of Kentucky (UK)**

As part of the “Strategy for Statewide Engineering Education in Kentucky,” adopted July 17, 2000 by all the chief executive officers of Kentucky universities and endorsed by the Kentucky Council on Postsecondary Education (CPE), the vision was expressed that “access to undergraduate engineering education will expand primarily through the creation of joint programs managed by multiple post-secondary institutions.” In response, WKU and UK now jointly offer an ABET-accredited baccalaureate degree in civil engineering on the WKU campus in Bowling Green, Kentucky. By CPE definition, a joint-degree program is “a program that is mutually sponsored by two or more institutions leading to a single credential or degree, which is conferred by both or all participating institutions. All institutions share responsibility for all aspects of the program’s delivery and quality.”

The joint civil engineering program is one of only four such joint-degree programs in Kentucky; the others include a joint-degree program between WKU and UK in mechanical engineering, between WKU and the University of Louisville (UL) in electrical engineering, and between Murray State University and UL in electrical and telecommunications engineering.

The WKU/UK joint programs emphasize a project-oriented educational approach. Courses are provided by both WKU and UK faculty. Students are required to complete a minimum of 16 credit hours of engineering course work taught by UK engineering faculty. At present, the UK contribution is provided by distance delivery via interactive television. The curriculum of the joint civil engineering program is under the direction of a joint program faculty, with equal representation from each participating institution. The curriculum for entering students requires 135.5 credit hours, with the General Studies component based on the requirements of WKU. Students who complete the program will receive a B.S. degree conferred jointly by WKU and UK. Under the terms of the agreements between the degree-awarding institutions, WKU provides basic administrative support for students in the joint-degree program, including admission services, registration, and student financial aid. In addition, academic advising, laboratory and equipment support, and library and media resources are supplied by WKU.

The civil engineering curriculum approved within UK is listed below. The joint program faculty are responsible for on-going review of the curricular requirements.

**Degree Requirements**

**Freshman Year**

<b>Fall Semester</b>	<b>Hours</b>
CE 175 Freshman Experience .....	2
AMS 202 CADD for Architecture .....	3
MATH 126 Calculus I .....	4.5
GEOL 111/113 Physical Geology & Lab .....	4
HIST 119 or 120 Western Civilization .....	3
Total .....	16.5

**Spring Semester**

CE 160/161 Surveying I & Lab .....	4
MATH 227 Calculus II .....	4.5
PHYS 250/251 Physics I/Lab .....	4
COMM 161 or 145 Public Speaking .....	3
ENG 100 Freshman English .....	3
Total .....	18.5

**Sophomore Year**

<b>Fall Semester</b>	<b>Hours</b>
CE 303 Construction Management .....	3
CE 304 Construction Mgmt. Lab .....	1
EM 221 Statics .....	3
MATH 327 Multivariable Calculus .....	4
CHEM 120/121 Chemistry I & Lab .....	5
SFTY 171 Category F .....	1
Total .....	17

**Spring Semester**

EM 302 Mech of Deform Solids .....	3
ME 331 Strength Of Mat Lab .....	1
MATH 331 Differential Equations .....	3
PHYS 260/261 Physics II & Lab .....	4
Category A - II Foreign Language .....	3
ENG 200 Intro to Literature .....	3
Total .....	17

**Junior Year**

<b>Fall Semester</b>	<b>Hours</b>
CE 382 Structural Analysis .....	3
CE 410/411 Soil Mechanics & Lab .....	4
ME 362 Thermo/Fluids .....	4
STAT 301 Prob & Applied Statistics .....	3
ENG 300 Junior English .....	3
Category F Health & Wellness Elec .....	1
Total .....	18

**Spring Semester**

CE 316 Equipment & Methods .....	3
CE 331 Transportation Eng .....	3
CE 370 Materials of Construction .....	3
CE 412 Foundation Engineering .....	3
CE Structures Elective .....	3
CE Technical Elective .....	3
Total .....	18

**Senior Year**

<b>Fall Semester</b>	<b>Hours</b>
CE 351 Intro to Environmental Eng .....	3
CE 461 Hydrology .....	3
CE Technical Elective .....	3
CE 400 Senior Design Seminar .....	1
Category B-II Humanities Elective .....	3
Category C Soc & Behav Sci Elective .....	3
Total .....	16

**Spring Semester**

CE 498 Senior Project .....	3
CE Technical Elective .....	3
Category B - II Humanities Elective .....	3
ECON 202E Economics .....	3
Category E Cultural Elective .....	3
Total .....	15

**CE Technical Elective (Typical Offerings)****Fall Semester Hours**

CE 360/361 Estimating & Bidding/Lab .....	4
CE 380/381 Surveying II & Lab .....	4
CE 384 Reinforced Concrete Design .....	3
CE 482 Elem. Structural Design .....	3

**Spring Semester**

CE 383 Structural Steel Design .....	3
CE 416 Construction Administration .....	3
CE 426 Adv. Construction Materials .....	3
CE 476 Highway Construction .....	3
CE 480/481 Surveying III & Lab .....	3

## BACHELOR OF SCIENCE IN COMPUTER ENGINEERING

The Computer Engineering program prepares students for a productive career through developing strong foundations in math, physics, computer, and general engineering skills necessary for contributing to a rapidly developing field. Computer engineering centers on integrating hardware and software to create computing systems through combining computing hardware concepts from electrical engineering with system software issues from computer science. In the junior and senior years the program includes courses in specific application areas such as embedded systems, computer architecture, compilers, operating systems, digital logic design, software engineering, and networking.

The undergraduate education program focuses on achieving the following goals:

- Maintain a curriculum focused on developing relevant engineering skills, knowledge, and experience with current technologies.
- Provide opportunities for students to develop leadership, communication, and teamwork skills.
- Provide an environment that encourages independent learning, problem identification, and problem solving.
- Raise awareness of the engineers' professional and ethical responsibilities to society.

**Degree Requirements**

Each student must complete the following:

**University Studies Requirements**

See "University Studies Program" on pages 75-79 for the complete University Studies requirements. Students should work closely with their advisor to complete the University Studies Program requirements.

**Premajor Requirements Hours**

CS 115 Introduction to Computer Programming .....	3
CS 215 Introduction to Program Design, Abstraction, and Problem Solving .....	4
EE 211 Circuits I .....	4
EE 280 Design of Logic Circuits .....	3
<b>Subtotal: Premajor Hours .....</b>	<b>14</b>

**Major Requirements Hours**

EE 101 Electrical Engineering Professions Seminar	
or	
CS 100 The Computer Science Profession .....	1
MA 113 Calculus I .....	4
CHE 105 General College Chemistry I .....	3
MA 114 Calculus II .....	4
CS 216 Introduction to Software Engineering .....	3
CS 275 Discrete Mathematics .....	4
PHY 231 General University Physics .....	4
PHY 241 General University Physics Laboratory ...	1
MA 213 Calculus III .....	4
PHY 232 General University Physics .....	4
PHY 242 General University Physics Laboratory ...	1
MA 214 Calculus IV .....	3
EE 221 Circuits II .....	3
EE 222 Electrical Engineering Laboratory I .....	2
EE 281 Logical Design Laboratory .....	2
EE/CS 380 Microcomputer Organization .....	3
EE 383 Introduction to Embedded Systems .....	3
CS 315 Algorithm Design and Analysis .....	3
CS 441G Compilers for Algorithmic Languages .....	3
CS 470G Introduction to Operating Systems .....	3
EE 480/CS 480G Advanced Computer Architecture .....	3
EE 421G Signals and Systems I .....	3
EE 461G Introduction to Electronics .....	3
STA 381 Introduction to Engineering Statistics .....	3
EE 499 Electrical Engineering Design (Subtitle required)	
or	
CS 499 Senior Design Project .....	3
<b>Subtotal: Major Hours .....</b>	<b>73</b>

**Electives**

Oral Communication Elective* .....	3
Supportive Elective** .....	6
Technical Elective† .....	3
EE/CS Technical Electives†† .....	12
<b>Subtotal: Electives .....</b>	<b>24</b>

**Total Minimum Hours for Program ..... 128**

**Curriculum****Freshman Year****First Semester Hours**

MA 113 Calculus I .....	4
EE 101 Electrical Engineering Professions Seminar	
or	
CS 100 The Computer Science Profession .....	1
ENG 104 Writing: An Accelerated Foundational Course .....	4
CHE 105 General College Chemistry I .....	3
CS 115 Introduction to Computer Programming .....	3
USP Humanities .....	3

**Second Semester**

MA 114 Calculus II .....	4
PHY 231 General University Physics .....	4
PHY 241 General University Physics Laboratory ...	1
Oral Communication Elective .....	3
CS 215 Introduction to Program Design, Abstraction, and Problem Solving .....	4

**Sophomore Year****First Semester Hours**

MA 213 Calculus III .....	4
EE 211 Circuits I .....	4
PHY 232 General University Physics .....	4
PHY 242 General University Physics Laboratory ...	1
EE 280 Design of Logic Circuits .....	3
EE 281 Logical Design Laboratory .....	2

**Second Semester**

MA 214 Calculus IV .....	3
CS 275 Discrete Mathematics .....	4
CS 216 Introduction to Software Engineering .....	3
EE/CS 380 Microcomputer Organization .....	3
USP Humanities/Writing Intensive Course .....	3

**Junior Year****First Semester Hours**

EE 221 Circuits II .....	3
EE 222 Electrical Engineering Laboratory I .....	2
CS 315 Algorithm Design and Analysis .....	3
EE 383 Introduction to Embedded Systems .....	3
USP Social and Behavioral Sciences .....	3
STA 381 Introduction to Engineering Statistics .....	3

**Second Semester**

EE 461G Introduction to Electronics .....	3
CS 470G Introduction to Operating Systems .....	3
EE 480/CS 480G Advanced Computer Architecture .....	3
USP Social and Behavioral Sciences .....	3
EE 421G Signals and Systems I .....	3

**Senior Year****First Semester Hours**

CS 441G Compilers for Algorithmic Languages .....	3
EE/CS Technical Electives .....	6
Supportive Elective .....	3
Technical Elective .....	3

**Second Semester**

EE 499 Electrical Engineering Design (Subtitle required)	
or	
CS 499 Senior Design Project .....	3
EE/CS Technical Electives .....	6
Supportive Elective .....	3
USP Cross Cultural .....	3

\*Oral communications elective is satisfied by any one of the following courses COM 181, COM 252, COM 281, COM 287.

\*\*Supportive elective is to be chosen from any University courses, excluding more elementary versions of required courses, such as precalculus mathematics or PHY 211.

†Technical elective may be selected from upper-division engineering, mathematics, statistics, computer science, physics, or other technically-related fields excluding more elementary version of required courses. To be selected in consultation with academic advisor.

††EE/CS technical electives are senior level courses in either the computer science or electrical engineering disciplines. These include 400-level CS courses and 500-level CS and EE courses with emphasis in the computer engineering area and excluding EE 595. To be selected in consultation with academic advisor.

**Recommended EE/CS Technical Electives:**

CS 405G Introduction to Database Systems
CS 415G Graph Theory
CS 416G Principles of Operations Research I
CS 422 Numerical Solutions of Equations
CS 450G Fundamentals of Programming Languages
CS 463G Logic and Artificial Intelligence
CS 471G Networking and Distributed Operating Systems
CS 485G Topics in Computer Science (Subtitle required)
EE 581 Advanced Logical Design
EE 582 Hardware Description Languages and Programmable Logic

EE 584 Introduction of VLSI Design and Testing  
 EE 585 Fault Tolerant Computing  
 EE 586 Communication and Switching Networks  
 EE 587 Microcomputer Systems Design  
 EE 599 Topics in Electrical Engineering  
 (Subtitle required)

**BACHELOR OF SCIENCE IN  
 COMPUTER SCIENCE**

The Computer Science program includes courses dealing with the design, implementation, analysis, and software-engineering issues related to algorithms and computer programs. A foundation in continuous and discrete mathematics is used to study numerical problems and to analyze algorithms. Through required and elective courses students are exposed to the fundamentals of computing theory and algorithms, programming languages, language translation and compiling, graphics, scientific computing, artificial intelligence, networks, databases, and operating systems.

The undergraduate program focuses on achieving the following goals:

- attract talented, motivated students with a strong background in mathematics and the sciences, some familiarity with computers and a desire to shape the future;
- develop the skills needed to analyze and synthesize solutions to computing problems;
- develop communications and teamwork skills in our students;
- open the doors to exciting, creative and economically-rewarding career opportunities;
- pave the way to educational opportunities at the graduate level; and
- instill a desire and ability for life-long learning in our students.

**Degree Requirements**

Each student must complete the following:

**University Studies Requirements**  
 See "University Studies Program" on pages 75-79 for the complete University Studies requirements. Students should work closely with their advisor to complete the University Studies Program requirements.

Courses marked with an asterisk (\*) may also be used to satisfy University Studies requirements.

Premajor Requirements	Hours
CS 100 The Computer Science Profession .....	1
CS 115 Introduction to Computer Programming .....	3
CS 215 Introduction to Program Design, Abstraction, and Problem Solving .....	4
CS 216 Introduction to Software Engineering .....	3
CS 275 Discrete Mathematics .....	4
ENG 104 Writing: An Accelerated Foundational Course .....	4
*MA 113 Calculus I .....	4
MA 114 Calculus II .....	4
*PHY 231 General University Physics .....	4
*PHY 241 General University Physics Laboratory ..	1
<b>Subtotal: Premajor Hours .....</b>	<b>32</b>

Major Requirements	Hours
*PHY 232 General University Physics .....	4
*PHY 242 General University Physics Laboratory .....	1
Additional Science Electives .....	6
MA 213 Calculus III	
<b>or</b>	
MA 322 Matrix Algebra and its Applications .....	3-4
EE 280 Design of Logic Circuits .....	3
*COM 181 Basic Public Speaking <b>or</b> *COM 252 Introduction to Interpersonal Communication <b>or</b> *COM 281 Communication in Small Groups <b>or</b> *COM 287 Persuasive Speaking .....	3
STA 281 Probability and Statistics Using Interactive Computer Techniques .....	3
CS 315 Algorithm Design and Analysis .....	3
CS/MA 321 Introduction to Numerical Methods .....	3
CS 375 Logic and Theory of Computing .....	3
CS/EE 380 Microcomputer Organization .....	3
CS 470G Introduction to Operating Systems .....	3
CS 499 Senior Design Project .....	3
<b>Subtotal: Major Hours .....</b>	<b>41-42</b>

Computer Science Electives	Hours
Choose three from the following list:	
CS 335 Graphics and Multimedia .....	3
CS 405G Introduction to Database Systems .....	3
CS 441G Compilers for Algorithmic Languages .....	3
CS 450G Fundamentals of Programming Languages .....	3
CS 463G Logic and Artificial Intelligence .....	3
Any other CS class at the 300-level or above .....	3
<b>Subtotal: CS Electives .....</b>	<b>9</b>

Technical Electives	Hours
Choose 12 credit hours of the following:	
MA 214 Calculus IV or any 300-level or higher classes selected from computer science, electrical engineering, mathematics, or the College or Business and Economics	
<b>Subtotal: Technical Electives .....</b>	<b>12</b>

Free Electives	Hours
Two courses must be in areas other than computer science, science, engineering, or mathematics to satisfy the University Studies Program and the computer science ABET accreditation requirements. Any remaining electives should be selected to meet the minimum total of 128 hours required for graduation	
<b>Subtotal: Free Electives .....</b>	<b>minimum of 6</b>

**TOTAL HOURS .....** 128

\*These courses may be used to satisfy University Studies requirements.

**Curriculum  
 Freshman Year**

First Semester	Hours
CS 100 The Computer Science Profession .....	1
CS 115 Introduction to Computer Programming .....	3
ENG 104 Writing: An Accelerated Foundational Course <b>or</b> Natural Science Elective [N] .....	3-4
MA 113 Calculus I .....	4
University Studies [U] .....	3
<b>Second Semester</b>	
CS 215 Introduction to Program Design, Abstraction, and Problem Solving .....	4

ENG 104 Writing: An Accelerated Foundational Course <b>or</b> Natural Science Elective [N] .....	3-4
MA 114 Calculus II .....	4
University Studies [U] .....	3

**Sophomore Year**

First Semester	Hours
CS 216 Introduction to Software Engineering .....	3
EE 280 Design of Logic Circuits .....	3
MA 213 Calculus III .....	4
<b>or</b>	
MA 322 Matrix Algebra and Its Applications .....	3
PHY 231 General University Physics .....	4
PHY 241 General University Physics Laboratory ....	1
University Studies [U] .....	3
<b>Second Semester</b>	
CS 275 Discrete Mathematics .....	4
CS/EE 380 Microcomputer Organization .....	3
PHY 232 General University Physics .....	4
PHY 242 General University Physics Laboratory ....	1
STA 281 Probability and Statistics Using Interactive Computer Techniques .....	3
University Studies [U] .....	3

**Junior Year**

First Semester	Hours
CS 315 Algorithm Design and Analysis .....	3
CS/MA 321 Introduction to Numerical Methods .....	3
University Studies [U] .....	3
ENG 2XX Writing Intensive Course .....	3
Free Elective [E] .....	3
<b>Second Semester</b>	
CS 375 Logic and Theory of Computing .....	3
Computer Science Elective [C] .....	3
Technical Elective [T] .....	3
COM 181 Basic Public Speaking <b>or</b> COM 252 Introduction to Interpersonal Communication <b>or</b> COM 281 Communication in Small Groups <b>or</b> COM 287 Persuasive Speaking .....	3
Natural Science Elective [N] .....	3
Free Elective [E] .....	3

**Senior Year**

First Semester	Hours
CS 470G Introduction to Operating Systems .....	3
Computer Science Elective [C] .....	3
Technical Elective [T] .....	3
University Studies [U] .....	3
Free Elective [E] .....	3
<b>Second Semester</b>	
CS 499 Senior Design Project .....	3
Computer Science Elective [C] .....	3
Technical Electives [T] .....	6
Free Elective [E] .....	3
[U] To be selected from University Studies areas in Social Sciences, Humanities, Cross-Cultural, and Electives in conjunction with the academic advisor.	
[N] Any natural science course excluding more elementary versions of completed required courses.	
[C] Computer Science electives include 300-level and above computer science courses with two to be selected from: CS 335, CS 405G, CS 441G, CS 450G, and CS 463G.	
[T] Technical electives include any 300-level and above courses in computer science, electrical engineering, mathematics, and business and economics. MA 214 is also an acceptable technical elective.	
[E] Two of the electives (6 credits) cannot be mathematics, computer science, science or engineering courses; these two courses can be used to satisfy the University Studies elective requirement.	

**Minor in Computer Science**

CS 100 The Computer Science Profession .....	1
CS 115 Introduction to Computer Programming .....	3
CS 215 Introduction to Program Design, Abstraction, and Problem Solving .....	4
CS 216 Introduction to Software Engineering .....	3
CS 275 Discrete Mathematics .....	4
CS 315 Algorithm Design and Analysis .....	3
<b>plus</b> three additional hours in computer science .....	3

**BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING**

The undergraduate electrical engineering degree program seeks to produce graduates who are trained in the theory and practice of electrical and computer engineering and are well prepared to handle the professional and leadership challenges of their careers.

The following objectives relate to expectations for program graduates while in the early stages of their careers. These objectives are regularly assessed through surveys of employers and alumni. The EE program objectives are:

- Maintain a curriculum focused on developing relevant engineering skills, knowledge, and experience with current technologies.
- Provide opportunities for students to develop leadership, communication, and teamwork skills.
- Provide an environment that encourages independent learning, problem identification, and problem solving.
- Raise awareness of the engineers' professional and ethical responsibilities to society.

**Degree Requirements**

Each student must complete the following:

**University Studies Requirements**

See "University Studies Program" on pages 75-79 for the complete University Studies requirements. Students should work closely with their advisor to complete the University Studies Program requirements.

**Premajor Requirements Hours**

EE 211 Circuits I .....	4
EE 221 Circuits II .....	3
EE 222 Electrical Engineering Laboratory I .....	2
EE 280 Design of Logic Circuits .....	3
<b>Subtotal: Premajor Hours .....</b>	<b>12</b>

**Major Requirements Hours**

CHE 105 General College Chemistry I .....	3
CS 115 Introduction to Computer Programming .....	3
EE 101 Electrical Engineering Professions Seminar .....	1
EE 360 Introduction to Semiconductor Devices .....	3
EE 380 Computer Organization .....	3
EE 415G Electromechanics .....	3
EE 416G Energy Conversion Laboratory <b>or</b> EE 281 Logical Design Laboratory .....	2
EE 421G Signals and Systems I .....	3
EE 422G Signals and Systems II .....	3
EE 461G Introduction to Electronics .....	3
EE 462G Electronic Circuits Laboratory .....	2

EE 468G Introduction to Engineering Electromagnetics .....	4
EE 499 Electrical Engineering Design .....	3
ENG 104 Writing: An Accelerated Foundational Course .....	4
Oral Communication Course .....	3
MA 113 Calculus I .....	4
MA 114 Calculus II .....	4
MA 213 Calculus III .....	4
MA 214 Calculus IV .....	3
MA 320 Introductory Probability .....	3
PHY 231 General University Physics .....	4
PHY 232 General University Physics .....	4
PHY 241 General University Physics Laboratory ...	1
PHY 242 General University Physics Laboratory ...	1

**Subtotal: Major Hours .....** 71

**Electives Hours**

Engineering/Science Electives .....	9
EE Technical Electives .....	12
Math/Statistics Elective .....	3
Supportive Elective .....	3
Technical Elective .....	6

**Subtotal: Electives .....** 33

**TOTAL HOURS: .....** 131

**Curriculum****Freshman Year****First Semester Hours**

EE 101 Electrical Engineering Professions Seminar .....	1
MA 113 Calculus I .....	4
CS 115 Introduction to Computer Programming .....	3
ENG 104 Writing: An Accelerated Foundational Course .....	4
University Studies – Social Science* .....	3
University Studies – Humanities* .....	3

**Second Semester**

MA 114 Calculus II .....	4
PHY 231 General University Physics .....	4
PHY 241 General University Physics Laboratory ...	1
CHE 105 General College Chemistry I .....	3
Oral Communications Elective (select one course from COM 181, COM 252, COM 281, COM 287 .....	3

**Sophomore Year****First Semester Hours**

MA 213 Calculus III .....	4
PHY 232 General University Physics .....	4
PHY 242 General University Physics Laboratory ...	1
EE 211 Circuits I .....	4
EE 280 Design of Logic Circuits .....	3

**Second Semester**

MA 214 Calculus IV .....	3
EE 221 Circuits II .....	3
EE 222 Electrical Engineering Laboratory I .....	2
EE 360 Introduction to Semiconductor Devices .....	3
Engineering/Science Elective [E] .....	3
University Studies – Writing Requirement/Humanities or Cross-Cultural* .....	3

**Junior Year****First Semester Hours**

EE 415G Electromechanics .....	3
EE 421G Signals and Systems I .....	3
EE 416G Energy Conversion Laboratory <b>or</b> EE 281 Logical Design Laboratory .....	2
EE 380 Computer Organization .....	3
EE 461G Introduction to Electronics .....	3
MA 320 Introductory Probability .....	3

**Second Semester**

EE 468G Introduction to Engineering Electromagnetics .....	4
EE 462G Electronic Circuits Laboratory .....	2
EE 422G Signals and Systems II .....	3
Engineering/Science Elective [E] .....	3
Technical Elective [T] .....	3
University Studies – Social Science* .....	3

**Senior Year****First Semester Hours**

EE Technical Electives*** .....	6
Math/Statistics Elective [M] .....	3
Engineering/Science Elective [E] .....	3
Technical Elective [T] .....	3

**Second Semester**

EE 499 Electrical Engineering Design .....	3
EE Technical Electives*** .....	6
Supportive Elective** .....	3
University Studies – Humanities or Cross-Cultural* .....	3

\*To be selected from University Studies areas in Social Sciences, Oral Communication, Humanities and Cross-Cultural in consultation with the academic advisor. For efficient course selection, either one of the humanities or cross-cultural electives must also satisfy the Writing Requirement.

\*\*Supportive elective is to be chosen from any University courses, excluding more elementary versions of required courses, such as precalculus mathematics or PHY 211.

[M] **Math/Statistics Elective:** Any upper-division (300-level or higher) math or statistics course (3 credit hours total).

[E] **Engineering/Science Electives:** Any engineering, physics, computer science, or math course at the 200-level or higher, other than an electrical engineering course and excluding more elementary versions of required courses (9 credit hours total).

[T] **Technical electives** may be selected from upper division engineering, mathematics, statistics, computer science, physics, or other technically-related fields and excluding more elementary versions of required courses, to be selected in consultation with the academic advisor (6 credit hours total).

\*\*\*EE **Technical Electives:** Courses recommended as electrical engineering technical electives are listed below (each course is 3 credit hours):

EE 511 Introduction to Communication Systems
EE 512 Digital Communication Systems
EE 517 Advanced Electromechanics
EE 518 Electric Drives
EE 522 Antenna Design
EE 523 Microwave Circuit Design
EE 524 Solid State Physics
EE 525 Numerical Methods and Electromagnetics
EE 527 Electromagnetic Compatibility
EE 537 Electric Power Systems I
EE 538 Electric Power Systems II
EE 560 Semiconductor Device Design
EE 561 Electric and Magnetic Properties of Materials
EE 562 Analog Electronic Circuits
EE 564 Digital Electronic Circuits
EE 565 Circuit Design With Analog Integrated Circuits
EE 567 Introduction to Lasers and Masers
EE 568 Fiber Optics
EE 569 Electronic Packaging Systems and Manufacturing Processes
EE 571 Feedback Control Design
EE 572 Digital Control of Dynamic Systems
EE 581 Advanced Logical Design
EE 582 Hardware Description Languages and Programmable Logic
EE 584 Introduction of VLSI Design and Testing
EE 585 Fault Tolerant Computing
EE 586 Communication and Switching Networks
EE 587 Microcomputer Systems Design
EE 599 Topics in Electrical Engineering (Subtitle required)

**BACHELOR OF SCIENCE IN MATERIALS ENGINEERING**

The materials engineer is responsible for the preparation, fabrication, selection, use and reuse of existing materials and for the development of new and improved materials. The professional in this field is often called on to consider metals, ceramics and polymers. The engineer considers chemical, electronic, magnetic, optical, and mechanical properties of materials.

The goals of the undergraduate program are as follows:

- Produce graduates with an understanding of materials, who can function independently as professionals in the practice of engineering or as successful members of related graduate and professional programs.
- Produce graduates who can use their materials educations to continue their careers with steady advancement and professional development.

**Degree Requirements**

Each student must complete the following:

**Premajor Requirements Hours**

ENG 104 Writing: An Accelerated Foundational Course .....	4
CHE 105 General College Chemistry I .....	3
CHE 107 General College Chemistry II .....	3
CHE 115 General Chemistry Laboratory .....	3
MA 113 Calculus I .....	4
MA 114 Calculus II .....	4
MA 213 Calculus III .....	4
MA 214 Calculus IV .....	4
PHY 231 General University Physics .....	3
PHY 232 General University Physics .....	4
PHY 241 General University Physics Laboratory ....	1
<b>Subtotal: Premajor Hours .....</b>	<b>37</b>

**Major Requirements Hours**

MSE 101 Materials Engineering .....	1
COM 181 Basic Public Speaking .....	3
CS 221 First Course in Computer Science for Engineers .....	2
CME 200 Process Principles .....	3
MSE 201 Materials Science .....	3
MSE 202 Materials Science Laboratory .....	1
CHE 236 Survey of Organic Chemistry .....	3
EM 221 Statics .....	3
MSE 301 Materials Science II .....	3
MSE 351 Material Thermodynamics .....	3
EM 302 Mechanics of Deformable Solids .....	3
EE 305 Electrical Circuits and Electronics .....	3
PHY 361 Principles of Modern Physics .....	3
STA 381 Introduction to Engineering Statistics .....	3
MSE 401G Metal and Alloys .....	3
MSE 402G Electronic Materials and Processing .....	3
MSE 403G Ceramic Engineering and Processing .....	3
MSE 404G Polymeric Materials .....	3
MSE 407 Materials Laboratory I .....	3
MSE 408 Materials Laboratory II .....	3
MSE 436 Material Failure Analysis .....	3
MSE 480 Materials Design .....	3
MSE 535 Mechanical Properties of Materials .....	3
MSE 538 Metals Processing .....	3
MSE 585 Materials Characterization Techniques .....	3
<b>Subtotal: Major Hours .....</b>	<b>70</b>

**Technical Electives Hours**

Choose 6 credit hours from the following:

MSE 395 Independent Work in Materials Engineering .....	3
(Or any other approved technical course)	
MSE 531 Powder Metallurgy .....	3
MSE 550 Corrosion .....	3
MSE 506 Mechanics of Composite Materials .....	3
MSE/CME 554 Chemical and Physical Processing of Polymer Systems .....	3
MSE 556 Introduction to Composite Materials .....	3
MSE 568 Fiber Optics .....	3
MSE 569 Electronic Packaging Systems and Manufacturing Processes .....	3
<b>Subtotal: Technical Electives .....</b>	<b>6</b>

**Supportive Elective Hours**

The supportive elective can be any course that carries college credit and is not a more elementary version of a required course. For example, college algebra would not be satisfactory because it is more elementary than the required calculus courses. The student completing 3 co-op tours (EGR 399) may count the co-op experience toward the supportive elective.

**Subtotal: Supportive Elective .....** 3

**University Studies Requirements Hours**

Social Science .....	6
Humanities .....	6*
Cross-Cultural .....	3
Electives .....	3
<b>Subtotal: USP .....</b>	<b>18</b>

\*Some literature courses can be counted for the Second-Tier Writing Requirement and 3 hours of humanities.

**TOTAL HOURS: .....** 134

**Curriculum**

**Freshman Year**

**First Semester Hours**

MSE 101 Materials Engineering .....	1
CHE 105 General College Chemistry I .....	3
ENG 104 Writing: An Accelerated Foundational Course .....	4
MA 113 Calculus I .....	4
CS 221 First Course in Computer Science for Engineers .....	2
University Studies* .....	3

**Second Semester**

CHE 107 General College Chemistry II .....	3
CHE 115 General Chemistry Laboratory .....	3
MA 114 Calculus II .....	4
COM 181 Basic Public Speaking .....	3
University Studies* .....	3

**Sophomore Year**

**First Semester Hours**

MSE 201 Materials Science .....	3
CHE 236 Survey of Organic Chemistry .....	3
MA 213 Calculus III .....	4
PHY 231 General University Physics .....	4
PHY 241 General University Physics Laboratory ....	1
MSE 202 Materials Science Laboratory .....	1

**Second Semester**

MSE 301 Materials Science II .....	3
MSE 351 Material Thermodynamics .....	3
MA 214 Calculus IV .....	3
PHY 232 General University Physics .....	4
EM 221 Statics .....	3

**Junior Year**

**First Semester Hours**

MSE 401G Metal and Alloys .....	3
MSE 404G Polymeric Materials .....	3
CME 200 Process Principles .....	3

EM 302 Mechanics of Deformable Solids .....	3
University Studies* .....	3

**Second Semester**

MSE 403G Ceramic Engineering and Processing .....	3
MSE 402G Electronic Materials and Processing .....	3
PHY 361 Principles of Modern Physics .....	3
STA 381 Introduction to Engineering Statistics .....	3
MSE 535 Mechanical Properties of Materials .....	3
MSE 407 Materials Laboratory I .....	3

**Senior Year**

**First Semester Hours**

MSE 585 Materials Characterization Techniques .....	3
MSE 436 Material Failure Analysis .....	3
EE 305 Electrical Circuits and Electronics .....	3
MSE 408 Materials Laboratory II .....	3
Technical Elective*** .....	3
ENG 2XX Writing Intensive Course or University Studies* .....	3

**Second Semester**

MSE 480 Materials Design .....	3
MSE 538 Metals Processing .....	3
Technical Elective*** .....	3
Supportive Elective** .....	3
University Studies* .....	3
University Studies* .....	3

\*To be selected from University Studies areas in Social Sciences, Humanities, Cross-Cultural and Electives in consultation with the academic advisor. A minimum of 18 credits in the humanities and social sciences are required.

\*\*Supportive elective is any university course, excluding more elementary versions of required courses, such as precalculus mathematics or PHY 211.

\*\*\*Choose from the list of Technical Electives above.

**BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING**

The training of the mechanical engineer is the broadest among the several fields of engineering. The mechanical engineer uses the techniques of mathematics combined with a specialized knowledge of the thermal and energy sciences, solid and fluid mechanics, and the properties of materials. This information is supplemented by an understanding of manufacturing processes, the design and control of systems, and the economics of the technological community.

Our graduates will be able to apply knowledge of mathematics, science and mechanical engineering to the solution of problems, particularly in the areas of thermodynamics and energy systems; heat transfer; fluid mechanics; mechanical systems and controls; mechanical design; finite element methods and computer-aided graphics; manufacturing; instrumentation; and experimental method.

Consistent with the Vision and Mission statements of the University of Kentucky, the undergraduate programs in mechanical engineering strive to meet the following educational objectives:

1. Mechanical Engineering programs will prepare our students for successful practice or academic pursuits in mechanical engineering.
2. Our graduates will have the knowledge

in analytical, computational, and experimental methods to begin engineering practice or continue their education. This will include the ability to design components and systems and to solve engineering problems using current analysis and computational methods.

- Our graduates will have a broad education and communication skills needed for a variety of career options and an appreciation of the need for life-long learning.
- Our graduates will have an understanding of the societal, environmental and ethical responsibilities of engineers.

### Degree Requirements

Each student must complete the following:

**University Studies Requirements Hours**  
See “University Studies Program” on pages 75-79 for the complete University Studies requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill University Studies areas. Students should work closely with their advisor to complete the University Studies Program requirements.

Courses marked with an asterisk (\*) may also be used to satisfy University Studies requirements.

#### Math

MA 113 Calculus I ..... 4

#### Inference –Logic

MA 113 Calculus I ..... 4

#### Oral Communication

COM 181 Basic Public Speaking ..... 3

#### Natural Sciences

CHE 105 General College Chemistry I ..... 3

CHE 107 General College Chemistry II ..... 3

#### USPElectives

Complete with Supportive Elective and Technical Elective ..... 6

### Premajor Requirements Hours

\*ENG 104 Writing: An Accelerated Foundational Course ..... 4

ENG 2XX Writing Intensive Course ..... 3

\*CHE 105 General College Chemistry I ..... 3

\*CHE 107 General College Chemistry II ..... 3

\*MA 113 Calculus I ..... 4

\*MA 114 Calculus II ..... 4

\*MA 213 Calculus III ..... 4

\*MA 214 Calculus IV ..... 3

\*PHY 231 General University Physics ..... 4

\*PHY 232 General University Physics ..... 4

\*PHY 241 General University Physics Laboratory ..... 1

\*PHY 242 General University Physics Laboratory ..... 1

**Subtotal: Premajor Hours: ..... 38**

### Major Requirements Hours

ME 101 Introduction to Mechanical Engineering ..... 3

\*COM 181 Basic Public Speaking ..... 3

ME 151 Manufacturing Engineering ..... 3

ME 205 Computer Aided Engineering Graphics ..... 3

ME 220 Engineering Thermodynamics I ..... 3

CS 221 First Course in Computer Science for Engineers ..... 2

EM 221 Statics ..... 3

EM 302 Mechanics of Deformable Solids ..... 3

EM 313 Dynamics ..... 3

EE 305 Electrical Circuits and Electronics ..... 3

ME 310 Engineering Experimentation I ..... 3

ME 311 Engineering Experimentation II ..... 3

ME 321 Engineering Thermodynamics II ..... 3

ME 325 Elements of Heat Transfer ..... 3

ME 330 Fluid Mechanics ..... 3

ME 340 Introduction to Mechanical Systems ..... 3

ME 344 Mechanical Design ..... 3

ME 411 ME Capstone Design I ..... 3

ME 412 ME Capstone Design II ..... 3

ME 440 Design of Control Systems ..... 3

ME 501 Mechanical Design with Finite Element Methods ..... 3

**Subtotal: Major Hours ..... 62**

### Technical Electives Hours

Choose 9 hours from the following:

ME 380 Topics in Mechanical Engineering ..... 3

ME 395 Independent Work in Mechanical Engineering ..... 3

ME/MFS 503 Lean Manufacturing Principles and Practices ..... 3

ME/MFS 505 Modeling of Manufacturing Processes and Machines ..... 3

ME/MSE 506 Mechanics of Composite Materials ..... 3

ME/MFS 507 Design for Manufacturing ..... 3

ME/MFS 512 Manufacturing Systems ..... 3

ME 513 Mechanical Vibrations ..... 3

ME 527 Applied Mathematics in the Natural Sciences I ..... 3

ME 530 Gas Dynamics ..... 3

ME 531 Fluid Dynamics I ..... 3

ME 532 Advanced Strength of Materials ..... 3

ME/MSE 556 Introduction to Composite Materials ..... 3

ME 560 Engineering Optics ..... 3

ME 563 Basic Combustion Phenomena ..... 3

ME/BAE 580 Heating, Ventilating and Air-Conditioning ..... 3

ME 599 Topics in Mechanical Engineering ..... 3

MFS 599 Topics in Manufacturing Engineering ..... 3

EGR 599 Topics in Engineering ..... 3

MSE 201 Materials Science ..... 3

**Subtotal: Technical Electives: ..... 9**

### Mathematics Elective Hours

Choose one course from the following:

MA 320 Introductory Probability ..... 3

MA 321 Introduction to Numerical Methods ..... 3

MA 322 Matrix Algebra and Its Applications ..... 3

MA 416G Principles of Operations Research I ..... 3

MA 432G Methods of Applied Mathematics I ..... 3

MA 433G Introduction to Complex Variables ..... 3

MA 481G Differential Equations ..... 3

STA 381 Introduction to Engineering Statistics ..... 3

**Subtotal: Mathematics Elective: ..... 3**

### Supportive Elective Hours

The supportive elective can be any course that carries college credit and is not a more elementary version of a required course. For example, college algebra would not be satisfactory because it is more elementary than the required calculus courses. The student completing 3 co-op tours (EGR 399) may count the co-op experience toward the supportive elective.

**Subtotal: Supportive Elective ..... 3**

**TOTAL HOURS: ..... 130**

## Curriculum

### Freshman Year

#### First Semester

ME 101 Introduction to Mechanical Engineering ..... 3

CHE 105 General College Chemistry I ..... 3

MA 113 Calculus I ..... 4

ENG 104 Writing: An Accelerated Foundational Course ..... 4

## Second Semester

ME 151 Manufacturing Engineering ..... 3

CHE 107 General College Chemistry II ..... 3

MA 114 Calculus II ..... 4

COM 181 Basic Public Speaking ..... 3

University Studies\* ..... 3

### Sophomore Year

#### First Semester

PHY 231 General University Physics ..... 4

PHY 241 General University Physics Laboratory ..... 1

MA 213 Calculus III ..... 4

CS 221 First Course in Computer Science for Engineers ..... 2

ME 205 Computer Aided Engineering Graphics ..... 3

Second-Tier Writing Requirement Course\*\* ..... 3

#### Second Semester

ME 220 Engineering Thermodynamics I ..... 3

PHY 232 General University Physics ..... 4

PHY 242 General University Physics Laboratory ..... 1

MA 214 Calculus IV ..... 3

EM 221 Statics ..... 3

University Studies\* ..... 3

### Junior Year

#### First Semester

ME 321 Engineering Thermodynamics II ..... 3

ME 330 Fluid Mechanics ..... 3

EM 302 Mechanics of Deformable Solids ..... 3

EM 313 Dynamics ..... 3

EE 305 Electrical Circuits and Electronics ..... 3

University Studies\* ..... 3

#### Second Semester

ME 310 Engineering Experimentation I ..... 3

ME 344 Mechanical Design ..... 3

ME 325 Elements of Heat Transfer ..... 3

ME 340 Introduction to Mechanical Systems ..... 3

Mathematics Elective\*\*\* ..... 3

### Senior Year

#### First Semester

ME 411 ME Capstone Design I ..... 3

ME 311 Engineering Experimentation II ..... 3

ME 440 Design of Control Systems ..... 3

ME 501 Mechanical Design with Finite Element Methods ..... 3

Technical Elective† ..... 3

#### Second Semester

ME 412 ME Capstone Design II ..... 3

Technical Electives† ..... 6

Supportive Elective†† ..... 3

University Studies\* ..... 6

\*To be selected from University Studies areas in Social Sciences, Humanities and Cross-Cultural in conjunction with the academic advisor.

\*\*To be selected in consultation with the academic advisor from acceptable courses as provided in the University of Kentucky *Bulletin*.

\*\*\*Mathematics elective must meet two criteria: (1) be offered by the department of mathematics or statistics; and (2) be higher course content than required mathematics courses. See *Undergraduate Handbook* for suggested courses.

†Technical Electives – see list below.

††The supportive elective is to be chosen from any University course, excluding more elementary versions of required courses, such as precalculus mathematics or PHY 211.

**Technical Electives:** Students should select from the list below.

BME 501 Foundations of Biomedical Engineering

BME 530 Biomedical Instrumentation

BAE 502 Modeling of Biological Systems

ME 380 Topics in Mechanical Engineering

ME 395 Independent Work in Mechanical Engineering

- ME/MFS 503 Lean Manufacturing Principles and Practices
- ME/MFS 505 Modeling of Manufacturing Processes and Machines
- ME/MSE 506 Mechanics of Composite Materials
- ME/MFS 507 Design for Manufacturing
- ME/MFS 512 Manufacturing Systems
- ME 513 Mechanical Vibrations
- ME 527 Applied Mathematics in the Natural Sciences I
- ME 530 Gas Dynamics
- ME 531 Fluid Dynamics I
- ME 532 Advanced Strength of Materials
- ME/MSE 556 Introduction to Composite Materials
- ME 560 Engineering Optics
- ME 563 Basic Combustion Phenomena
- ME/BAE 580 Heating, Ventilating and Air-Conditioning
- ME 599 Topics in Mechanical Engineering
- MSE 201 Materials Science
- EGR 599 Topics in Engineering

**BACHELOR OF SCIENCE IN  
MECHANICAL ENGINEERING—  
PADUCAH**

In addition to the program on the Lexington campus, students can pursue a B.S. degree in mechanical engineering through the College's Extended Campus Program in Paducah, Kentucky. The Paducah program uses the same curriculum as the main campus, but provides the opportunity for students to complete all B.S. degree requirements without having to relocate to Lexington.

Consistent with the Vision and Mission statements of the University of Kentucky, the mechanical engineering program at the UK Extended Campus in Paducah strives to meet the following educational objectives:

- The Mechanical Engineering program will prepare our students for successful practice or academic pursuits in mechanical engineering.
- Our graduates will have the technical skills needed to begin engineering practice or to continue their education. These will include the knowledge of how to design and conduct experiments, mathematics and analytical skills, principles for the design of components and systems, as well as a familiarity with software tools common to the field.
- Our graduates will have the broad education and communication skills needed for a variety of career options, and an appreciation of the need for life-long learning to maintain their competency.
- Our graduates will have an understanding of the social and ethical responsibilities of engineers, and the impact that engineers have in environmental and societal issues.

The Paducah mechanical engineering program collaborates with West Kentucky Community and Technical College to provide the basic math and science courses, as well as the general studies course requirements. Murray

State University faculty members teach upper-level non-engineering courses on the Paducah campus. On-site UK mechanical engineering faculty members and jointly-appointed Murray engineering faculty members teach the upper-division engineering courses. Program admission, course registration, student advising and other student services all can be completed at the Paducah site.

**Degree Requirements**

The curriculum requirements for the B.S. degree in mechanical engineering in Paducah are identical to those on the Lexington campus. Refer to those degree requirements for the Paducah degree program. Not all the technical electives listed for the Lexington program will be available in Paducah. The student must satisfy the College graduation requirements listed earlier.

**BACHELOR OF SCIENCE IN  
MECHANICAL ENGINEERING**

**Joint-Degree Program Offered by  
Western Kentucky University (WKU)  
and the University of Kentucky (UK)**

As part of the "Strategy for Statewide Engineering Education in Kentucky," adopted July 17, 2000 by all the chief executive officers of Kentucky universities and endorsed by the Kentucky Council on Postsecondary Education (CPE), the vision was expressed that "access to undergraduate engineering education will expand primarily through the creation of joint programs managed by multiple post-secondary institutions." In response, WKU and UK now jointly offer an ABET-accredited baccalaureate degree in mechanical engineering on the WKU campus in Bowling Green, Kentucky. By CPE definition, a joint-degree program is "a program that is mutually sponsored by two or more institutions leading to a single credential or degree, which is conferred by both or all participating institutions. All institutions share responsibility for all aspects of the program's delivery and quality."

The joint mechanical engineering program is one of only four such joint-degree programs in Kentucky; the others include a joint-degree program between WKU and UK in civil engineering, between WKU and the University of Louisville (UL) in electrical engineering, and between Murray State University and UL in electrical and telecommunications engineering.

The WKU/UK joint programs emphasize a project-oriented educational approach. Courses are provided by both WKU and UK faculty. Students are required to complete a minimum of 16 credit hours of engineering course work taught by UK engineering faculty. At present, the UK contribution is provided by distance delivery via interactive television. The curriculum of the joint mechanical

engineering program is under the direction of a joint program faculty, with equal representation from each participating institution. The curriculum for entering students requires 139.5 credit hours, with the General Studies component based on the requirements of WKU. Students who complete the program will receive a B.S. degree conferred jointly by WKU and UK. Under the terms of the agreements between the degree-awarding institutions, WKU provides basic administrative support for students in the joint-degree program, including admission services, registration, and student financial aid. In addition, academic advising, laboratory and equipment support, and library and media resources are supplied by WKU.

The mechanical engineering curriculum approved within UK is listed below. The joint program faculty are responsible for on-going review of the curricular requirements.

**Curriculum**

**Freshman Year**

<b>Fall Semester</b>	<b>Hours</b>
ENG 100 Freshman English .....	3
MATH 126 Calculus I .....	4.5
UC101/ME 101 ME Freshman Experience .....	3
ME 240/241 Materials/Methods Mfg. ....	4
CHEM 120/121E Chemistry for Engineers .....	4
<b>Total</b> .....	<b>18.5</b>

**Spring Semester**

CS 245 Intro to Comp Prog Lang .....	1.5
MATH 227 Calculus II .....	4.5
SCOM 161 Business Speaking .....	3
PHYS 250/251 Physics I & Lab .....	4
HIST 119/120 Western Civilization .....	3
Category F .....	2
<b>Total</b> .....	<b>18</b>

**Sophomore Year**

<b>Fall Semester</b>	<b>Hours</b>
MATH 327 Multivariable Calculus .....	4
EM 221 Statics .....	3
EE 250 EE Fundamentals .....	4
PHYS 260/261 Physics II & Lab .....	4
AMS 205 CADD for Manufacturing .....	3
<b>Total</b> .....	<b>18</b>

**Spring Semester**

ME 200 Sophomore Design .....	2
MATH 331 Differential Equations .....	3
EM 313 Dynamics .....	3
EM 302 Mechanics of Deformable Solids .....	3
ME 331 Mechanics of Deformable Solids Lab .....	1
EE 285 Intro to Ind. Automation .....	2
Category B .....	3
<b>Total</b> .....	<b>17</b>

**Junior Year**

<b>Fall Semester</b>	<b>Hours</b>
STAT 301 Applied Statistics .....	3
MATH 350 Adv. Engineering Math .....	3
ME 220 Eng. Thermodynamics I .....	3
ME 344 Mechanical Design .....	3
Category B Elective .....	3
ENG 200 Intro. To Literature .....	3
<b>Total</b> .....	<b>18</b>

**Spring Semester**

ME 300 Junior Design .....	2
ME 310 Eng. Instru. And Exper. ....	3
ME 321 Eng. Thermodynamics II .....	3
ME Tech. Elective I .....	3
ME 330 Fluid Mechanics .....	3
Economics .....	3
Total .....	17

**Senior Year**

**Fall Semester**

**Hours**

ME 325 Heat Transfer .....	3
ME 410/411 ME Vib/Controls & Lab .....	4
ME 400 Mechanical Eng Design .....	2
ME 420 Senior ME Lab I .....	3
ME Tech. Elective II .....	3
ENG 300 Junior English .....	3
Total .....	18

**Spring Semester**

ME 430 Senior ME Lab II .....	3
ME 412 ME Senior Project .....	3
ME Tech. Elective III .....	3
Category C Elective .....	3
Category E Elective .....	3
Total .....	15

**TOTAL HOURS ..... 139.5**

(1) The following UK courses are offered at WKU through the University of Kentucky: EM 221, EM 313, ME 220, ME 321, ME 344, and at least one Technical Elective (18-21 hours of UK courses).

(2) The following additional courses are based on UK syllabus, but taught by WKU: EM 302, ME 325, 330.

(3) Technical Electives: Two lists of ME Technical Electives are available, one for WKU courses and one for UK courses. Students must select one from each list, with the remaining ME Technical Elective selected from either list.

(4) Check the WKU undergraduate catalog for category B, C, E and F above.

Category B electives – Humanities

Category C electives – Social and Behavioral Sciences

Category E electives – World Cultures and American Cultural Diversity

Category F electives – Health and Wellness

**BACHELOR OF SCIENCE IN MINING ENGINEERING**

Mining engineering requires the broadest knowledge of sciences and other fields of engineering in its practice after graduation. The curriculum below prepares the student for a career in the field of mining.

The objectives of the undergraduate program in mining engineering take into consideration the intellectual and personal development of students so that after graduation they will be able to:

- Advance in their careers, adapting to new situations and emerging problems, through the application of general purpose engineering skills and the core technical disciplines, analytical procedures, and design practices of the mining engineering profession.
- Function ethically in a variety of professional roles such as mine planner, designer, production manager, mineral processing engineer, consultant, technical support representative and regulatory

specialist with emphasis on the mineral industries of Kentucky and the surrounding region.

- Pursue advanced degrees in mineral-related fields and also those fields that support the mineral industries such as business and law.
- Utilize professional skills such as effective communication, teamwork, and leadership.
- Demonstrate an understanding of the critical role mining engineers play in society with respect to health, safety, and the environment in tangible ways such as achieving professional licensure.

Visit our Web page at: [www.engr.uky.edu/mng](http://www.engr.uky.edu/mng).

**Degree Requirements**

Each student must complete the following:

**University Studies Requirements Hours**  
See “University Studies Program” on pages 75-79 for the complete University Studies requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill University Studies areas. Students should work closely with their advisor to complete the University Studies Program requirements.

Courses marked with an asterisk (\*) may also be used to satisfy University Studies requirements.

**Math**

MA 113 Calculus I .....	4
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**Inference – Logic**

MA 113 Calculus I .....	4
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**Written Communication**

ENG 104 Writing: An Accelerated Foundational Course .....	4
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**Oral Communication**

COM 199 Presentational Communication Skills .....	1
<b>plus</b> MNG 371 and MNG 592	

**Natural Sciences**

CHE 105 General College Chemistry I .....	3
CHE 107 General College Chemistry II .....	3

**Social Sciences**

ECO 201 Principles of Economics I .....	3
<b>plus</b> one other course from USP listing .....	3

**Humanities**

Two courses from USP listing .....	6
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**Cross-Cultural**

Select from list .....	3
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**USPElectives**

Technical Elective .....	3
Supportive Elective .....	3

**Premajor Requirements Hours**

*ENG 104 Writing: An Accelerated Foundational Course .....	4
*MA 113 Calculus I .....	4
MA 114 Calculus II .....	4
MA 213 Calculus III .....	4
MA 214 Calculus IV .....	3
*CHE 105 General College Chemistry I .....	3
*CHE 107 General College Chemistry II .....	3
PHY 231 General University Physics .....	4
PHY 232 General University Physics .....	4
PHY 241 General University Physics Laboratory ....	1
PHY 242 General University Physics Laboratory ....	1
<b>Subtotal: Premajor Hours .....</b>	<b>35</b>

**Graduation Writing RequirementHours**

Select course from list of Graduation Writing Requirement courses .....	3
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**Major Requirements Hours**

CS 221 First Course in Computer Science for Engineers .....	2
*ECO 201 Principles of Economics I .....	3
EE 305 Electrical Circuits and Electronics .....	3
EM 221 Statics .....	3
EM 313 Dynamics .....	3
EM 302 Mechanics of Deformable Solids .....	3
GLY 220 Principles of Physical Geology .....	4
GLY 230 Fundamentals of Geology I .....	3
ME 220 Engineering Thermodynamics I .....	3
ME 330 Fluid Mechanics .....	3
MNG 101 Introduction to Mining Engineering .....	1
MNG 211 Mine Surveying .....	2
MNG 264 Mining Methods .....	3
MNG 291 Mineral Reserve Modeling .....	2
MNG 301 Minerals Processing .....	3
MNG 302 Minerals Processing Laboratory .....	1
MNG 303 Deformable Solids Laboratory .....	1
MNG 331 Explosives and Blasting .....	2
MNG 332 Mine Plant Machinery .....	3
MNG 335 Introduction to Mine Systems Analysis ....	3
MNG 341 Mine Ventilation .....	3
MNG 371 Professional Development of Mining Engineers .....	3
MNG 431 Mines Systems Engineering and Valuation .....	4
MNG 463 Surface Mine Design and Environmental Issues .....	3
MNG 551 Rock Mechanics .....	4
MNG 591 Mine Design Project I .....	1
MNG 592 Mine Design Project II .....	3
<b>Subtotal: Major Hours .....</b>	<b>72</b>

**Electives Hours**

Mineral Processing Technical Elective .....	3
Supportive Elective .....	3
*Technical Electives .....	6

**Subtotal: Electives ..... 12**

**TOTAL HOURS: ..... 132**

**Curriculum**

**Freshman Year**

**First Semester Hours**

CHE 105 General College Chemistry I .....	3
CS 221 First Course in Computer Science for Engineers .....	2
ENG 104 Writing: An Accelerated Foundational Course .....	4
MA 113 Calculus I .....	4
MNG 101 Introduction to Mining Engineering .....	1
University Studies* .....	3

**Second Semester**

CHE 107 General College Chemistry II .....	3
MA 114 Calculus II .....	4
MNG 264 Mining Methods .....	3
PHY 231 General University Physics .....	4
PHY 241 General University Physics Laboratory ....	1

**Sophomore Year**

**First Semester Hours**

EM 221 Statics .....	3
GLY 220 Principles of Physical Geology .....	4
MA 213 Calculus III .....	4
MNG 331 Explosives and Blasting .....	2
PHY 232 General University Physics .....	4
PHY 242 General University Physics Laboratory ....	1

**Second Semester**

EM 302 Mechanics of Deformable Solids .....	3
MA 214 Calculus IV .....	3
ME 220 Engineering Thermodynamics I .....	3

MNG 211 Mine Surveying .....	2
MNG 291 Mineral Reserve Modeling .....	2
MNG 303 Deformable Solids Laboratory .....	1
MNG 332 Mine Plant Machinery .....	3

**Junior Year**

<b>First Semester</b>	<b>Hours</b>
COM 199 Presentational Communication Skills .....	1
EE 305 Electrical Circuits and Electronics .....	3
GLY 230 Fundamentals of Geology I .....	3
ME 330 Fluid Mechanics .....	3
MNG 301 Minerals Processing .....	3
MNG 302 Minerals Processing Laboratory .....	1
MNG 371 Professional Development of Mining Engineers .....	3

**Second Semester**

ECO 201 Principles of Economics I .....	3
EM 313 Dynamics .....	3
MNG 335 Introduction to Mine Systems Analysis .....	3
MNG 463 Surface Mine Design and Environmental Issues .....	3
Minerals Processing Technical Elective*** .....	3
University Studies/ Graduation Writing Requirement*† .....	3

**Senior Year**

<b>First Semester</b>	<b>Hours</b>
MNG 341 Mine Ventilation .....	3
MNG 431 Mines Systems Engineering and Valuation .....	4
MNG 551 Rock Mechanics .....	4
MNG 591 Mine Design Project I .....	1
University Studies* .....	3

**Second Semester**

MNG 592 Mine Design Project II .....	3
Supportive Elective** .....	3
Technical Electives†† .....	6
University Studies* .....	3

\*To be selected from University Studies areas in Social Sciences (6 credits), Humanities (6 credits), and Cross-Cultural (3 credits) in consultation with the academic advisor. Of these totals, 3 credits of Social Sciences are fulfilled by ECO 201. A minimum of 15 credits in the humanities and social sciences are required.

\*\*The supportive elective is to be chosen from any University course outside the student's major excluding more elementary versions of required courses such as precalculus mathematics.

\*\*\*The Mineral Processing Technical Elective is to be chosen between MNG 575, Coal Preparation Design, and MNG 580, Mineral Processing Plant Design.

†The course selected to fulfill the Graduation Writing Requirement can also be used to satisfy the Cross-Cultural requirement or 3 credits of the Humanities requirement. Selection of ENG 264 will satisfy the Graduation Writing Requirement and the Cross-Cultural requirement. Alternatively, selection of one course from among ENG 230, ENG 231, ENG 232, ENG 233, ENG 234, ENG 261, ENG 262, ENG 270, or ENG 271 will satisfy the Graduation Writing requirement and 3 credits of the Humanities requirement. Please consult the *Schedule of Classes* for updates to the list of courses.

††Courses recommended as technical electives are listed below. These courses must be chosen with the approval of the student's advisor to ensure that the curriculum includes sufficient engineering design content.

**Technical Electives:** Of the two technical electives in the undergraduate program, students are required to select at least one from departmental courses. The remaining course, chosen with the approval of the student's advisor, can be used to fulfill specific educational goals.

- MNG 511 Mine Power System Design
- MNG 561 Mine Construction Engineering I
- MNG 563 Simulation of Industrial Production Systems
- MNG 572 Advanced Coal Preparation
- MNG 575 Coal Preparation Design
- MNG 580 Mineral Processing Plant Design
- MNG 581 Geostatistics
- MNG 599 Topic in Mining Engineering
- BAE 438G Fundamentals of Groundwater Hydrology
- CE 441 Fluid Mechanics II
- CE 471G Soil Mechanics
- GLY 450G Sedimentary Geology
- GLY 585 Hydrogeology
- PLS 501 Reclamation of Disturbed Land