The College of Engineering offers programs leading to undergraduate and graduate degrees in computer science and the following engineering disciplines – biomedical, biosystems, chemical, civil, computer, electrical, materials, mechanical, and mining. 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 College of Engineering produces over 600 graduates per year. 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 a meaningful part of the educational process. The faculty, in addition to their duties related to instruction and research, serve as mentors to the student in the preparation of the academic program best matched to the student’s needs and intellectual capabilities. Students are also assigned a professional advisor who works with them on course selection and progress to degree.

Accreditation and Program Assessment

The undergraduate program in Computer Science is accredited by the Computing Accreditation Commission of ABET, www.abet.org.

The undergraduate programs in Biosystems Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Materials Engineering, Mechanical Engineering and Mining Engineering are accredited by the Engineering Accreditation Commission of ABET, www.abet.org. Biomedical Engineering will apply for accreditation through the Engineering Accreditation Commission of ABET following the first graduating class. If awarded, the accreditation will be retroactive.

In addition, the University of Kentucky is accredited by the Southern Association of Colleges and Schools (SACS), and therefore all degree programs and certificates including those in the College of Engineering are governed by the rules associated with that accrediting body. All programs are assessed periodically based on achievement of their self-proclaimed student learning outcomes and the results are used in the improvement of those programs and certificates.

Undergraduate Certificates in Engineering

The University of Kentucky grants the following undergraduate certificates in the College of Engineering:

• Aerospace Engineering
• Biopharmaceutical Engineering
• Cybersecurity
• Environmental Engineering
• Power and Energy
• Production Engineering

Information and requirements for the undergraduate certificates are listed after the Bachelor of Science in Mining Engineering.

Student certification in Lean Systems is also available.

Undergraduate Programs in Engineering

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

• Bachelor of Science in Biomedical Engineering
• Bachelor of Science in Chemical Engineering
• Bachelor of Science in Civil Engineering
• Bachelor of Science in Computer Engineering
• Bachelor of Science in Electrical Engineering
• Bachelor of Science in Mechanical Engineering
• Bachelor of Science in Mining Engineering
• Bachelor of Science in Materials 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. 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.

In addition, students have the option to pursue minors in biomedical engineering and in computer science.

Students in a number of our engineering programs have the option to complete pre-medical requirements while pursuing the engineering degree. Interested students should contact their academic advisor.

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 MBA will be taken during a student’s fifth year of study beginning in the summer and finishing the following spring semester. In addition, students in the program will be required to complete an international study on Global Business 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. Admission is highly competitive and is limited based upon the financial resources available.
For engineering students interested in manufacturing, the University offers a dual-degree program. This program allows students pursuing a B.S. in Electrical Engineering or Mechanical Engineering to concurrently enroll in the M.S. in Manufacturing Systems Engineering. The BSEE/MSMSE or BSME/MSMSE dual-degree programs can be completed in five years. Students in the program are strongly encouraged to be Co-op students or to do industry internships to supplement their course work with industry experience. During their junior year, students should apply to the Graduate School for admittance into the dual-degree program.

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

**ADMISSION POLICY**

To be accepted to the College of Engineering, high school students must have both:

- An ACT math score of 25 or higher, or the SAT equivalent of 590 or higher.
- An unweighted high school GPA of 3.0 or higher.

For students who meet the high school GPA requirement but not the ACT or SAT requirement, alternative admission routes include:

1. A score of 3 or above on the Calculus AB portion of the Advanced Placement Exam, or
2. A score of 61 percent on the proctored ALEKS Placement Exam.

Students who are not initially admitted into the College of Engineering may apply at a later date as a transfer student.

To be accepted to the College of Engineering, transfer students must have a minimum cumulative college GPA of 2.5 and have completed MA 110 or its equivalent (or MA 109 and 112 or their equivalencies) with a grade of B or higher. Students who do not receive a B in these courses but who have completed calculus courses required in the Engineering curricula will be considered on a case-by-case basis.

Additionally, students must meet the minimum Kentucky statewide academic readiness requirements for Reading and Writing to be admitted to the College of Engineering:

- **Reading**: Students must have an ACT Reading subscore of 20 or above, or SAT subscore of 26 or above in Critical Reading.
- **English/Writing**: Students must have an ACT English subscore of 18 or above, or SAT of 25 or above in Writing.

Students who do not meet the reading/writing requirements will be required to take the ACCUPLACER exam and receive a score of 244 or better. Students who do not meet the minimum score on the ACCUPLACER will be required to take APP courses (UK 120 for Reading and UK 130 for Writing) and can be considered for admission to the College of Engineering after successful completion of these courses.

**International Students Freshmen:**

In addition to meeting the requirements listed above, international freshman applicants must also obtain a Test of English as a Foreign Language (TOEFL) score of 71 or above or an International English Language Testing System (IELTS) score of 6.0 or above. Students who received a TOEFL score of 71 but less than 100 (IELTS score of 6.0 but less than 7.5) will be admitted to the College of Engineering but will be required to participate in English for Academic Purposes (EAP).

If students do not meet the IELTS/TOEFL (6.0 or 71) or ACT/SAT requirements, they will be admitted to the College of Engineering after meeting the following criteria: attend ESL, meet EAP requirements, and complete the appropriate math class. They must retake the TOEFL and earn a minimum score of 71 or the IELTS and earn a minimum score of 6.0. Then they would apply for a change of major to Engineering.

**Transfer:**

In addition to the requirements listed above, international transfer applicants must obtain a Test of English as a Foreign Language (TOEFL) score of 71 or above (527 paper-based); an International English Language Testing System (IELTS) score of 6.0 or above; or completion of the first and second English composition classes (e.g., ENG 101 and 102) from another US college, i.e., institution upon review. If students do not meet these requirements once they have completed UK’s ESL program, they must retake the TOEFL and earn a minimum score of 71 or the IELTS and earn a minimum score of 6.0.

**First-Year Engineering Program**

All newly admitted students will participate in the First-Year Engineering Program for their first two semesters. During this first year, they will have the opportunity to participate in hands-on engineering activities, explore all the engineering and computer science disciplines and learn about the Engineering Grand Challenges. Based on this experience, students will have the option to change their major or declare their major based on their interests.

Upon declaring their major, students will be designated as pre-major until they meet engineering standing requirements. Every student must be admitted to engineering standing in a specific program prior to taking engineering upper level courses that require engineering standing as a prerequisite.

**Engineering Standing Admission**

Admission to engineering standing in a degree program is necessary in order to continue in upper level courses and to be granted a baccalaureate degree in engineering or computer science. Specific departmental requirements for admission to engineering standing are noted below and engineering standing applies to a specific program. Hence, receiving engineering standing in one program does not grant engineering standing in another. Students can request admission to engineering standing after completing the required set of pre-major courses in the first three semesters of the published curriculum in their chosen program. In addition to the requirements described below, each program may specify specific procedures for applying for engineering standing, submitting appeals, etc. Students should refer to the departmental handbook or their undergraduate advisor in their program of choice to identify these specific procedures.

**For Transfer Students**: The same criteria are applied to transfer students with the equivalence of courses reviewed by the Director of Undergraduate Studies. It is important to note if a student receives acceptance of transfer credit for one or more of the below listed courses, the grades earned will be used in the calculation for engineering standing. Transfer students who have not completed all courses listed below may be considered for admission into courses that require engineering standing on a case-by-case basis.

**Biomedical Engineering**: A cumulative UK GPA of at least 2.5 and successful completion of the following courses with at least a 2.5 GPA: BIO 148, BIO 152, BME 201, CHE 105, CIS/WRD 110, CIS/WRD 111, EGR 101, EGR 102, EGR 103, MA 113, MA 114, MA 213, PHY 231, PHY 241, PHY 232 and PHY 242. If the course is repeated, the best grade will be used for calculation of GPA in the above listed courses.

**Biomedical Engineering**: A cumulative UK GPA of at least 2.5 and successful completion of the following courses with at least a 2.5 GPA: CHE 105, CIS/WRD 110, MA 113, MA 114, MA 213, and PHY 231. Completion of BAE 200 with a grade of C or better. If a course is repeated, the best grade will be used for calculation of GPA in the above listed courses.

**Chemical Engineering**: A cumulative UK GPA of at least 2.5 and successful completion of the following courses with at least a 2.5 GPA: CHE 105, CHE 107, CHE 111, CHE 113, CIS/WRD 110, MA 113, MA 114, MA 213, and PHY 231. Completion of CME 200 with a grade of C or better. If a course is repeat-
ed, the best grade will be used for calculation of GPA in the above listed courses.

Civil Engineering: A cumulative UK GPA of at least 2.5 and successful completion of all pre-major courses. Successful completion of the following courses with at least a 2.5 GPA: CE 106, CE 211, CHE 105, CHE 107, CIS/WRD 110, EGR 103, EM 221, MA 113, MA 114, MA 213, PHY 231, and PHY 241. If a course is repeated, the best grade will be used for calculation of GPA in the above listed courses.

Computer Engineering: A cumulative UK GPA of at least 2.5 and successful completion of all pre-major courses. Successful completion of the following courses with at least a 2.5 GPA: CHE 105, CIS/WRD 110, CS 215, CS 216, EE/CPE 282, and PHY 231. If a course is repeated, the best grade will be used for calculation of GPA in the above listed courses.

Computer Science: A cumulative UK GPA of at least 2.5 and successful completion of all pre-major courses. Successful completion of the following courses with at least a 2.5 GPA: CS 215, CS 216, CS 275, and MA 114. If a course is repeated, the best grade will be used for calculation of GPA in the above listed courses.

Electrical Engineering: A cumulative UK GPA of at least 2.5 and successful completion of all pre-major courses. Successful completion of the following courses with at least a 2.5 GPA: CIS/WRD 110, CHE 105, CS 215, EE 211, EE/CPE 282, and PHY 231. If a course is repeated, the best grade will be used for calculation of GPA in the above listed courses.

Materials Engineering: A cumulative UK GPA of at least 2.5 and successful completion of all pre-major courses. Successful completion of the following courses with at least a 2.5 GPA: CHE 105, CHE 107, CHE 111, CHE 113, CIS/WRD 110, MA 113, MA 114, MA 213, PHY 231, and PHY 241. Completion of MSE 201 with a grade of C or better. If a course is repeated, the best grade will be used for calculation of GPA in the above listed courses.

Mechanical Engineering: A cumulative UK GPA of at least 2.5 and successful completion of all pre-major courses. Successful completion of the following courses with at least a 2.5 GPA: CHE 105, CIS/WRD 111, EGR 101, EGR 102, EGR 103 (or EGR 215 in lieu of EGR 101 and EGR 103), EM 221, MA 113, MA 114, MA 213, PHY 231, PHY 241, PHY 232, and PHY 242 and a C or better in each course. If a course is repeated, the best grade will be used for calculation of GPA in the above listed courses.

Mining Engineering: A cumulative UK GPA of at least 2.5 and successful completion of all pre-major courses. Successful completion of the following courses with at least a 2.5 GPA: CIS/WRD 110, CHE 105, MA 113, MA 114, MA 213, and PHY 231. If a course is repeated, the best grade will be used for calculation of GPA in the above listed courses.

NOTE: According to Senate Rule 4.3.3, the chair of a department may refuse to allow a student to register in a course a third time. A withdrawal from the course shall not be counted as a registration for these purposes if a student can demonstrate that the withdrawal was for urgent non-academic reasons.

COMBINED DEGREE PROGRAM

The College of Engineering has transfer agreements with several institutions throughout the state. These programs enable students to enroll in a pre-engineering curriculum at their respective schools and then transfer to the College of Engineering. Upon completion, they can 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 co-op program provides students the opportunity to gain practical work experience before graduation. By alternating semesters of academic study with semesters of paid, full-time career-related employment, participants can gain a full year of engineering work experience. Students who wish to participate in the Cooperative Education program in the College of Engineering should contact the Engineering Career Development Office or its co-op director.

To be eligible for this program, students should have a minimum grade-point average of 2.50. In addition, students should be making sufficient progress in their curriculum prior to the first work tour, which typically begins at the end of the sophomore year. 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 co-op director, is based on a self evaluation, a work report written by the student, and an evaluation completed by the immediate supervisor. In some states, co-op experience counts towards the practical experience requirement to sit for the Principles and Practice of Engineering (PE) exam.

The Cooperative Education program contributes significantly to the student’s academic motivation, career preparation, and success with job offers upon graduation. About a quarter of our graduates obtain co-op experience before graduation, and about 100 employers nationwide participate in the UK Engineering Co-op 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 Institute of Research for Technology Development 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- and need-based scholarships to incoming freshmen and transfer students as well as continuing students.

For further information, visit https://www.engr.uky.edu/students/undergraduate/scholarships-and-financial-aid

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 (not including duplicate credit or pass/fail grades);
The curriculum provides students with a unique set of qualitative and quantitative healthcare problem definition, analysis, and solution skills. This program uses the shared freshman-engineering curriculum, and offers students the flexibility to select among a variety of foundational engineering courses beginning in the third semester and a variety of upper-level BME courses in the senior year. A novel 2-semester interdisciplinary Capstone Senior Design project focused on creative engineering solution of an actual healthcare issue posed by collaborating industrial and/or healthcare partners completes the curriculum. BME and Product Design courses jointly created by BME and College of Design faculty, are integral to semesters 4 to 8 of the proposed program and are intended to instill “design-thinking” in students.

The curriculum is distinct from other BS BME programs due to these integral design-thinking courses and experiences within the proposed curriculum. These design-thinking experiences balance left-brain oriented technical materials with right-brain creative approaches to cultivate crucial abilities needed to: 1) communicate empathetically with all stakeholders in a design cycle; 2) frame healthcare challenges into engineering problems; and 3) design, prototype, build, test, refine, and implement solutions that solve contemporary healthcare challenges problems and meet all user needs.

Degree Requirements

Each student must complete the following:

**UK Core Requirements**

See the UK Core section of this Bulletin for the complete UK Core requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

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### 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 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.

### Additional Bachelor’s Degrees

A student is eligible to qualify for additional Bachelor’s degrees in different majors. The student must complete all university, college, and departmental requirements for all degrees. Courses taken towards fulfilling one degree may also count towards fulfilling parallel requirements in another degree, but the student must complete at least 24 additional hours for each degree. The student may elect to receive the degrees simultaneously if college and departmental requirements can be met simultaneously.

### ACADEMIC ADVISING

Professional staff provide academic advising and support services to entering freshman students through the James and Gay Hardymon Center for Student Success. Sophomores, juniors and seniors are advised by professional advisors and faculty mentors in the department of the student's major.

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 BIOMEDICAL ENGINEERING

Biomedical engineering (BME) is a multidisciplinary field that applies engineering principles and design methods to improve the interaction and integration of engineering with medicine and biological sciences for improving human health and solving healthcare challenges.

The 4-year Bachelor of Science (BS) in BME undergraduate program is designed for students who aspire to engineer novel treatments, devices, materials, technologies, or processes to improve human healthcare. Students seeking careers in industry, the healthcare professions, government agencies, or graduate studies in BME are candidates for this program.

### MINIMUM REQUIREMENTS FOR GRADUATION

In addition to the University graduation requirements listed in the Graduation Requirements section of this Bulletin, to be awarded a Bachelor of Science degree in any field of engineering or Computer Science, a student must:

1. complete the University and College requirements relating to writing and the UK Core.

2. complete the required number of 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.

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.

### UK Core Requirements

See the UK Core section of this Bulletin for the complete UK Core requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

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College of Engineering

IX. Community, Culture and Citizenship in the USA
Choose one course from approved list..........................3

X. Global Dynamics
Choose one course from approved list..........................3

UK Core hours ..................................................33

Graduation Composition and Communication Requirement (GCCR)
BME 421 Senior Design Project in Biomechanical Engineering II ..................3

Graduation Composition and Communication Requirement hours (GCCR) ....3

Premajor Requirements Hours
BIO 148 Introductory Biology I ..................................3
BME 201 Introduction to Biomedical Engineering ..............3
CHE 105 General College Chemistry I .............................4
CIS/WRD 110 Composition and Communication I .................3
CIS/WRD 111 Composition and Communication II .................3
EGR 101 Engineering Exploration I ..................................1
EGR 102 Fundamentals of Engineering Computing ...............2
EGR 103 Engineering Exploration II ..................................2
MA 113 Calculus I ..................................................4
MA 114 Calculus II ..................................................4
MA 213 Calculus III ..................................................4
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 ........................................43

Major Requirements Hours
BIO 152 Principles of Biology II ...................................3
PRD/BME 170 Human Anatomy for Design ......................3
PRD/EGR 250 Computer Aided Design: Solidworks ..........2
PRD 271 Introduction to Ergonomics ..................................2
PRD 272 Introduction to UX for Product Design ..................2
BME 302 Design Strategies for Biomedical Engineering ............3
BME 330 Experimental Methods in Biomedical Engineering ......3
PRD/BME 350 Materials and Processes ............................3
PRD/BME 371 Ergonomics ..........................................1
PRD/BME 372 UX + UI for Product Design .......................1
BME 420 Senior Design Project in Biomechanical Engineering I ....3
BME 421 Senior Design Project in Biomechanical Engineering II ....3
BME 435 Computer Modeling of Complex Systems ............4
PRD/BME 451 Integrated Entrepreneurship in Product Design ....2
CHE 107 General College Chemistry II ............................3
MA 214 Calculus IV ...............................................3
PRD/BME 412G Principles of Human Physiology ..................4
STA 381 Engineering Statistics – A Conceptual Approach ..........3
Subtotal: Major hours ...........................................48

Guided Engineering Electives
Choose 9 credit hours from the following:
CME 200 Process Principles ..........................................3
CME 320 Engineering Thermodynamics ............................3
EE 211 Circuits I .....................................................4
EE 305 Electronic Circuits and Electronics ..........................4
EM 221 Statics .......................................................3
EM 302 Mechanics of Deformable Bodies ..........................3
EM 313 Dynamics ....................................................3
ME 340 Introduction to Mechanical Systems ......................3

Basic BME Electives
Choose 12 credit hours from the following:
BME 405 Introduction to Biomedical Signal Processing ..............3
BME 470 Bionanotechnology ........................................3
BME 472 Human Biomechanics ......................................3
BME 481G Topics in Biomedical Engineering (may not be repeated) ....3
BME 485 Fundamentals of Biomechanics ............................3
BME 488 Introduction to Biomaterials ..................................3

Advanced BME Electives
Choose 6 credit hours from the following:
BME 508 Cell Mechanics and Mechanobiology ......................3
BME 515 Modeling of Physiological Systems .......................3
BME 530 Biomedical Instrumentation ................................3
BME 540 Mechanical Modeling of Human Motion .................3
BME 395 Independent Research in Biomedical Engineering (may not be repeated) ..........3
Subtotal: Electives: ..................................................27

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

Curriculum

Freshman Year

First Semester Hours
MA 113 Calculus I ..................................................4
PHY 231 General University Physics ..................................4
PHY 232 General University Physics Laboratory .................1
BIO 152 Principles of Biology II ....................................3
BME 201 Introduction to Biomedical Engineering ..........3
Guided Engineering Elective I ........................................3

Second Semester
MA 114 Calculus II ..................................................4
CHE 105 General College Chemistry I .............................4
CIS/WRD 110 Composition and Communication I .................3
CIS/WRD 111 Composition and Communication II .................3
EGR 101 Engineering Exploration I .................................1
EGR 102 Fundamentals of Engineering Computing ...............2
BIO 148 Introductory Biology I ......................................3

Sophomore Year

First Semester Hours
MA 213 Calculus III ..................................................4
PHY 232 General University Physics ..................................4
PHY 242 General University Physics Laboratory .................1
BIO 152 Principles of Biology II ....................................3
BME 201 Introduction to Biomedical Engineering ..........3
Guided Engineering Elective I ........................................3

Second Semester
MA 214 Calculus IV ..................................................4
CHE 107 General College Chemistry II ............................3
PRD/BME 170 Human Anatomy for Design .................3
PRD 272 Introduction to UX for Product Design ..........3
Guided Engineering Elective II ........................................3
UK Core – Humanities ..............................................3

Junior Year

First Semester Hours
BME 302 Design Strategies for Biomedical Engineering ............3
BME 435 Computer Modeling of Complex Systems ............3
PRD/EGR 250 Computer Aided Design: Solidworks ............2
PRD/BME 371 Ergonomics ..........................................1
Guided Engineering Elective III .......................................3
UK Core – Social Sciences ..........................................3

Second Semester
STA 381 Engineering Statistics – A Conceptual Approach ...........3
BME 330 Experimental Methods in Biomedical Engineering ....3
PRD/BME 350 Materials and Processes ............................3
PRD/BME 372 UX + UI for Product Design .......................1
BME Basic Elective I ................................................3
UK Core – Citizenship - USA ......................................3

Senior Year

First Semester Hours
BME 420 Senior Design Project in Biomedical Engineering I ........3
PRD/BME 451 Integrated Entrepreneurship in Product Design ........2
PGY 412G Principles of Human Physiology .......................4
BME Basic Elective II ................................................3
BME Advanced Elective I .............................................3

Second Semester
*BME 421 Senior Design Project in Biomedical Engineering II ................3
BME Basic Elective III .................................................3
BME Basic Elective IV ................................................3
BME Advanced Elective II ............................................3
UK Core – Global Dynamics .........................................3

∗Students must complete both EGR 101 and EGR 103 to fulfill the UK Core Arts and Creativity requirement. Transfer students must satisfy the UK Core Arts and Creativity requirement by taking EGR 215.

∗Graduation Composition and Communication Requirement (GCCR) course.

Minor in Biomedical Engineering

This minor is intended for undergraduate engineering students seeking to supplement their education by applying skills learned in their respective disciplines to the field of biomedical engineering (BME). The emphasis on upper level BME courses builds upon the foundation taught in core undergraduate engineering courses. Beyond the one required course, students pursuing this minor will choose at least five elective courses in consultation with a Biomedical Engineering faculty advisor. Students and their Biomedical Engineering faculty advisor may select courses providing concentration in a particular subfield, or they may select courses providing breadth across the field of biomedical engineering.

The minor in Biomedical Engineering requires: a) at least 18 credit hours of course work; b) a GPA of 2.5 or greater in these courses; and c) no grade lower than C in any BME course. At the discretion of the BME department chair (or designee), a limited number (maximum 6 credit hours) of equivalent course substitutions may be used. At least 12 credit hours must have the BME prefix.

Required Course
BME 301 Fundamentals of Biomedical Engineering .............3
College of Engineering

Elective Courses
*Select five from among the following:
BME 395 Independent Research in Biomedical Engineering ......................... 1-6
BME 405 Introduction to Biomedical Signal Processing .................................. 3
BME 472 Human Biomechanics ................................................................. 3
BME 485 Fundamentals of Biofluid Mechanics ......................................... 3
BME 488 Introduction to Biomaterials ......................................................... 3
BME 508 Cell Mechanics and Mechanobiology ........................................... 3
BME 515 Modeling of Physiological Systems .............................................. 3
BME 530 Biomedical Instrumentation ....................................................... 3
BME 540 Mechanical Modeling of Human Motion ..................................... 3
BME 579 Neural Engineering: Merging Engineering with Neuroscience ...... 3
BME 580 Introduction to Biomedical Imaging ............................................ 3
BME 481G Topics in Biomedical Engineering (Subtitle required) ......... 3

*Up to 6 credit hours of independent research (e.g., BME 395) or special topics courses (e.g., BME 481G or BME 599) may count as electives.

BACHELOR OF SCIENCE IN BIOSYSTEMS ENGINEERING

Biosystems engineering provides an essential link between the biological sciences and the engineering profession. This linkage is essential 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 bioenvironmental engineering, food and bioprocessing, machine systems, or controlled environment engineering. The curriculum is also ideal preparation for those students wanting to pursue a graduate or professional degree in medicine, biomedical engineering or veterinary medicine through pre-medicine, pre-biomedical engineering 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 engineers may work in the areas of biomedical/biotechnology engineering; environmental engineering; agricultural equipment; heating, ventilation and refrigeration equipment; food processing industries; livestock equipment and housing or greenhouse structures; and bioenergy.

The program educational objectives of the biosystems engineering program are based on the intellectual and professional development of our students. Graduates of the biosystems engineering program are expected within a few years of graduation to have:

- Established themselves as practicing professionals or engaged in advanced study in agricultural, biological, or environmental engineering or related area.
- Demonstrated their ability to work successfully as a responsible professional and function effectively on a professional team.

Degree Requirements
Each student must complete the following:

UK Core Requirements
See the UK Core section of this Bulletin for the complete UK core requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

I. Intellectual Inquiry in the Humanities
EGR 101 Engineering Exploration I § ▼ ............................................. 1
EGR 103 Engineering Exploration II § ▼ .......................................... 2

II. Intellectual Inquiry in the Humanities
Choose one course from approved list ............................................. 3

III. Intellectual Inquiry in the Social Sciences
Choose one course from approved list ............................................. 3

IV. Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences
PHY 231 General University Physics ............................................. 4
PHY 241 General University Physics Laboratory ................................ 1

V. Composition and Communication I
CIS/WRD 110 Composition and Communication I ........................... 3

VI. Composition and Communication II
CIS/WRD 111 Composition and Communication II ......................... 3

VII. Quantitative Foundations
MA 113 Calculus I ................................................................. 4

VIII. Statistical Inferential Reasoning
BME 202 Statistical Inferences for Biosystems Engineering ............. 3

IX. Community, Culture, and Citizenship in the USA
Choose one course from approved list ............................................. 3

X. Global Dynamics
Choose one course from approved list ............................................. 3

UK Core hours ................................................................. 33

Graduation Composition and Communication Requirement (GCCR)
WRD 204 Technical Writing ............................................................. 3
Graduation Composition and Communication requirement hours (GCCR) ... 3

Premaj or Requirements
BME 200 Principles of Biosystems Engineering .................................... 3
BIO 148 Introductory Biology I ......................................................... 3
CE 106 Computer Graphics and Communication ................................ 3
CIS/WRD 110 Composition and Communication I .................................. 3
CIS/WRD 111 Composition and Communication II .................................. 3
CHE 105 General College Chemistry I .............................................. 4
CHE 107 General College Chemistry II ................................................ 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
EGR 101 Engineering Exploration I § ▼ ............................................. 1
EGR 102 Fundamentals of Engineering Computing ................................ 2
EGR 103 Engineering Exploration II § ▼ .......................................... 2

Subtotal: Premajor hours ................................................................. 44

Major Requirements
BME 202 Statistical Inferences for Biosystems Engineering .................. 3
BME 301 Economic Analysis for Biosystems ...................................... 2
BME 305 DC Circuits and Microelectronics ....................................... 3
BME 310 Heat and Mass Transfer in Biosystems Engineering ............. 3
BME 400 Senior Seminar ............................................................... 1
BME 402 Biosystems Engineering Design I ....................................... 2
BME 403 Biosystems Engineering Design II ...................................... 2
BIO 152 Principles of Biology II ......................................................... 3
EE 305 Electrical Circuits and Electronics ......................................... 3
EM 221 Statics ............................................................................. 3
EM 302 Mechanics of Deformable Solids ......................................... 3
EM 313 Dynamics ......................................................................... 3
MA 214 Calculus IV ................................................................. 4
ME 220 Engineering Thermodynamics ............................................... 3
*ME 330 Fluid Mechanics ............................................................... 3
BME 502 Modeling of Biological Systems .......................................... 3
PHY 232 General University Physics ............................................. 4
PHY 242 General University Physics Laboratory ................................ 1

Subtotal: Major hours ................................................................. 48

*CE 341 Introduction to Fluid Mechanics can be used to fulfill the requirement for ME 330.

Electives
BME 488 Introduction to Biomaterials ............................................. 3
BME 472 Human Biomechanics ......................................................... 3
BME 485 Fundamentals of Biofluid Mechanics ..................................... 3

Core Electives (choose 3 of the following 4 courses)
BME 417 Design of Machine Systems .............................................. 3
BME 427 Structures and Environment Engineering ......................... 3
BME 437 Land and Water Resources Engineering ............................. 3
BME 447 Bioprocess Engineering Fundamentals ............................... 3

Technical Electives (chosen by the student and leading to a concentration in one area of study) ................................................................. 9

Subtotal: Electives ................................................................. 21

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

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

Freshman Year
First Semester
EGR 101 Engineering Exploration I § ▼ ............................................. 1
EGR 102 Fundamentals of Engineering Computing ................................ 2
CHE 105 General College Chemistry I .............................................. 4
CIS/WRD 110 Composition and Communication I .................................. 3
MA 113 Calculus I ................................................................. 4

Second Semester
EGR 103 Engineering Exploration II § ▼ .......................................... 2
MA 114 Calculus II ................................................................. 4
CIS/WRD 111 Composition and Communication II ........................... 3
PHY 231 General University Physics ............................................. 4
PHY 241 General University Physics Laboratory ................................ 1
UK Core .................................................................................. 3

Sophomore Year
First Semester
BME 200 Principles of Biosystems Engineering ............................... 3
BIO 148 Introductory Biology I ......................................................... 3
MA 213 Calculus III ................................................................. 4
PHY 231 General University Physics ............................................. 4
PHY 241 General University Physics Laboratory ................................ 1
CE 106 Computer Graphics and Communication ................................ 1

Second Semester
BME 202 Statistical Inferences for Biosystems Engineering ............. 3
MA 214 Calculus IV ................................................................. 3
ME 220 Engineering Thermodynamics I ............................................ 3
EM 221 Statics ............................................................................. 3
CHE 107 General College Chemistry II ........................................... 3

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Junior Year

First Semester

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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<tr>
<td>BAE 301</td>
<td>Economic Analysis for Biosystems</td>
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<tr>
<td>ME 330</td>
<td>Fluid Mechanics</td>
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<tr>
<td>EE 305</td>
<td>Electrical Circuits and Electronics</td>
<td>3</td>
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<tr>
<td>EM 313</td>
<td>Dynamics</td>
<td>3</td>
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<tr>
<td>BBO 152</td>
<td>Principles of Biology II</td>
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</tr>
<tr>
<td>WRD 204</td>
<td>Technical Writing***</td>
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Second Semester

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<tr>
<td>BAE 305 DC Circuits and Microelectronics</td>
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<tr>
<td>BAE 410</td>
<td>Heat and Mass Transfer in Biosystems Engineering</td>
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<tr>
<td>Biosystems Core Elective*</td>
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Senior Year

First Semester

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<tbody>
<tr>
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<td>Biosystems Engineering Design</td>
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<tr>
<td>BAE 400 Senior Seminar</td>
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<tr>
<td>Biosystems Core* or Technical Elective**</td>
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<td></td>
<td>3</td>
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<tr>
<td>Biological Science Elective</td>
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Second Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>BAE 403</td>
<td>Biosystems Engineering Design II</td>
<td>2</td>
</tr>
<tr>
<td>BAE 502</td>
<td>Modeling of Biological Systems</td>
<td>3</td>
</tr>
<tr>
<td>Biosystems Core* or Technical Elective**</td>
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<td>3</td>
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<tr>
<td>Biosystems Core* or Technical Elective**</td>
<td></td>
<td>3</td>
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<tr>
<td>UK Core</td>
<td></td>
<td>3</td>
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</tbody>
</table>

§ Transfer students will take EGR 215, Introduction to the Practice of Engineering for Transfer Students, in place of EGR 101 and EGR 103.

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 transformation of matter and energy are developed in subjects including thermodynamics, fluid flow, separations, heat and mass transfer, reactor design, and chemical process design. Undergraduate electives are available in bio- pharmaceutical engineering, energy and fuels, environmental engineering, and materials engineering and nanotechnology. A program is also available to fulfill pre-medical requirements simultaneously with requirements for the B.S. in chemical engineering.

The educational objectives of the chemical engineering program state that graduates will:

- Excel in their chosen career pathways, as practicing chemical engineers or through the pursuit of advanced technical or professional degrees.
- Impact their profession through effective leadership, communication, teamwork, and through creative solution strategies to address global and societal issues.
- Apply their engineering training to contribute to the health, safety, environmental and economic well-being of their communities.
- Seek out continuing education, professional development and career advancement opportunities.

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:

UK Core Requirements

See the UK Core section of this Bulletin for the complete UK Core requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

I. Intellectual Inquiry in Arts and Creativity

EGR 101 | Engineering Exploration I | 1

II. Intellectual Inquiry in the Humanities

Choose one course from approved list | 3

III. Intellectual Inquiry in the Social Sciences

Choose one course from approved list | 3

IV. Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences

CHE 105 | General College Chemistry I | 4
 qualifier
CHE 111 | General Chemistry I Laboratory | 1
 qualifier

V. Composition and Communication I

CIS/WRD 110 Composition and Communication I | 3
 qualifier

VI. Composition and Communication II

CIS/WRD 111 Composition and Communication II | 3
 qualifier

VII. Quantitative Foundations

MA 113 | Calculus I | 4
 qualifier

VIII. Statistical Inference Reasoning

STA 381 | Engineering Statistics – A Conceptual Approach | 3
 qualifier

IX. Community, Culture and Citizenship in the USA

Choose one course from approved list | 3

X. Global Dynamics

Choose one course from approved list | 3

UK Core hours | 33

Graduation Composition and Communication Requirement (GCCR)

WRD 204 | Technical Writing | 3
 qualifier

Graduation Composition and Communication Requirement hours (GCCR) | 3
 qualifier

Premajor Requirements

See the Premajor section of this Bulletin for the complete Premajor requirements. The courses listed below are (a) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the Premajor requirements.

CIS/WRD 110 | Composition and Communication I | 3
 qualifier

CIS/WRD 111 | Composition and Communication II | 3
 qualifier

CHE 105 | General College Chemistry I | 4
 qualifier

CHE 107 | General College Chemistry II | 3
 qualifier

CHE 111 | General Chemistry I Laboratory | 1
 qualifier

CHE 113 | General Chemistry II Laboratory | 2
 qualifier

CME 200 | Process Principles | 3
 qualifier

MA 113 | Calculus I | 4
 qualifier

MA 114 | Calculus II | 3
 qualifier

MA 213 | Calculus III | 4
 qualifier

PHY 231 | General University Physics | 4
 qualifier

EGR 101 | Engineering Exploration I | 1
 qualifier

EGR 102 | Fundamentals of Engineering Computing | 2
 qualifier

EGR 103 | Engineering Exploration II | 2
 qualifier

MSE 201 | Materials Science | 3
 qualifier

Subtotal: Premajor Requirements: 43
 qualifier

Major Requirements

See the Major section of this Bulletin for the complete Major requirements. The courses listed below are (a) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the Major requirements.

CHE 230 | Organic Chemistry I | 3
 qualifier

CHE 231 | Organic Chemistry Laboratory I | 1
 qualifier

CHE 232 | Organic Chemistry II | 3
 qualifier

CHE 446G | Physical Chemistry for Engineers | 3
 qualifier

MA 214 | Calculus IV | 3
 qualifier

PHY 232 | General University Physics | 4
 qualifier

CME 220 | Computational Tools in Chemical Engineering | 3
 qualifier

CME 320 | Thermodynamics | 3
 qualifier

CME 415 | Separation Processes | 3
 qualifier

CME 006 | The Engineering Profession | 3
 qualifier

CME 330 | Fluid Mechanics | 3
 qualifier

CME 470 | Professionalism, Ethics and Safety | 2
 qualifier

CME 420 | Process Modeling in Chemical Engineering | 3
 qualifier

CME 425 | Heat and Mass Transfer | 4
 qualifier

CME 432 | Chemical Engineering Laboratory I | 2
 qualifier

CME 433 | Chemical Engineering Laboratory II | 3
 qualifier

CME 455 | Chemical Engineering Process Design I | 3
 qualifier

CME 550 | Chemical Reactor Design | 3
 qualifier

CME 456 | Chemical Engineering Process Design II | 3
 qualifier

CME 457 | Chemical Engineering Process Design III | 3
 qualifier

CME 462 | Process Control | 3
 qualifier

STA 381 | Engineering Statistics – A Conceptual Approach | 3
 qualifier

Subtotal: Major hours: 58
 qualifier

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

Engineering/Science Electives

Totaling three or more credit hours for each course. Students must select four courses, as follows:

1. One chemical engineering elective: (CME 395*, 404G, 505, 515, 523, 542, 552, 554, 556, 570, 573, 580, 599)
College of Engineering

2. One science/math elective (totaling 3 or more credit hours*) that is not a more elementary version of a required course.
   b. Chemistry (CHE 226, 250, 510 and above)
   c. Biology (BIO 148 and above)
   d. Physics (PHY 241 and above)
   e. Other courses by approval of Director of Undergraduate Studies

3. One engineering elective (level 300 and above) that does not significantly duplicate content in a core chemical engineering course (e.g., ME 330) or a CME elective (CME 395 and above).

4. One chemical engineering elective (CME 395 and above) or one engineering elective (level 300 and above) or one science/math elective as described above.

*CME 395 (3 credits) can be used to satisfy only one elective requirement.

**Students may combine multiple qualifying courses that total 3 credits (e.g., pre-medical students may wish to combine PHY 243, 242 and CHE 315).

Subtotal: Engineering/Science Electives: ...12
TOTAL HOURS: 128

Curriculum

Freshman Year

First Semester
CIS/WRD 110 Composition and Communication I ...............3
MA 113 Calculus I .................................................4
EGR 101 Engineering Exploration I § ▼ ......................1
EGR 102 Fundamentals of Engineering Computing ...........2
CHE 105 General College Chemistry I ........................4
CME 111 General Chemistry I Laboratory ......................1

Second Semester
CIS/WRD 111 Composition and Communication II ...........3
MA 114 Calculus II ..................................................4
EGR 103 Engineering Exploration II § ▼ ......................2
PHY 231 General University Physics ............................4
UK Core – Social Sciences ........................................3

Sophomore Year

First Semester
CME 200 Process Principles .......................................3
MA 213 Calculus III ..................................................4
CHE 107 General College Chemistry II .........................3
CHE 113 General Chemistry II Laboratory .....................2
MSE 201 Materials Science .........................................3
UK Core – Humanities ..............................................3

Second Semester
CME 220 Computational Tools in Chemical Engineering ....3
CME 320 Engineering Thermodynamics .......................3
MA 214 Calculus IV ..................................................3
PHY 232 General University Physics ............................4
STA 381 Engineering Statistics –
   A Conceptual Approach .........................................3

Junior Year

First Semester
CME 330 Fluid Mechanics .........................................3
CME 415 Separation Processes ....................................3
CHE 230 Organic Chemistry I ....................................3
CHE 231 Organic Chemistry Laboratory I .....................1
CHE 446G Physical Chemistry for Engineers .................3
WRD 204 Technical Writing* ...................................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
CME 432 Chemical Engineering Laboratory I ................2
CHE 232 Organic Chemistry II ....................................3
Engineering/Science Elective ....................................3

Senior Year

First Semester
CME 006 The Engineering Profession
   (Junior and Senior) ...............................................0
CME 433 Chemical Engineering Laboratory II ................3
CME 455 Chemical Engineering Process Design I ............3
CME 470 Professionalism, Ethics and Safety .................2
CME 550 Chemical Reactor Design ............................3
UK Core – Citizenship - USA ......................................3
Engineering/Science Elective ....................................3

Second Semester
CME 006 The Engineering Profession
   (Junior and Senior) ...............................................0
CME 456 Chemical Engineering Process Design II ............3
CME 462 Process Control .........................................3
UK Core – Global Dynamics ......................................3
Engineering/Science Elective ....................................3
Engineering/Science Elective ....................................3

§ Transfer students will take EGR 215, Introduction to the Practice of Engineering for Transfer Students, in place of EGR 101 and EGR 103.

▼ Students must complete both EGR 101 and EGR 103 to fulfill the UK Core Arts and Creativity requirement. Transfer students may satisfy the UK Core Arts and Creativity requirement by taking EGR 215.

*Bachelors of Chemical Engineering 2020-2021 Undergraduate Bulletin

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

- Produce graduates who are successful in chemical engineering practice, professional and/or academic pursuits.
- Produce graduates who function independently and in teams to carry out in-depth solution strategies to chemical engineering problems.
- Produce graduates who continue to advance in their careers and participate in professional development activities.

The Paducah chemical engineering program collaborates with West Kentucky Community and Technical College to provide the foundation math and science courses, as well as the general studies course requirements. On-site UK chemical engineering faculty members teach the 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 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 and project management, environmental engineering, geotechnical engineering, materials engineering, structural engineering, transportation engineering, and water resources engineering.

The program educational objectives for the civil engineering program reflect the mission of the Department of Civil Engineering. They are important for successful professional practice and the ability to pursue advanced degrees. Civil Engineering graduates from the University of Kentucky will:

1. Excel in Civil Engineering or a related career.
2. Create ethical and sustainable solutions.
3. Seek professional licensure.
4. Embrace lifelong 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:

UK Core Requirements

See the UK Core section of this Bulletin for the complete UK Core requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

1. Intellectual Inquiry in Arts and Creativity
   EGR 101 Engineering Exploration I § ▼ ......................1
   EGR 103 Engineering Exploration II § ▼ ....................2

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### Electives

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<th>Course</th>
<th>Hours</th>
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<tbody>
<tr>
<td>CE Design Electives</td>
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<tr>
<td>Engineering Science Elective</td>
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<tr>
<td>Statistics Elective</td>
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<tr>
<td>CE Technical Elective</td>
<td>6</td>
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<tr>
<td>Math or Science Elective</td>
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**Subtotal: Electives**  21  
**TOTAL HOURS:** 128  

### Curriculum

#### Freshman Year

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<tr>
<td>First Semester</td>
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<tr>
<td>EGR 101 Engineering Exploration I § $\n$</td>
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<tr>
<td>EGR 102 Fundamentals of Engineering Computing</td>
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<td>CIS/WRD 110 Composition and Communication</td>
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<td>MA 113 Calculus I ........</td>
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<td>CHE 105 General College Chemistry I ..........</td>
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**Second Semester**

<table>
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<td>PHY 241 General University Physics Laboratory</td>
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<td>UK Core – Social Sciences</td>
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#### Sophomore Year

<table>
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<tr>
<td>CE 106 Computer Graphics and Communication</td>
<td>3</td>
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<td>CE 211 Surveying ..........</td>
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<td>CHE 107 General College Chemistry II ..........</td>
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<td>EM 221 Statics ...........</td>
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<td>MA 213 Calculus III ......</td>
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**Second Semester**

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<tr>
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<td>PHY 232 General University Physics .............</td>
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<td>PHY 242 General University Physics Laboratory</td>
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#### Junior Year

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<td>WRD 204 Technical Writing *</td>
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<td>EES 220 Principles of Physical Geology</td>
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<tr>
<td>CE 303 Introduction to Construction Engineering</td>
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<td>CE 341 Introduction to Fluid Mechanics ..........</td>
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<tr>
<td>CE 381 Civil Engineering Materials I ...........</td>
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**Second Semester**

<table>
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<tr>
<td>CE 331 Transportation Engineering ..........</td>
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<tr>
<td>CE 351 Introduction to Environmental Engineering</td>
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<tr>
<td>CE 482 Structural Analysis and Design ..........</td>
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<tr>
<td>Math Elective or Science Elective [3] .......</td>
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</table>

#### Senior Year

<table>
<thead>
<tr>
<th>Section</th>
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<tbody>
<tr>
<td>First Semester</td>
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<tr>
<td>CE 461G Water Resources Engineering ..........</td>
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<tr>
<td>CE 471G Soil Mechanics ....</td>
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**Second Semester**

<table>
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<tr>
<td>CE 429 Civil Engineering Systems Design ......</td>
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<td>UK Core – Humanities ......</td>
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<tr>
<td>UK Core – Global Dynamics ..</td>
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</table>

*Students must complete both EGR 101 and EGR 103 to fulfill the UK Core Arts and Creativity requirement. Transfer students may satisfy the UK Core Arts and Creativity requirement by taking EGR 215.*

### BACHELOR OF SCIENCE IN COMPUTER ENGINEERING

#### Program Educational Objectives

Computer Engineers shape the way people work, play, live and learn in the modern world and develop the infrastructure and devices people can’t imagine living without. Computer Engineering is a dynamic and rewarding field that draws upon Electrical Engineering and Computer Science. Computer Engineers solve today’s most challenging technology problems by applying their expertise in both hardware and software systems. Leveraging everything from the world’s smallest micro-controllers to the largest server farms on the planet, Computer Engineers have revolutionized modern entertainment, medicine, telecommunications, transportation, and Information Technology. Computer Engineering graduates find employment in positions requiring Computer Science, Electrical Engineering or Computer Engineering expertise, are in high demand in virtually all industries, and are among the highest compensated specialties in engineering.

The objective of the computer engineering degree program is to prepare students for success as practicing engineers engaged in lifelong learning and serving in leadership roles in their chosen career path. Specifically, within five years of graduation, the computer engineering degree program will prepare graduates to:

- Establish themselves as practicing professionals meeting or exceeding the expectations of their employers.
- Continue their professional development or pursue formal education to earn advanced degrees and/or certifications.
**College of Engineering**

- Demonstrate leadership in their professional endeavors and/or in their communities.

**Degree Requirements**

Each student must complete the following:

**UK Core Requirements**

See the UK Core section of this Bulletin for the complete UK core requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK core requirements.

**I. Intellectual Inquiry in Arts and Creativity**

- EGR 101 Engineering Exploration I
- EGR 103 Engineering Exploration II

**II. Intellectual Inquiry in the Humanities**

Choose one course from approved list

**III. Intellectual Inquiry in the Social Sciences**

Choose one course from approved list

**IV. Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences**

- PHY 231 General University Physics
- PHY 241 General University Physics Laboratory

**V. Composition and Communication I**

CIS/WRD 110 Composition and Communication I

**VI. Composition and Communication II**

CIS/WRD 111 Composition and Communication II

**VII. Quantitative Foundations**

- MA 113 Calculus I

**VIII. Statistical Inference Reasoning**

- STA 381 Engineering Statistics – A Conceptual Approach

**IX. Community, Culture and Citizenship in the USA**

Choose one course from approved list

**X. Global Dynamics**

Choose one course from approved list

**UK Core hours**

**33**

**Graduation Composition and Communication Requirement (GCCR)**

CPE 490 ECE Capstone Design I

**Graduation Composition and Communication Requirement hours (GCCR)**

**3**

**Premajor Requirements**

CIS/WRD 110 Composition and Communication I

CIS/WRD 111 Composition and Communication II

CS 215 Introduction to Program Design, Abstraction, and Problem Solving Techniques

CS 216 Introduction to Software Engineering Techniques

CPE 200 Computer Engineering Sophomore Seminar

**Premajor Requirements**

**Hours**

CIS/WRD 110 Composition and Communication I

CIS/WRD 111 Composition and Communication II

CS 215 Introduction to Program Design, Abstraction, and Problem Solving Techniques

CS 216 Introduction to Software Engineering Techniques

CPE 200 Computer Engineering Sophomore Seminar

**Major Requirements**

**Hours**

MA 214 Calculus IV

CS 270 Systems Programming

CS 275 Discrete Mathematics

CS 315 Algorithm Design and Analysis

EE 211 Circuits I

EE 223 AC Circuits

CPE 200 Computer Engineering Sophomore Seminar

CPE 287 Introduction to Embedded Systems

CS 270 Systems Programming

CS 275 Discrete Mathematics

**Subtotal: Premajor hours**

**48**

**First Semester**

- EGR 101 Engineering Exploration I
- MA 113 Calculus I
- CHE 105 General College Chemistry I
- CIS/WRD 110 Composition and Communication I

**Second Semester**

- EGR 102 Fundamentals of Engineering Computing
- CS 216 Introduction to Software Engineering Techniques
- CPE 200 Computer Engineering Sophomore Seminar
- EGR 101 Engineering Exploration II
- MA 113 Calculus I
- CHE 105 General College Chemistry I
- CIS/WRD 110 Composition and Communication I

**Electives**

- Technical Electives†
- Hardware/Software Electives
- Technical Electives†

**Subtotal: Electives**

**21**

**TOTAL HOURS**

**128**

**Curriculum**

**Freshman Year**

**First Semester**

- EGR 101 Engineering Exploration I
- MA 113 Calculus I
- CHE 105 General College Chemistry I
- CIS/WRD 110 Composition and Communication I

**Second Semester**

- EGR 102 Fundamentals of Engineering Computing
- CS 216 Introduction to Software Engineering Techniques
- CPE 200 Computer Engineering Sophomore Seminar
- EGR 101 Engineering Exploration II
- MA 113 Calculus I
- CHE 105 General College Chemistry I
- CIS/WRD 110 Composition and Communication I

**Sophomore Year**

**First Semester**

- MA 213 Calculus III
- PHY 232 General University Physics
- PHY 242 General University Physics Laboratory
- CS 216 Introduction to Software Engineering Techniques
- CPE 200 Computer Engineering Sophomore Seminar

**Second Semester**

- MA 214 Calculus IV
- EE 211 Circuits I
- EGR 101 Engineering Exploration I
- CS 270 Systems Programming

**Junior Year**

**First Semester**

- EE 223 AC Circuits
- CS 315 Algorithm Design and Analysis
- CPE 380 Computer Organization
- STA 381 Engineering Statistics – A Conceptual Approach

**Second Semester**

- EE 421G Signals and Systems
- EE 461G Introduction to Electronics
- CPE 480 Advanced Computer Architecture
- UK Core – Social Sciences

**Senior Year**

**First Semester**

- CPE 490 ECE Capstone Design I
- CPE Electives†
- CPE Electives†
- Technical Elective†

**Second Semester**

- CPE 491 ECE Capstone Design II
- Hardware Elective €
- Software Elective
- CPE Electives†

**UK Core – Global Dynamics**

Students must complete both EGR 101 and EGR 103 to fulfill the UK Core Arts and Creativity requirement. Transfer students may satisfy the UK Core Arts and Creativity requirement by taking EGR 215.

*Graduation Composition and Communication Requirement (GCCR) course.

†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.

‡Transfer students will take EGR 215, Introduction to the Practice of Engineering for Transfer Students, in place of EGR 101 and EGR 103.

§Students must complete both EGR 101 and EGR 103 to fulfill the UK Core Arts and Creativity requirement. Transfer students may satisfy the UK Core Arts and Creativity requirement by taking EGR 215.

Software electives are senior level courses in the CPE or EE disciplines and shall be selected from the following list and/or selected in consultation with academic advisor:

- EE 582 Hardware Description Languages and Programma-
- Logic
- CPE 584 Introduction of VLSI Design and Testing
- CPE 585 Fault Tolerant Computing
- CPE 586 Communication and Switching Networks

- Software electives are senior level courses in the CPE or EE disciplines and shall be selected from the following list and/or selected in consultation with academic advisor:

- CS 441G Compilers for Algorithmic Languages (fall only)
- CS 471G Networking and Distributed Operating Systems
- CS 570 Modern Operating Systems
- CPE 588 Real-Time Computer Systems
BACHELOR OF SCIENCE IN COMPUTER SCIENCE

The computer science program prepares students to identify and to solve computational problems in all areas of modern life; to design, implement, and analyze algorithmic solutions; and to build software for a variety of applications. Through required, elective and special topics courses students are exposed to the foundations and current practices of computing and algorithms, software engineering, programming languages, operating systems, graphics and multimedia, scientific computing and numerical analysis, databases, artificial intelligence, machine learning, and networks. Students are encouraged to take advantage of special topics courses, undergraduate certificate programs, cooperative education, independent studies, undergraduate research, and university scholars program.

The program’s educational objective is to equip graduates to succeed in their chosen career path. Specifically, within three to five years after graduation:

- Those employed in industry or entrepreneurial endeavors will demonstrate professional advancement through expanded leadership responsibility, significant technical accomplishment, or other recognition of their contributions.
- Those who continue their formal education will achieve an advanced degree or other technical certification.

In addition, graduates will appreciate the preparation received in the program as it relates to their chosen careers, to their role as educated citizens in a global society, and to continued learning.

For more information, please visit the department website at: www.cs.uky.edu

Degree Requirements

Each student must complete the following:

UK Core Requirements

See the UK Core section of this Bulletin for the complete UK core requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

I. Intellectual Inquiry in Arts and Creativity
   EGR 101 Engineering Exploration I § \( \triangleright \) ................. 1
   EGR 103 Engineering Exploration II § \( \triangleright \) ................. 2

II. Intellectual Inquiry in the Humanities
   Choose one course from approved list
   ______________________ 3

III. Intellectual Inquiry in the Social Sciences
   Choose one course from approved list
   ______________________ 3

IV. Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences
   PHY 231 General University Physics
   ______________________ 4
   PHY 241 General University Physics Laboratory
   ______________________ 1

V. Composition and Communication I
   CIS/WRD 110 Composition and Communication I
   ______________________ 3

VI. Composition and Communication II
   CIS/WRD 111 Composition and Communication II
   ______________________ 3

VII. Quantitative Foundations
   MA 133 Calculus I
   ______________________ 4

VIII. Statistical Inference
   STA 381 Engineering Statistics – A Conceptual Approach
   ______________________ 3

IX. Community, Culture and Citizenship in the USA
   Choose one course from approved list
   ______________________ 3

X. Global Dynamics
   Choose one course from approved list
   ______________________ 3

UK Core hours
   ______________________ 33

Graduation Composition and Communication Requirement (GCCR)
   CS 499 Senior Design Project
   ______________________ 3
   Graduation Composition and Communication Requirement hours (GCCR)
   ______________________ 3

Premajor Requirements

CIS/WRD 110 Composition and Communication I
   ______________________ 3
CIS/WRD 111 Composition and Communication II
   ______________________ 3
CHE 105 General College Chemistry I
   ______________________ 4
MA 113 Calculus I
   ______________________ 4
MA 114 Calculus II
   ______________________ 4
PHY 231 General University Physics
   ______________________ 4
PHY 241 General University Physics Laboratory
   ______________________ 1
EGR 101 Engineering Exploration I § \( \triangleright \) ................. 1
EGR 102 Fundamentals of Engineering Computing
   ______________________ 2
EGR 103 Engineering Exploration II § \( \triangleright \) ................. 2
CS 215 Introduction to Program Design, Abstraction, and Problem Solving Techniques
   ______________________ 4
CS 216 Introduction to Software Engineering Techniques
   ______________________ 3
CS 275 Discrete Mathematics
   ______________________ 4
MA 213 Calculus III
   ______________________ 4
EE 280 Design of Logic Circuits
   ______________________ 3

Subtotal: Premajor requirements
   ______________________ 46

Major Requirements

CS 270 Systems Programming
   ______________________ 3
STA 381 Engineering Statistics – A Conceptual Approach
   ______________________ 3
CS 315 Algorithm Design and Analysis
   ______________________ 3
CS/MA 321 Introduction to Numerical Methods
   ______________________ 3
MA 322 Matrix Algebra and Its Applications
   ______________________ 3
CS 371 Introduction to Computer Networking
   ______________________ 3
CS 375 Logic and Theory of Computing
   ______________________ 3
CS 498 Software Engineering for Senior Project
   ______________________ 3
CS 499 Senior Design Project
   ______________________ 3

Subtotal: Major hours
   ______________________ 24

Computer Science Electives

Choose 18 credit hours in CS courses at the 300-level or above with at least three courses from the following list:
CS 335 Graphics and Multimedia
   ______________________ 3
CS 378 Introduction to Cryptology
   ______________________ 3
CS 405G Introduction to Database Systems
   ______________________ 3
CS 441G Compilers for Algorithmic Languages
   ______________________ 3
CS 450G Fundamentals of Programming Languages
   ______________________ 3
CS 460G Machine Learning
   ______________________ 3
CS 463G Introduction to Artificial Intelligence
   ______________________ 3

Subtotal: CS Electives [C]
   ______________________ 18

Technical Electives

Choose 12 credit hours of the following:

Any additional 300-level or higher classes selected from computer science, electrical engineering, mathematics (including MA 214: Calculus IV and excluding MA 308: Problem Solving – Middle School and MA 310: Mathematics Problem Solving-Teachers), the Gatton College of Business and Economics, or approved by the Department of Computer Science.

Subtotal: Technical Electives \([T]\)
   ______________________ 12

Electives

Choose 16 credit hours from the following:

Natural Science Elective \([N]\)
   ______________________ 3
Free Electives \([E]\)
   ______________________ 10

At least 6 credit hours of Free Electives must be in areas other than computer science, natural science, engineering, or mathematics.

Subtotal: Electives
   ______________________ minimum of 16

TOTAL HOURS
   ______________________ 128

Curriculum

Freshman Year

First Semester

   EGR 101 Engineering Exploration I § \( \triangleright \) ................. 1
   EGR 102 Fundamentals of Engineering Computing
   ______________________ 2
   CHE 105 General College Chemistry I
   ______________________ 4
   PHY 231 General University Physics
   ______________________ 4
   CIS/WRD 110 Composition and Communication I
   ______________________ 3
   MA 113 Calculus I
   ______________________ 4

Second Semester

   EGR 103 Engineering Exploration II § \( \triangleright \) ................. 2
   CIS/WRD 111 Composition and Communication II
   ______________________ 3
   MA 114 Calculus II
   ______________________ 4
   PHY 231 General University Physics
   ______________________ 4
   CHE 105 General College Chemistry I
   ______________________ 4
   PHY 241 General University Physics Laboratory
   ______________________ 1
   CS 215 Introduction to Program Design, Abstraction, and Problem Solving Techniques
   ______________________ 4

Sophomore Year

First Semester

   CS 216 Introduction to Software Engineering Techniques
   ______________________ 3
   EE 280 Design of Logic Circuits
   ______________________ 4
   MA 213 Calculus III
   ______________________ 4
   UK Core – Social Sciences
   ______________________ 3

Second Semester

   CS 270 Systems Programming
   ______________________ 3
   CS 315 Algorithm Design and Analysis
   ______________________ 3
   Technical Elective \([T]\)
   ______________________ 3
   UK Core – Humanities
   ______________________ 3
   Science Elective \([S]\)
   ______________________ 3

Junior Year

First Semester

   CS/MA 321 Introduction to Numerical Methods
   ______________________ 3
   MA 322 Matrix Algebra and Its Applications
   ______________________ 3
   CS 371 Introduction to Computer Networking
   ______________________ 3
   Computer Science Elective \([C]\)
   ______________________ 3
   Computer Science Elective \([C]\)
   ______________________ 3
   STA 381 Engineering Statistics – A Conceptual Approach
   ______________________ 3
The courses listed below are (a) minimum of 19-20 hours of course work in CS, earns college credit and is not a more elementary version of a course to be selected from the UK core natural science list or applied science list, or (b) required courses that proved by the Department of Computer Science. Natural science courses included may be selected from the UK core natural science list, UK core social science list, or applied science list.

**Second Semester**
- CS 375 Logic and Theory of Computing
- Computer Science Elective [C]
- Computer Science Elective [C]
- Technical Elective [T]
- UK Core – Citizenship - US
- Natural Science Elective [N]

**Senior Year**

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Hours</th>
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<tr>
<td>CS 498 Software Engineering for Senior Project</td>
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<td>Technical Elective [T]</td>
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<td>UK Core – Global Dynamics</td>
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<th>Second Semester</th>
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<tr>
<td>CS 499 Senior Design Project*</td>
<td>3</td>
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<tr>
<td>Computer Science Elective [C]</td>
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<tr>
<td>Free Elective [E]</td>
<td>3</td>
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<tr>
<td>Free Elective [E]</td>
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</table>

§ Transfer students will take EGR 215. Introduction to the Practice of Engineering for Transfer Students, in place of EGR 101 and EGR 103.

* Students must complete both EGR 101 and EGR 103 to fulfill the UK Core Arts and Creativity requirement. Transfer students may satisfy the UK Core Arts and Creativity requirement by taking EGR 215.

**BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING**

The electrical engineering undergraduate 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 program allows students to specialize in high performance and embedded computing, microelectronics and nanotechnology, power and energy, signal processing and communications, high frequency circuits and fields, and control systems, among others.

The objective of the electrical engineering degree program is to prepare students for success as practicing engineers engaged in lifelong learning and serving in leadership roles in their chosen career path. Specifically, within five years of graduation, the electrical engineering degree program will prepare graduates to:

- Establish themselves as practicing professionals meeting or exceeding the expectations of their employers.
- Continue their professional development or pursue formal education to earn advanced degrees and/or certifications.
- Demonstrate leadership in their professional endeavors and/or in their communities.

The electrical engineering undergraduate program has identified curriculum tracks as recommended groups of courses for undergraduate students interested in a particular area of electrical engineering. Each track consists of a list of three recommended electives (typically EE Technical Electives) and possibly a recommended lab elective. A student will be considered to have completed a track if these course requirements have been satisfied with a grade of C or better.

Students are not required to participate in a track. Tracks are intended for students as a guide of classes to take in a particular area. Student transcripts will not explicitly mention completion of a track. However, any student completing a track will receive an official recognition of this completion from the department.

The current set of tracks are:

1. Electric Power and Energy
   - EE Technical Electives EE 537 and EE 538, and one of the following: EE 518, EE 531, or EE 539. Also, EE 416G as a Lab Elective.
2. Signals and Systems
   - Any three of the following EE Technical Electives: EE 511, EE 512, EE 513, EE 571, EE 572, EE 586. Also, EE 422G as a Lab Elective.
3. Digital Systems
   - EE Technical Electives EE 582 and EE 584, and one of the following: EE 585, EE 586, EE 587, EE 589.
4. High Frequency Circuits and Fields
   - EE Technical Electives EE 522 and EE 523, and one of the following additional: EE 525, EE 527.

**Degree Requirements**

Each student must complete the following:

**UK Core Requirements**

See the UK Core section of this Bulletin for the complete UK Core requirements. The courses listed below are (a) recommended by the college, or (b) required courses that fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

1. Intellectual Inquiry in Arts and Creativity
   - EGR 101 Engineering Exploration I § 1
   - EGR 103 Engineering Exploration II § 2
2. Intellectual Inquiry in the Humanities
   - Choose one course from approved list
3. Intellectual Inquiry in the Social Sciences
   - Choose one course from approved list
4. Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences
   - PHY 231 General University Physics
   - PHY 241 General University Physics Laboratory
5. Composition and Communication I
   - CIS/WRD 110 Composition and Communication I
6. Composition and Communication II
   - CIS/WRD 111 Composition and Communication II
7. Quantitative Foundations
   - MA 113 Calculus I
8. Statistical Inferential Reasoning
   - STA 210 Making Sense of Uncertainty: An Introduction to Statistical Reasoning
9. X. Global Dynamics
   - Choose one course from approved list
10. US Core hours
   - 33
11. Graduation Composition and Communication Requirement (GCCR)
   - EE 490 ECE Capstone Design I
   - Graduation Composition and Communication Requirement hours (GCCR)

**Minor in Computer Science**

The minor in Computer Science requires a minimum of 19-20 hours of course work in CS, to include:

- CS 115 Introduction to Computer Programming or EGR 102 Fundamentals of Engineering Computing ...2-3
- CS 215 Introduction to Program Design, Abstraction, and Problem Solving ...
- CS 216 Introduction to Software Engineering Techniques ...4
- CS 275 Discrete Mathematics ...
- CS 315 Algorithm Design and Analysis ...

or equal, plus 3 additional hours of upper-division courses (300 or higher) in computer science. A GPA of at least 2.5 across these courses is required. At least 10 of the credit hours required to complete the minor must be earned at the University of Kentucky.
College of Engineering

Premajor Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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<td>Composition and Communication I</td>
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<tr>
<td>CIS/WRD 111</td>
<td>Composition and Communication II</td>
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<tr>
<td>CHE 105</td>
<td>General College Chemistry I</td>
<td>4</td>
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<tr>
<td>CS 215</td>
<td>Introduction to Program Design</td>
<td>4</td>
</tr>
<tr>
<td>MA 113</td>
<td>Calculus I</td>
<td>4</td>
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<tr>
<td>MA 114</td>
<td>Calculus II</td>
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<td>PHY 242</td>
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<tr>
<td>EE 211</td>
<td>Circuits I</td>
<td>4</td>
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<tr>
<td>EE 282</td>
<td>Digital Logic Design</td>
<td>4</td>
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<td>EGR 101</td>
<td>Engineering Exploration I</td>
<td>2</td>
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<tr>
<td>EGR 102</td>
<td>Fundamentals of Engineering Computing</td>
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</tr>
<tr>
<td>EGR 103</td>
<td>Engineering Exploration II</td>
<td>2</td>
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Subtotal: Premajor hours: 49

Major Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>EE 223</td>
<td>AC Circuits</td>
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<tr>
<td>EE 287</td>
<td>Introduction to Embedded Systems</td>
<td>4</td>
</tr>
<tr>
<td>EE 415</td>
<td>Electromechanics</td>
<td>3</td>
</tr>
<tr>
<td>EE 421</td>
<td>Signals and Systems</td>
<td>3</td>
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<tr>
<td>EE 461</td>
<td>Introduction to Electronics</td>
<td>3</td>
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<tr>
<td>EE 468</td>
<td>Introduction to Engineering Electromagnetics</td>
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<tr>
<td>EE 490</td>
<td>ECE Capstone Design IA</td>
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<tr>
<td>EE 491</td>
<td>ECE Capstone Design IIA</td>
<td>3</td>
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<tr>
<td>MA 214</td>
<td>Calculus IV</td>
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<tr>
<td>MA 320</td>
<td>Introductory Probability</td>
<td>3</td>
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<tr>
<td>STA 381</td>
<td>Engineering Statistics – A Conceptual Approach</td>
<td>3</td>
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<td>or</td>
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<tr>
<td></td>
<td>STA 381 Engineering Statistics –</td>
<td></td>
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<td>or</td>
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<td></td>
<td>STA 381 Engineering Statistics – A Conceptual Approach</td>
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Subtotal: Major hours: 37

Electives

<table>
<thead>
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<th>Course Title</th>
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<tr>
<td>EE/CPE 490</td>
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<td>EE 415</td>
<td>Technical Elective*</td>
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<td>EE 421</td>
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Subtotal: Electives: 27

TOTAL HOURS: 128

Curriculum

Freshman Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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<tr>
<td>EGR 101</td>
<td>Engineering Exploration I</td>
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<tr>
<td>EGR 102</td>
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<tr>
<td>PHY 231</td>
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<tr>
<td>MA 113</td>
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Second Semester

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<td>CHE 105</td>
<td>General College Chemistry I</td>
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<tr>
<td>CS 215</td>
<td>Introduction to Program Design</td>
<td>4</td>
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<tr>
<td>MA 113</td>
<td>Calculus I</td>
<td>4</td>
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<td>PHY 231</td>
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<td>MA 213</td>
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<tr>
<td>EE 211</td>
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<tr>
<td>EE 282</td>
<td>Digital Logic Design</td>
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Sophomore Year

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<tr>
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<td>PHY 232</td>
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<td>PHY 242</td>
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<td>EE 211</td>
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Second Semester

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<td>EE/CPE 287</td>
<td>Introduction to Embedded Systems</td>
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Junior Year

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<td>EE 421</td>
<td>Signals and Systems</td>
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<td>EE 461</td>
<td>Introduction to Electronics</td>
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<tr>
<td>MA 320</td>
<td>Introductory Probability</td>
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<td>EUR 381</td>
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Senior Year

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<tr>
<td>EE/CPE 490</td>
<td>ECE Capstone Design II</td>
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<td>EE 415</td>
<td>Technical Elective*</td>
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<tr>
<td>EE 421</td>
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<td>Technical Elective [E]</td>
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<tr>
<td>Engineering/Science Elective</td>
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<tr>
<td>UK Core – Global Dynamics</td>
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</table>

§ Transfer students will take EGR 215, Introduction to the Practice of Engineering for Transfer Students, in place of EGR 101 and EGR 103.

$ Students must complete both EGR 101 and EGR 103 to fulfill the UK Core Arts and Creativity requirement. Transfer students may satisfy the UK Core Arts and Creativity requirement by taking EGR 215.

$[M] Math/Statistics Elective: Any upper-division (300-level or higher) math or statistics course excluding MA 308 and MA 310 (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 MA 308, MA 310, and more elementary versions of required courses (6 credit hours total). Cooperative education credit may not be used to satisfy this requirement.

$[T] Technical elective may be selected from upper-division (300-level or higher) engineering, mathematics, statistics, computer science, physics, or other technically-related fields excluding MA 308, MA 310, EE 305, and more elementary versions of required courses(s), to be selected in consultation with the academic advisor (6 credit hours total).


*Graduation Composition and Communication Requirement (GCCR) course.

*EE Technical Electives (must be 300-level courses). Courses recommended as electrical engineering technical electives are listed below (each course is 3 credit hours):

EE 503 Power Electronics
EE 511 Introduction to Communication Systems
EE 512 Digital Communication Systems
EE 513 Audio Signals and Systems
EE 517 Advanced Electromechanics
EE 518 Electric Drives
EE 522 Antenna Design
EE 523 Microwave Circuit Design
EE 525 Numerical Methods and Electromagnetics
EE 527 Electromagnetic Compatibility
EE 531 Alternative and Renewable Energy Systems
EE 532 Smart Grid: Automation and Control of Power Systems
EE 533 Advanced Power System Protection
EE 535 Power Systems: Generation, Operation and Control
EE 536 Power System Fault Analysis and Protection
EE 537 Electric Power Systems I
EE 538 Electric Power Systems II
EE 539 Power Distribution Systems
EE 543 Solar Cell Devices and Systems for Electrical Energy Generation
EE 546 Electric Power System Fundamentals
EE 560 Semiconductor Device Design
EE 566 Engineering Optics
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 582 Hardware Description Languages and Programmable Logic
EE 584 Introduction of VLSI Testing and Design
EE 585 Fault Tolerant Computing
EE 586 Communication and Switching Networks
EE 587 Microcomputer Systems Design
EE 588 Real-Time Computer Systems
EE 589 Advanced VLSI
EE 599 Topics in Electrical Engineering (Subtitle required)

BACHELOR OF SCIENCE IN MATERIALS ENGINEERING

The materials engineer is responsible for the selection, preparation and application of existing materials and for the development of new and improved materials. Materials engineers study the relationships between atomic and/or molecular constitution, microstructure and physical properties including mechanical, thermal, electrical, and optical behavior. Classes of materials include metals, ceramics, polymers, and electronic materials.

The educational objectives of the materials engineering program state that graduates will:

• Excel in their chosen career pathways, as practicing materials engineers or through the pursuit of advanced technical or professional degrees.

• Impact their profession through effective leadership, communication, teamwork, and through creative solution strategies to address global and societal issues.
**College of Engineering**

- Apply their engineering training to contribute to the health, safety, environmental and economic well-being of their communities.
- Seek out continuing education, professional development and career advancement opportunities.

**Degree Requirements**
The following curriculum meets requirements for the B.S. in materials engineering, provided the student satisfies the graduation requirements listed earlier. Each student must complete the following:

**UK Core Requirements**
See the **UK Core** section of this Bulletin for the complete UK Core requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

I. Intellectual Inquiry in the Arts and Creativity
   - EGR 101 Engineering Exploration I \( \checkmark \) \( \checkmark \)…………… 1
   - EGR 103 Engineering Exploration II \( \checkmark \) \( \checkmark \)…………… 2

II. Intellectual Inquiry in the Humanities
   - CHE 236 Survey of Organic Chemistry ………………… 3

III. Intellectual Inquiry in the Social Sciences
   - Course one from approved list………….…… 3

IV. Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences
   - CHE 105 General College Chemistry I………………… 4
   - CHE 111 General Chemistry I Laboratory……………. 1

V. Composition and Communication I
   - CIS/WRD 110 Composition and Communication I ……… 3

VI. Composition and Communication II
   - CIS/WRD 111 Composition and Communication II…………. 3

VII. Quantitative Foundations
   - MA 113 Calculus I…………………….…… 4

VIII. Statistical Inferential Reasoning
   - STA 381 Engineering Statistics – A Conceptual Approach… 3

IX. Community, Culture and Citizenship in the USA
   - Choose one course from approved list………………….. 3

X. Global Dynamics
   - Choose one course from approved list………………….. 3

**UK Core hours……………………………………… 33**

**Graduation Composition and Communication Requirement (GCCR)**
- MSE 407 Materials Laboratory I………………… 3

**Graduation Composition and Communication Requirement hours (GCCR)……………………. 3**

**Premajor Requirements**

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Hours</th>
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<tbody>
<tr>
<td>EGR 101 Engineering Exploration I ( \checkmark ) ( \checkmark )…………… 1</td>
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<tr>
<td>EGR 102 Fundamentals of Engineering Computing ………………… 2</td>
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<tr>
<td>CHE 105 General College Chemistry I………………… 4</td>
<td></td>
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<tr>
<td>CHE 111 General Chemistry I Laboratory……………. 1</td>
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<tr>
<td>CIS/WRD 110 Composition and Communication I………………… 3</td>
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<tr>
<td>MA 113 Calculus I…………………….…… 4</td>
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</table>

**Subtotal: Premajor hours…………… 42**

**Major Requirements**

<table>
<thead>
<tr>
<th>Hours</th>
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<tbody>
<tr>
<td>CHE 236 Survey of Organic Chemistry ………………… 3</td>
</tr>
<tr>
<td>CME 200 Process Principles………………… 3</td>
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<td>EM 221 Statics…………………….…… 3</td>
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<tr>
<td>MA 214 Calculus IV………………… 3</td>
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<tr>
<td>PHY 232 General University Physics………………… 4</td>
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<tr>
<td>MSE 301 Materials Science II………………… 3</td>
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<tr>
<td>MSE 351 Materials Thermodynamics………………… 3</td>
</tr>
<tr>
<td>EM 302 Mechanics of Deformable Solids………………… 3</td>
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<tr>
<td>EE 305 Electrical Circuits and Electronics………………… 3</td>
</tr>
<tr>
<td>PHY 361 Principles of Modern Physics………………… 3</td>
</tr>
<tr>
<td>MSE 401G Metal and Alloys………………… 3</td>
</tr>
<tr>
<td>MSE 402G Electronic Materials and Processing………………… 3</td>
</tr>
<tr>
<td>MSE 403G Ceramic Engineering and Processing………………… 3</td>
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<tr>
<td>MSE 404G Polymeric Materials………………… 3</td>
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<td>MSE 407 Materials Laboratory I………………… 3</td>
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<td>MSE 408 Materials Laboratory II………………… 3</td>
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<td>MSE 436 Material Failure Analysis………………… 3</td>
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<td>MSE 470 Application of Materials Engineering to Design Problems………………… 3</td>
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<td>MSE 480 Materials Design………………… 3</td>
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<td>MSE 535 Mechanical Properties of Materials………………… 3</td>
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<td>MSE 538 Metals Processing………………… 3</td>
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<tr>
<td>MSE 585 Materials Characterization Techniques………………… 3</td>
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<tr>
<td>STA 381 Engineering Statistics – A Conceptual Approach………………… 3</td>
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</table>

**Subtotal: Major hours…………… 68**

**Technical Electives**

Total of 6 credit hours must be chosen. Technical electives are to be selected from a technical discipline, with approval from the Director of Undergraduate Studies. At least 3 credit hours must come from a course with an MSE prefix. MSE 395 (Research) may count for one elective, but not both. Recommended technical electives include but are not limited to:

- MSE 395 IndependentWorkin Materials Engineering………………… 3
- MSE 506 Mechanics of Composite Materials………………… 3
- MSE 531 Powder Metallurgy………………… 3
- MSE 532 Automotive Plastics………………… 3
- MSE 554 Chemical and Physical Processing of Polymer Systems………………… 3
- MSE 556 Introduction to Composite Materials………………… 3
- MSE 569 Electronic Packaging Systems and Manufacturing Processes………………… 3
- MSE 599 Topics in Materials Science and Engineering (Subtitle required)………………… 3
- BME 488 Introduction to Biomaterials………………… 3
- CHE 580 Topics in Chemistry………………… 3
- CME 542 Electric Power Generation Technologies………………… 3
- CME 599 Topics in Chemical Engineering………………… 3
- MA 222 Matrix Algebra and Its Applications………………… 3
- MA 422 Numerical Solutions of Equations………………… 3
- MA 432G Methods of Applied Mathematics………………… 3
- ME/MFS 503 Lean Manufacturing Principles and Practices………………… 3

**Subtotal: Technical Electives…………… 6**

**TOTAL HOURS:…………… 128**

**Curriculum**

**Freshman Year**

**First Semester**

<table>
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<tr>
<td>EGR 101 Engineering Exploration I ( \checkmark ) ( \checkmark )…………… 1</td>
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<td>EGR 102 Fundamentals of Engineering Computing ………… 2</td>
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<td>CHE 105 General College Chemistry I………………… 4</td>
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<td>CHE 111 General Chemistry I Laboratory……………. 1</td>
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<td>CIS/WRD 110 Composition and Communication I………………… 3</td>
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<td>MA 113 Calculus I…………………….…… 4</td>
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**Second Semester**

<table>
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<td>PHY 241 General University Physics Laboratory……………. 1</td>
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<td>UK Core – Social Sciences………………… 3</td>
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**Sophomore Year**

**First Semester**

<table>
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<tbody>
<tr>
<td>MSE 201 Materials Science………………… 3</td>
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<td>MSE 202 Materials Science Laboratory………………… 1</td>
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<td>MA 213 Calculus III………………… 4</td>
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<td>CHE 107 General College Chemistry II………………… 3</td>
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<td>CHE 113 General Chemistry II Laboratory……………. 2</td>
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<td>EM 221 Statics…………………….…… 3</td>
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**Second Semester**

<table>
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<tbody>
<tr>
<td>MSE 301 Materials Science II………………… 3</td>
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<td>MSE 351 Materials Thermodynamics………………… 3</td>
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<td>MA 214 Calculus IV………………… 3</td>
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<td>PHY 232 General University Physics………………… 4</td>
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<td>CHE 236 Survey of Organic Chemistry………………… 3</td>
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**Junior Year**

**First Semester**

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<tr>
<td>MSE 401G Metal and Alloys………………… 3</td>
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<td>MSE 404G Polymeric Materials………………… 3</td>
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<td>CME 200 Process Principles………………… 3</td>
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<td>EM 302 Mechanics of Deformable Solids………………… 3</td>
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<td>STA 381 Engineering Statistics – A Conceptual Approach………………… 3</td>
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<td>UK Core – Humanities………………… 3</td>
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**Second Semester**

<table>
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<tr>
<td>MSE 402G Electronic Materials and Processing………………… 3</td>
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<td>MSE 403G Ceramic Engineering and Processing………………… 3</td>
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<td>MSE 535 Mechanical Properties of Materials………………… 3</td>
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<td>PHY 361 Principles of Modern Physics………………… 3</td>
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**Senior Year**

**First Semester**

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<td>MSE 408 Materials Laboratory II………………… 3</td>
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<td>MSE 470 Application of Materials Engineering to Design Problems………………… 3</td>
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<td>MSE 585 Materials Characterization Techniques………………… 3</td>
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<td>Technical Elective* (MSE prefix)………………… 3</td>
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**Second Semester**

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<td>MSE 480 Materials Design………………… 3</td>
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<td>MSE 538 Metals Processing………………… 3</td>
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<td>Technical Elective*………………… 3</td>
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<tr>
<td>UK Core – Citizenship - USA………………… 3</td>
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<tr>
<td>UK Core – Global Dynamics………………… 3</td>
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</table>

§ Transfer students will take EGR 215, Introduction to the Practice of Engineering for Transfer Students, in place of EGR 101 and EGR 103.

\( \checkmark \) Students must complete both EGR 101 and EGR 103 to fulfill the UK Core Arts and Creativity requirement. Transfer students may satisfy the UK Core Arts and Creativity requirement by taking EGR 215.

*Choose from the list of Technical Electives.

**Promotion Composition and Communication Requirement (GCCR) course.**
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 and the College of Engineering, the undergraduate program in mechanical engineering will prepare our graduates for successful practice or academic pursuits in mechanical engineering. We expect our graduates to attain the following Program Educational Objectives within a few years of graduation:

1. Our graduates will be employed in mechanical engineering or a variety of related fields as professionals, or attend graduate and professional schools in their career paths.
2. Our graduates will continue their education and professional growth by supporting and participating in professional societies, licensure programs, short courses, or other professional development activities.

Degree Requirements
Each student must complete the following:

UK Core Requirements
See the UK Core section of this Bulletin for the complete requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

I. Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences
   EGR 101 Engineering Exploration I .......................... 3
   CHE 105 General College Chemistry I ..................... 4
   PHY 241 General University Physics Laboratory .......... 1

II. Intellectual Inquiry in the Humanities
    Choose one course from approved list ........................ 3

III. Intellectual Inquiry in the Social Sciences
    Choose one course from approved list ........................ 3

IV. Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences
   PHY 231 General University Physics ....................... 4
   PHY 241 General University Physics Laboratory .......... 1

V. Composition and Communication I
   CIS/WRD 110 Composition and Communication I ........ 3

VI. Composition and Communication II
   CIS/WRD 111 Composition and Communication II ......... 3

VII. Quantitative Foundations
    MA 113 Calculus I ........................................ 4

VIII. Statistical Inferential Reasoning
    Choose one course from approved list:
    STA 210 Making Sense of Uncertainty:
    An Introduction to Statistical Reasoning
    or
    STA 381 Engineering Statistics –
    A Conceptual Approach ...................................... 3

IX. Community, Culture and Citizenship in the USA
    Choose one course from approved list ........................ 3

X. Global Dynamics
    Choose one course from approved list ........................ 3

UK Core hours ................................................. 33

Graduation Composition and Communication Requirement (GCCR)
WRD 204 Technical Writing .................................... 3
Graduation Composition and Communication Requirement hours (GCCR) ................. 3

Premajor Requirements
CIS/WRD 110 Composition and Communication I ......... 3
CIS/WRD 111 Composition and Communication II ........ 3
CHE 105 General College Chemistry I ..................... 4
CHE 107 General College Chemistry II ..................... 4
MA 113 Calculus I ........................................ 4
MA 114 Calculus II ........................................ 4
MA 213 Calculus III ....................................... 4
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 ........... 2
EGR 101 Engineering Exploration I § △ .................... 1
EGR 102 Fundamentals of Engineering Computing ......... 2
MA 113 Calculus I ........................................ 4
PHY 231 General University Physics ....................... 4
PHY 241 General University Physics Laboratory .......... 1
ME 205 Computer Aided Engineering Graphics .......... 3
EM 221 Statics ................................................ 3

Subtotal: Premajor hours: ................................. 46

Major Requirements
MA 214 Calculus IV ........................................ 3
ME 220 Engineering Thermodynamics I ..................... 3
ME 251 Introduction to Materials and Manufacturing Processes ........................................ 3
EM 362 Mechanics of Deformable Solids ................... 3
EM 313 Dynamcis ............................................ 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 341 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 ........................................ 51

Electives
Math Elective*** ............................................. 3
Technical Electives† .......................................... 9

Subtotal: Elective hours ................................. 12

TOTAL HOURS: .................................... 127

Curriculum

First Semester
EGR 101 Engineering Exploration I § △ .................... 1
EGR 102 Fundamentals of Engineering Computing ......... 2
MA 113 Calculus I ........................................ 4
PHY 231 General University Physics ....................... 4
PHY 241 General University Physics Laboratory .......... 1

Second Semester
EGR 103 Engineering Exploration II § △ .................. 2
MA 114 Calculus II ........................................ 4
CIS/WRD 111 Composition and Communication II ......... 3
CHE 105 General College Chemistry I ..................... 4
UK Core* – Social Sciences .................................. 3

Sophomore Year

First Semester
MA 213 Calculus III ........................................ 4
PHY 232 General University Physics ....................... 4
PHY 242 General University Physics Laboratory .......... 1
EM 221 Statics ................................................ 3
ME 205 Computer Aided Engineering Graphics .......... 3
CHE 107 General College Chemistry II ..................... 3
UK Core* – Humanities ...................................... 3

Second Semester
ME 220 Engineering Thermodynamics I ..................... 3
ME 251 Introduction to Materials and Manufacturing Processes ........................................ 3
MA 214 Calculus IV ........................................ 3
EM 313 Dynamics ............................................ 3
UK Core* – Humanities ...................................... 3
CHE 107 General College Chemistry II ..................... 3
UK Core* – Statistical Inferential Reasoning. Recommended:
STA 210 Making Sense of Uncertainty:
An Introduction to Statistical Reasoning
or
STA 381 Engineering Statistics –
A Conceptual Approach ...................................... 3

Junior Year

First Semester
EM 362 Mechanics of Deformable Solids ................... 3
EE 305 Electrical Circuits and Electronics ................ 3
ME 330 Fluid Mechanics .................................... 3
ME 340 Introduction to Mechanical Systems .............. 3
WRD 204 Technical Writing** ................................ 3

Second Semester
ME 310 Engineering Experimentation I ..................... 3
ME 321 Engineering Thermodynamics II .................... 3
ME 325 Elements of Heat Transfer.......................... 3
ME 344 Mechanical Design ................................ 3
Mathematics Elective*** ..................................... 3
**College of Engineering**

<table>
<thead>
<tr>
<th>Senior Year</th>
<th>First Semester</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 411 ME Capstone Design I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ME 311 Engineering Experimentation II</td>
<td>3</td>
<td></td>
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<tr>
<td>ME 440 Design of Control Systems</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ME 501 Mechanical Design with Finite Element Methods</td>
<td>3</td>
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<tr>
<td>Technical Elective</td>
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<tr>
<th>Second Semester</th>
<th>ME 412 ME Capstone Design II</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>Technical Elective</td>
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<tr>
<td>Technical Elective</td>
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<tr>
<td>UK Core – Citizenship</td>
<td>3</td>
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<tr>
<td>UK Core – Global Dynamics</td>
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</tbody>
</table>

- Transfer students will take EGR 215, Introduction to the Practice of Engineering for Transfer Students, in place of EGR 101 and EGR 103.

- Students must complete both EGR 101 and EGR 103 to fulfill the UK Core Arts and Creativity requirement. Transfer students may satisfy the UK Core Arts and Creativity requirement by taking EGR 215.

**Mathematics Elective** – choose one course from approved list.

**Technical Electives** – choose 9 hours from approved list.

**Subtotal: Mathematics Elective** | 3 |

<table>
<thead>
<tr>
<th>Mathematics Elective</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 320 Introductory Probability</td>
<td>3</td>
</tr>
<tr>
<td>MA 321 Introduction to Numerical Methods</td>
<td>3</td>
</tr>
<tr>
<td>MA 322 Matrix Algebra and Its Applications</td>
<td>3</td>
</tr>
<tr>
<td>MA 416G Introduction to Optimization</td>
<td>3</td>
</tr>
<tr>
<td>MA 432G Methods of Applied Mathematics I</td>
<td>3</td>
</tr>
<tr>
<td>MA 433G Introduction to Complex Variables</td>
<td>3</td>
</tr>
<tr>
<td>MA 481G Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>STA 381 Engineering Statistics – A Conceptual Approach</td>
<td>3</td>
</tr>
</tbody>
</table>

**Technical Electives** | Hours |

Choose one course from the following:

- MA 230 Introductory Probability
- MA 321 Introduction to Numerical Methods
- MA 322 Matrix Algebra and Its Applications
- MA 416G Introduction to Optimization
- MA 432G Methods of Applied Mathematics I
- MA 433G Introduction to Complex Variables
- MA 481G Differential Equations
- STA 381 Engineering Statistics – A Conceptual Approach

**BACHELOR OF SCIENCE IN MINING 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 and the College of Engineering, the undergraduate program in mechanical engineering will prepare our graduates for successful practice or academic pursuits in mechanical engineering. Our educational objectives are:

1. Our graduates will practice mechanical engineering in a variety of fields as professionals and/or be recruited to graduate and professional schools in their career paths.
2. Our graduates will communicate effectively, work in diverse teams, address the challenges of a global society, and exhibit leadership, ethics, and creativity in their work places.
3. Our graduates will value continuing education and professional growth by supporting or participating in professional societies, licensure programs, short courses, or other professional development activities.

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. On-site UK mechanical engineering faculty members teach the 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 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 program educational objectives of the bachelor of science program in mining engineering take into consideration the university mission and the constituents’ needs by producing graduates who, in their first few years after graduation, 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.

• 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 website at: www.engr.uky.edu/mng.

Degree Requirements

Each student must complete the following:

UK Core Requirements

See the UK Core section of this Bulletin for the complete UK Core requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

I. Intellectual Inquiry in Arts and Creativity
EGR 101 Engineering Exploration I § \(\nabla\) 1
EGR 103 Engineering Exploration II § \(\nabla\) 2
or
MNG 592 Mine Design Project II 3

II. Intellectual Inquiry in the Humanities

Choose one course from approved list 3

III. Intellectual Inquiry in the Social Sciences

Choose one course from approved list 3

IV. Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences

PHY 231 General University Physics
and
PHY 241 General University Physics Laboratory 5

OR

CHE 105 General College Chemistry I 3
and
CHE 111 General Chemistry I Laboratory 5

V. Composition and Communication I
CIS/WRD 110 Composition and Communication I 3

VI. Composition and Communication II
CIS/WRD 111 Composition and Communication II 3

VII. Quantitative Foundations
MA 113 Calculus I 4

VIII. Statistical Inferential Reasoning
MNG 335 Introduction to Mine Systems Analysis 3

IX. Community, Culture and Citizenship in the USA

Choose one course from approved list 3

X. Global Dynamics
Choose one course from approved list 3

UK Core hours 33

Graduation Composition and Communication Requirement (GCCR)
MNG 371 Professional Development of Mining Engineers 3

Graduation Composition and Communication Requirement hours (GCCR) 3

Premajor Requirements

CHE 105 General College Chemistry I 4
CIS/WRD 110 Composition and Communication I 3
CIS/WRD 111 Composition and Communication II 3
MA 113 Calculus I 3
MA 114 Calculus II 4
MA 213 Calculus III 4
MNG 201 Mining Engineering Fundamentals 3
PHY 231 General University Physics 4
PHY 241 General University Physics Laboratory or
CHE 111 General Chemistry I Laboratory 5
PHY 232 General University Physics 4
EES 220 Principles of Physical Geology 4
EGR 101 Engineering Exploration I § \(\nabla\) 1
EGR 102 Fundamentals of Engineering Computing 2
EGR 103 Engineering Exploration II § \(\nabla\) 2

Subtotal: Premajor requirements 43

Major Requirements

Hours
MA 214 Calculus IV 3
EES 230 Fundamentals of Geology I 3
EM 221 Statics 3
EM 302 Mechanics of Deformable Solids 3
EM 313 Dynamics 3
CE 341 Introduction to Fluid Mechanics 4
MNG 211 Mine Surveying 2
MNG 291 Elements of Mine Design 3
MNG 301 Minerals Processing 3
MNG 303 Deformable Solids Laboratory 1
MNG 311 Electrical Circuits and Mining Machinery 3
MNG 322 Mine Safety and Health Management and Processes 2
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 351 Underground Mine Design 3
MNG 371 Professional Development of Mining Engineers 3
MNG 435 Mine Systems Engineering and Economics 3
MNG 463 Surface Mine Design 3
BAE/MNG 535 Environmental Control System Design and Reclamation 3
MNG 551 Rock Mechanics 4
MNG 591 Mine Design Project I 1
MNG 592 Mine Design Project II 3

Subtotal: Major hours 67

Electives

Technical Elective* 3
Minerals Processing Technical Elective* 3

Subtotal: Electives 6

TOTAL HOURS: 128

Curriculum

First Semester

Freshman Year

Hours
CHE 105 General College Chemistry I 4
CIS/WRD 110 Composition and Communication I 3
EGR 101 Engineering Exploration I § \(\nabla\) 1
EGR 102 Fundamentals of Engineering Computing 2
MA 113 Calculus I 3

Second Semester

CIS/WRD 111 Composition and Communication II 3
EGR 103 Engineering Exploration II § \(\nabla\) 2
MA 114 Calculus II 4
PHY 231 General University Physics 4
PHY 241 General University Physics Laboratory or
CHE 111 General Chemistry I Laboratory 5
UK Core – Social Sciences 3

Sophomore Year

First Semester

Hours
EES 220 Principles of Physical Geology 4
EM 221 Statics 3
MA 213 Calculus III 4
MNG 201 Mining Engineering Fundamentals 3
PHY 232 General University Physics 4

Second Semester

EES 230 Fundamentals of Geology I 3
EM 302 Mechanics of Deformable Solids 3
MA 214 Calculus IV 3
MNG 291 Elements of Mine Design 3
MNG 303 Deformable Solids Laboratory 1
MNG 322 Mine Safety and Health Management and Processes 2
MNG 331 Explosives and Blasting 2

Junior Year

First Semester

Hours
EM 313 Dynamics 3
MNG 211 Mine Surveying 2
MNG 301 Minerals Processing 3
MNG 335 Introduction to Mine Systems Analysis 3
MNG 463 Surface Mine Design 3
UK Core – Humanities 3

Second Semester

CE 341 Introduction to Fluid Mechanics 4
MNG 311 Electrical Circuits and Mining Machinery 3
MNG 371 Professional Development of Mining Engineers*** 3
MNG 435 Mine Systems Engineering and Economics 3
MNG 551 Rock Mechanics 4

Senior Year

First Semester

Hours
MNG 332 Mine Plant Machinery 3
MNG 341 Mine Ventilation 3
MNG 351 Underground Mine Design 3
MNG 591 Mine Design Project I 1
UK Core – Citizenship - USA 3

Second Semester

BAE/MNG 535 Environmental Control System Design and Reclamation 3
MNG 592 Mine Design Project II (UK Core – Arts and Creativity) 3
Minerals Processing Technical Elective* 3
Technical Elective* 3
UK Core – Global Dynamics 3

§ Transfer students will take EGR 215, Introduction to the Practice of Engineering for Transfer Students, in place of EGR 101 and EGR 103.
College of Engineering

Students must complete both EGR 101 and EGR 103 to fulfill the UK Core Arts and Creativity requirement. Transfer students must satisfy the UK Core Arts and Creativity requirement by taking EGR 215.

Students only required to take one lab. Consult with advisor.

The Minerals Processing Technical Elective is to be chosen between MNG 375, Coal Preparation Design, and MNG 580, Mineral Processing Plant Design.

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.

Graduation Composition and Communication Requirement (GCCCR) course.

MNG 335 satisfies the Statistical Inferential Reasoning requirement in the UK Core.

Technical Electives: Students are required to select their technical elective from the departmental courses listed below:

MNG 511 Mine Power System Design
MNG/MFS 520 Industrial Automation and Control
MNG 531 Advanced Blast Design and Technology
MNG 541 Computer Design of Mine Ventilation Systems
MNG 552 Ground Control Software and Analysis
MNG 555 Advanced Geomechanics I
MNG 561 Mine Construction Engineering I
MNG 570 Sustainable Materials and Recycling Technologies (SMART)
MNG 575 Coal Preparation Design
MNG 580 Mineral Processing Plant Design
MNG 585 Applied Surface Chemistry
MNG 599 Topic in Mining Engineering

UNDERGRADUATE CERTIFICATES

The University of Kentucky grants the following undergraduate certificates in the College of Engineering:

Undergraduate Certificate in Aerospace Engineering

Aerospace Engineering careers are multidisciplinary, mathematical, and typically developed in graduate school or through career experience. Therefore, the UK undergraduate Aerospace Engineering certificate introduces UK students to multidisciplinary context of aerospace engineering through experiential education while preparing them for graduate education and careers through certificate course work. A strong foundation in mathematics is also essential, so technical elective course work is paired with cross-disciplinary Mathematics options. This will advance the mathematical maturity of aerospace certificate students, positively impact student performance in engineering courses, and prepare students for aerospace graduate degree programs and career opportunities.

Admission

For admission to the aerospace certificate program, students must submit an application, be in good academic standing, and have completed at least 24 hours and no more than 80 hours of course work with a minimum GPA of 2.5.

Curriculum

For completion of the Certificate, the GPA must be at least 3.0 with no grade less than C. In addition to successfully completing with a C or better the 12 hours of course work for at least one of the aerospace specialties listed below, students must also successfully complete at least one of the following educational experiences relevant for aerospace engineering (all courses must be completed with C or better):

- Aerospace-related capstone design project or design/build/fly competition, aerospace-related internship or co-op term, faculty mentored aerospace-related research or independent study, EGR 490 Engineering Leadership or Engineering Scholars Program, AFROTC or aerospace-related military experience, or approved equivalent aerospace-related educational experience. Your Aerospace Educational Experience is documented by your registration in EGR 390 Experiential Learning in Engineering or Computer Science (0 credits).

Structures, Instrumentation and Testing (minimum 12 hours)

EGR 390 Experiential Learning in Engineering or Computer Science* ............................................................... 0
MA 4XXG§ or
MA 322 Matrix Algebra and Its Applications§ .......... 3
ME 506 Mechanics of Composite Materials
or
ME 556 Introduction to Composite Materials .......... 3
ME 513 Mechanical Vibrations
or
ME 510 Vibro-Acoustic Design in Mechanical Systems .......................................................... 3

And one of the following:

ME 532 Advanced Strength of Materials ................. 3
ME 565 Scale Modeling in Engineering ................. 3
ME 599 Topics in Mechanical Engineering (Subtitle required) – with Certificate Director approval .......... 3

*Aerospace Experience.

Aerodynamics (minimum 12 hours)

EGR 390 Experiential Learning in Engineering or Computer Science* ............................................................... 0
MA 4XXG§ or
MA 322 Matrix Algebra and Its Applications§ .......... 3
ME 530 Gas Dynamics .............................................. 3
ME 531 Fluid Dynamics I .......................................... 3
and one of the following:

ME 548 Aerodynamics of Turbomachinery ............ 3
ME 565 Scale Modeling in Engineering ................. 3
ME 599 Topics in Mechanical Engineering (Subtitle required) – with Certificate Director approval .......... 3

*Aerospace Experience.

Mechanical Systems Engineering (minimum 12 hours)

EGR 390 Experiential Learning in Engineering or Computer Science* ............................................................... 0
MA 4XXG§ or
MA 322 Matrix Algebra and Its Applications§ .......... 3
ME 516 Systems Engineering .................................... 3
and two of the following:

ME 513 Mechanical Vibrations
or
ME 510 Vibro-Acoustic Design in Mechanical Systems .......................................................... 3
ME 506 Mechanics of Composite Materials
or
ME 556 Introduction to Composite Materials .......... 3
ME 530 Gas Dynamics
or
ME 531 Fluid Dynamics I .......................................... 3
ME 599 Topics in Mechanical Engineering (Subtitle required) – with Certificate Director approval .......... 3
ME 565 Scale Modeling in Engineering ................. 3

*Aerospace Experience.

Embedded Systems (minimum 12 hours)

EGR 390 Experiential Learning in Engineering or Computer Science* ............................................................... 0
MA 4XXG§ or
MA 322 Matrix Algebra and Its Applications§ .......... 3
EE 580 Embedded Systems Design ........................................... 3
and two of the following:

EE 582 Hardware Description Languages and Programmable Logic ........................................... 3
EE 584 Introduction of VLSI Design and Testing .......... 3
EE 585 Fault Tolerant Computing ......................... 3
EE 587 Advanced Embedded Systems .......... 3
EE 588 Real-Time Computer Systems .......... 3

*Aerospace Experience.

Communications (minimum 12 hours)

EGR 390 Experiential Learning in Engineering or Computer Science* ............................................................... 0
MA 4XXG§ or
MA 322 Matrix Algebra and Its Applications§ .......... 3
EE 511 Introduction to Communication Systems .......... 3
and two of the following:

EE 512 Digital Communication Systems ................. 3
EE 522 Antenna Design ........................................... 3
EE 523 Microwave Circuit Design .......... 3
EE 586 Communication and Switching Networks .......... 3

*Aerospace Experience.

Power and Performance (minimum 12 hours)

EGR 390 Experiential Learning in Engineering or Computer Science* ............................................................... 0
MA 4XXG§ or
MA 322 Matrix Algebra and Its Applications§ .......... 3
and three of the following:

EE 503 Power Electronics ........................................... 3
EE 527 Electromagnetic Compatibility .......... 3

*Aerospace Experience.
upon innovative new engineers who are able to easily communicate with people on either side. The goal of this program is to provide students a cohesive view of basic biopharmaceutical principles, so that they can more readily apply their chemical engineering skills to this diverse discipline.

### Applying to the Program

Students apply to the program during the fall semester of their sophomore year. The application process includes an online form, a written statement on career goals and an interview with two members of the faculty of record. In order for students to be admitted, they must have at least a 3.3 GPA and receive a B or better in CME 200. After this time, all students enrolled in the program meet once a semester with the director of the program or a faculty of record to assess progress, aid in course selection and provide guidance with career goals.

### Core Courses (12 credit hours)

- BCH 401G Fundamentals of Biochemistry
- PHS 522 Fundamentals of Pharmaceutical Sciences and Development
- CME 575 Fundamentals of Pharmaceutical Engineering
- PHY 206 Elementary Physiology

### Elective Courses (6 credit hours)

- CME 573 Drug Delivery: Advanced Pharmaceuticals
- CME 570 Bionanotechnology: Interfaces and Devices
- *CME 395 Special Problems in Chemical Engineering

### Total Hours

18

*2. Students must earn 13-15 credit hours by taking these courses:

1. EE 576 Cryptography
2. CS 571 Computer Networks
3. CS 505 Intermediate Topics in Database Systems
4. CS 570 Modern Operating Systems
5. CS 571 Computer Networks
6. EE 480 Advanced Computer Architecture
7. EE 566 Communication and Switching Networks
8. ICT 351 Technology Security
9. ICT 550 Security Informatics
10. ICT 552 Cybercrime and Digital Law Enforcement

### Undergraduate Certificate in Cybersecurity

For students who are interested in pursuing careers in information technology, the Cybersecurity Certificate enhances traditional educational opportunities offered within the University of Kentucky’s existing degree programs by equipping students with skills to identify, analyze and understand cybersecurity threats, and design and implement appropriate effective countermeasures. The certificate targets students in the computer science, computer engineering and electrical engineering programs. However, other students with appropriate background are also encouraged to apply.

The Cybersecurity Certificate educates undergraduate students in an increasingly important curriculum, preparing them to understand the challenges of cybersecurity, identify potential threats, and design effective countermeasures. The certificate is affiliated with the B.S. degrees in Computer Science and in Computer Engineering. Today, software and hardware security are a growing aspect of a computer scientist’s or computer engineer’s profession. The certificate complements standard curricula of the two programs with courses from Electrical and Computer Engineering, Computer Science, and Information Science and culminating in an independent study project, report, and presentation on a cybersecurity topic.

### Admission

In order for students to be admitted, they must be enrolled in an undergraduate degree program. They must have completed CS 270, EE 287 or have comparable experience. In addition, students must submit an application for the certificate program and go through the program interview process.

Any student may apply. The intended start semester for the program is the second semester of the student’s junior year, although some students could be admitted earlier or as late as at the start of their senior year.

The application process requires students to submit a written statement about career goals and a follow-up interview with a member of the faculty of record. After admission, all students enrolled in the program will meet every semester with the director of the program or a faculty of record to discuss their progress, course selection and career goals.

### Curriculum

Students must earn 13-15 credit hours by taking these courses:

1. EE 576 Cybersecurity
2. CS 371 Introduction to Cryptography
3. CS 564 Computer Security
4. CS 572 Network Security
5. CS 505 Intermediate Topics in Database Systems
6. CS 570 Modern Operating Systems
7. CS 571 Computer Networks
8. EE 380 Computer Organization
9. EE 480 Advanced Computer Architecture
10. EE 566 Communication and Switching Networks
11. ICT 351 Technology Security
12. ICT 550 Security Informatics
13. ICT 552 Cybercrime and Digital Law Enforcement
Undergraduate Certificate in Environmental Engineering

For students who are interested in pursuing environmental engineering careers, the Environmental Engineering Certificate enhances traditional educational opportunities offered within the existing degree programs available within the College of Engineering. Environmental engineering careers often begin with educational training in traditional engineering disciplines, but then require specialized cross-disciplinary training to cover a broader breadth of environmental issues. Environmental engineers work on projects related to drinking water, wastewater, storm water, solid waste, air, energy, site assessment and remediation, health and safety, etc. To develop sustainable solutions that address such a wide range of applications, environmental engineers not only require a strong foundation in engineering principles, but they also must have an understanding of biology and chemistry within the context of natural and engineered systems. The Environmental Engineering Certificate integrates principles of engineering, biology, and chemistry to address environmental problems impacting ecosystem and human health.

The Environmental Engineering Certificate offers current and incoming degree-seeking undergraduate students in the College of Engineering a curriculum that integrates principles of engineering, biology, and chemistry with the development of sustainable solutions to environmental problems impacting ecosystem and human health. The Environmental Engineering Certificate will: 1) formalize environmental engineering training taking place across various degree programs within the College of Engineering; 2) raise visibility of environmental engineering as a discipline among students, faculty and advisors; and, 3) increase cross-departmental interaction among four departments within the College of Engineering.

Admission

Students are encouraged to apply to the program during the fall semester of their sophomore year; however, students can apply anytime until graduation. The application process will include an online form, a written statement about career goals, and an interview with a member of the faculty of record. In order for students to be admitted, they must be enrolled in an undergraduate degree program and be in “good” standing as defined by the College. In addition, students must submit an application for the certificate program and go through the program interview process.

After admission, all students enrolled in the program will meet annually with the director of the program or a faculty of record to assess progress, aid in course selection, and provide guidance with career goals.

Course Plan for Environmental Engineering Certificate

The Environmental Engineering undergraduate certificate involves a total of 12 credit hours (200-level or greater). To complete the certificate, student must take the foundation course (CE 351), one biology course, one chemistry course, and one course from a focus area. Course substitutions will be considered on a case-by-case basis and must be approved by the Certificate Director.

Foundation Course

3 credits
CE 351 Introduction to Environmental Engineering

Biology Course

Choose one course, 3 credits:
BIO 208 Principles of Microbiology
or
BIO 308 General Microbiology

CE 555 Microbial Aspects of Environmental Engineering

PLS 566 Soil Microbiology

Chemistry Course

Choose one course, 3 credits:
CHE 226 Analytical Chemistry
CHE 230 Organic Chemistry I
CHE 236 Survey of Organic Chemistry
CE 565 Environmental Chemistry

Focus Areas

Choose one course, 3 credits:
Natural Water Systems
BAE 532/CE 542 Introduction to Stream Restoration
BAE 535/MNG 535 Environmental Control System Design and Reclamation
CE 547/BAE 547 Watershed Sedimentation

Water and Wastewater Treatment
BAE 435G Waste Management for Biosystems
CE 551 Water and Wastewater Treatment Engineering
CME 580 Design of Rate and Equilibrium Processes for Water Pollution Control
CME 599 Topics in Chemical Engineering
CME 395 Special Problems in Chemical Engineering (Environmental related)

Chemical Engineering

CME 599 Topics in Chemical Engineering (Membrane Science and Technology)

Stormwater

BAE 599 Topics in Biosystems Engineering (Low Impact Development)

Air

MNG 341 Mine Ventilation
MNG 541 Computer Design of Mine Ventilation Systems

Energy

CE 553 Environmental Consequences of Energy Production
CME 523 Concepts, Assessment Tools and Methods in Sustainable Power and Energy

Environmental Health and Remediation

CE 599 Topics in Civil Engineering (Subtitle required)

Undergraduate Certificate in Power and Energy

Requirements for the Undergraduate Certificate in Power and Energy

The purpose of the Power and Energy Undergraduate Certificate is to provide students with a formalized recognition of an emphasis in power and energy as part of their undergraduate degree program. The certificate consists of a series of foundational courses, supplemented with a broad array of elective courses related to power and energy. The elective courses cover a wide variety of areas, including fundamentals, conventional and emerging technologies, smart grid systems, distributed generation, power system protection, energy storage, solar power, biofuels, and others. This certificate is an important part of the Power and Energy Institute of Kentucky (PEIK), created through a grant from the US Department of Energy.

Structure

The Director of the Power and Energy Undergraduate Certificate is responsible for admitting students into the certificate, approving each student’s curriculum for completing the certificate, and notifying the Registrar when certificate requirements have been completed. Students completing the certificate will receive a paper certificate and the certification will also be posted on the student’s official transcript. The certification will not appear on the student’s diploma.

Entrance Requirements

To be accepted into the University of Kentucky Power and Energy Undergraduate Certificate, the student must pursue an undergraduate degree and have completed at least 24 credits with a UK cumulative GPA of at least 2.50. A transfer student can be accepted into the certificate if he/she has completed at least 24 credits with a weighted cumulative GPA from all other institutions of at least 2.50.
Exit Requirements

- The student must complete a minimum of 15 credits of course work in the certificate curriculum taken for a letter grade. Courses taken prior to admission into the certificate can be applied to the certificate.
- A minimum of 9 credits must be at, or above, the 300-level.
- The student must earn a grade of C or better in each course used to satisfy the certificate.
- The student must complete a 3-credit breadth component. The breadth component requires that a student take courses in at least two disciplines, with a minimum of 3 credits completed in the second discipline.
- The certificate will be awarded to students who complete the certificate curriculum and also complete an undergraduate degree.
- No more than 9 credits of the Power and Energy Undergraduate Certificate can be used as required courses in the student's major, minor, or other certificate. Courses used to satisfy the certificate can be used as electives (including technical electives) in a student's degree program.
- Courses applied to the Power and Energy Undergraduate Certificate cannot also be applied to the Power and Energy Graduate Certificate.
- The Power and Energy Undergraduate Certificate Director must approve the certificate curriculum for each student.

Power and Energy Undergraduate Certificate Curriculum

The structure of the certificate curriculum is shown below:

**Required Course (3 credits)**

EGR 240 Global Energy Issues ........................................... 3

**Core Elective (3 credits)**

Choose one of the following courses:

EGR 540 Power Economics and Public Policy .................. 3
EGR 542 Electric Power Generation Technologies .......... 3
EGR 546 Electric Power System Fundamentals ................. 3

**Power and Energy Electives (9 credits)**

Choose 9 credits from the approved list of Power and Energy Electives. The selected courses must be approved by the Director of the Power and Energy Undergraduate Certificate to ensure that the selections maintain a thematic consistency and fulfill the certificate breadth requirement. A partial list of approved power and energy courses is provided below. Additional courses will be added as they are approved for the power and energy certificate curriculum.

BAE 503 Fundamentals of Biorenewable Resource Engineering ........................................... 3
BAE 505 Thermochemical Processing of Biomass .......... 3
BAE/EE/EGR 543 Solar Cell Devices and Systems for Electrical Energy .................................... 3
BAE/ME 580 Heating, Ventilating and Air Conditioning ......................................................... 3

BAE/EE/EGR/ME/MFS 583 Industrial Energy Utilization and Assessment ................................... 3
CE 351 Introduction to Environmental Engineering .......... 3
CE 433 Railway Operations and Multi-Modal Transportation ...................................................... 3
CE 533 Railroad Facilities Design and Analysis ............... 3
CE/EGR 553 Environmental Consequences of Energy Production ............................................ 3
CHE 565 Environmental Chemistry ............................... 3
CME 425 Heat and Mass Transfer ................................. 3
CME 515 Air Pollution Control ................................... 3
CME 580 Design of Rate and Equilibrium Processes for Water Pollution Control ..................... 3
EE 415G Electromechanics ............................................ 3
EE 416G Energy Conversion Laboratory .................... 2
EE 503 Power Electronics ......................................... 3
EE 517 Advanced Electromechanics ............................ 3
EE 518 Electric Drives ............................................. 3
EGR 521 Renewable Energy ....................................... 3
EE 531 Alternative and Renewable Energy Systems ...... 3
EE 532 Smart Grid: Automation and Control of Power Systems .............................................. 3
EE 533 Advanced Power System Protection ................. 3
EE 533 Power System Generation, Operation and Control ...................................................... 3
EE 536 Power System Fault Analysis and Protection ....... 3
EE 537 Electric Power Systems I .................................. 3
EE 538 Electric Power Systems II ................................ 3
EE 539 Power Distribution Systems ............................ 3
EGR 540 Power Economics and Public Policy ............... 3
EGR/CME 542 Electric Power Generation Technologies ......................................................... 3
EE/EGR/CME 543 Solar Cell Devices and Systems for Electrical Energy .................................... 3
EGR/EE 546 Electric Power System Fundamentals ........ 3
EGR 549 Power and Energy Experiences .................... 3
ME 321 Engineering Thermodynamics II ..................... 3
ME 325 Elements of Heat Transfer ............................ 3
ME 515 Rotodynamics of Turbomachinery .................. 3
ME 530 Gas Dynamics ............................................ 3
ME 548 Aerodynamics of Turbomachinery .................. 3
ME 549 Power Generation ....................................... 3
ME 563 Basic Combustion Phenomena ....................... 3
MNG 511 Mine Power System Design....................... 3
MNG 575 Coal Preparation Design ......................... 3

Undergraduate Certificate in Production Engineering

The Production Engineering Certificate (PEC) encompasses development of students' experiences and knowledge, and the application of engineering and scientific principles, in automotive manufacturing. It enhances capstone senior design projects, promotes student understanding of key automotive production processes, and involves students in capstone projects that develop knowledge of problems in and potential solutions for automotive production process design. Design projects within the Core Courses are developed through proposals from industry or an engineering organization.

The program requires 12 credit hours minimum to be awarded the certificate, which includes 6 credit hours of capstone design and 6 credit hours of elective courses. However, students from departments or disciplines that do not have two semesters (6 credit hours) of capstone design courses can substitute ME 526 Lean Operations Management (a required prerequisite for the certificate) as an acceptable core course to meet the 6 credit hours requirements. For example, CME/MSE students whose capstone design course is only one semester (3 credit hours), ME 526 Lean Operations Management, can count for one of the core courses or they will be required to take three elective courses (9 credit hours) to satisfy the total of 12 credit hours required. Students from departments or disciplines that may be interested in the certificate but do not have capstone design as part of their degree requirements, their core course requirement will be assessed by the director on a case by case basis.

Admission Requirements

Students accepted for the PEC Program must be pursuing or have pursued an accredited university degree. For UK students, 24 credits completed and a minimum cumulative GPA of 2.5 are required; in the case of transfer students into UK, 24 credits completed and a minimum cumulative GPA of 2.5 are required from all other institutions.

Core Courses

ME 411 ME Capstone Design I or EE 490 ECE Capstone Design I ........................................... 3
ME 412 ME Capstone Design II or EE 491 ECE Capstone Design II ...................................... 3
MSE 480 Materials Design ......................................... 3

Electives

ME 416 Automotive Painting Technology .................... 3
EE 528 Automotive Body Welding ............................ 3
CME/MSE 552 Automotive Plastics .......................... 3
ME 418 Automotive Assembly and Quality Control ....... 3
ME/MFS 511 Machining of Materials and Applications ......... 3