School of Engineering

Dean: Jeffrey W. Holmes, MD, PhD
Associate Dean for Academic Affairs & Graduate Programs: Gregg M. Janowski, PhD
Associate Dean for Undergraduate Programs: Andrew Sullivan, MSCE, PE
Associate Dean for Research: Mark Banaszak Holl, PhD

The School of Engineering provides professional education in engineering through the Departments of Biomedical Engineering; Civil, Construction, and Environmental Engineering; Electrical and Computer Engineering; and Mechanical and Materials Engineering. The Bachelor of Science in Biomedical Engineering; Bachelor of Science in Civil Engineering; Bachelor of Science in Electrical Engineering; Bachelor of Science in Materials Engineering; and Bachelor of Science in Mechanical Engineering are accredited by the Engineering Accreditation Commission (EAC) of ABET. The Bachelor of Science in Engineering degree with a major in Engineering Design will seek accreditation from the Engineering Accreditation Commission of ABET as soon as it is eligible to do so.

Each undergraduate curriculum is comprised of four components: the Blazer Core as specified for engineering majors; mathematics and basic science courses; a series of engineering courses intended to provide a breadth of technical education; and concentrated study in a particular engineering discipline. The curricula are designed to prepare the graduate to practice the profession of engineering and effectively participate as a member of society. Additionally, the School of Engineering participates in UAB Teach.

At the graduate level, the School of Engineering offers programs of study leading to the Master of Science in Biomedical Engineering; the Master of Science in Civil Engineering; the Master of Science in Electrical and Computer Engineering; the Master of Science in Engineering Management; the Master of Science in Materials Engineering; and the Master of Science in Mechanical Engineering. A Master of Engineering degree is offered with concentrations in Advanced Safety Engineering and Management; Information Engineering Management; Structural Engineering; and Sustainable Smart Cities. A Master of Engineering in Construction Engineering Management is also offered. The Doctor of Philosophy degree in Biomedical Engineering, the Doctor of Philosophy degree in Mechanical Engineering, and the Doctor of Philosophy degree in Interdisciplinary Engineering are also offered. Joint Doctor of Philosophy degrees are offered in Civil Engineering (UAB and UAH), Materials/Metallurgical Engineering (UAB and UA), and Materials Science (UAB, UA, and UAH). A shared Doctor of Philosophy degree in Computer Engineering (UAB and UAH) is available. The Doctor of Philosophy in Neuroengineering is housed in the Schools of Engineering and Medicine.

In order to keep pace with accreditation standards as well as educational and technological developments, the School of Engineering reserves the right to make changes in its degree requirements. Changes may be applied to students already enrolled. In such cases, every effort will be made to give the student the benefit of the new educational program without imposing undue hardships.

Vision

To be nationally and internationally recognized as a top *research-oriented* School of Engineering: a first choice for a quality undergraduate and graduate education.

Mission

To create and apply knowledge for the benefit of society and to prepare engineering graduates to be immediately productive and able to adapt and to lead in a rapidly changing environment

Goals

- Provide an excellent educational experience for a community of highly capable students that reflect the diversity of our society
- Develop an education and research program that fosters the development of a community of scholars capable of defining and solving problems to benefit society
- Develop an internationally recognized research program focused in distinctive multi-disciplinary areas
- Develop extensive and mutually beneficial relationships that foster understanding, respect, and a sense of common responsibility
- Provide an environment where faculty and staff can achieve their full potential for the mutual benefit of the School and the individual

Pre-College Preparation

The recommended program of high school preparation for the study of engineering includes four units of English; four units of mathematics (including algebra, geometry, trigonometry, and calculus); four units of science (biology, chemistry, and physics are strongly recommended); and four units of social science (history, economics, government, etc.).

Admission to the School of Engineering

First-Term Freshmen

In addition to satisfying the general requirements for admission to UAB listed in the Undergraduate Catalog, admission to the majors of Biomedical Engineering, Civil Engineering, Electrical and Computer Engineering, Engineering Design, Materials Engineering, or Mechanical Engineering, requires an ACT Math sub score of 22 (or SAT equivalent) and high school GPA of 3.00. Students meeting these requirements who are undecided on an engineering major are admitted as Undeclared Engineering students.

Students with an ACT Math sub score lower than 22 (or SAT equivalent) and a high school GPA of 3.00 or higher who subsequently place into MA 105 Pre-Calculus Algebra or higher in the pre-calculus sequence can be admitted into their chosen major in the School of Engineering.

Students who do not meet the above criteria are admitted as Undeclared – Interest in Engineering students in the Vulcan Materials Academic Success Center.

Transfer Students, Re-Admitted Students, Post-Baccalaureate Students, and Change of Major

Students must have a minimum overall GPA of 2.20 and math placement in MA 105 Pre-Calculus Algebra or higher in the pre-calculus sequence to be admitted to the School of Engineering as Civil Engineering, Electrical and Computer Engineering, Engineering Design, Materials Engineering, or Mechanical Engineering. Students meeting these requirements who are undecided on an engineering major are admitted as Undeclared Engineering students. Readmitted students and students transferring into engineering from other schools/colleges at UAB must have a minimum institutional (UAB) GPA of 2.20.

To be admitted to the School of Engineering as Biomedical Engineering, students must have a minimum overall GPA of 3.00 and math placement in MA 105 Pre-Calculus Algebra or higher in the pre-calculus sequence. Students who meet the mathematics requirement with GPAs between 2.20 and 2.99 will be admitted as Undeclared Engineering. Readmitted students and students transferring into Biomedical Engineering from other schools/colleges at UAB must have a minimum institutional (UAB) GPA of 3.00.

Dual Degree Program Participants

Dual degree program participants from cooperating four-year institutions must provide the following information:

- A letter or email from the student acknowledging their participation in the Dual Degree Program and intent to complete an Engineering degree at UAB
- A letter from the cooperating institution stating that the student has successfully completed the general education requirements at that institution and will be awarded a degree from the institution upon completion of UAB Engineering requirements

Change of Major within the School of Engineering

Students changing majors within the School of Engineering should follow procedures outlined under Declaration of Major in this catalog. Students must meet the requirements listed previously.

Mandatory Academic Advising

To assure that students are progressing toward graduation, the School of Engineering advisors and faculty advisors provide academic advice and planning each term. During advising, students receive a registration access code (RAC) which will allow them to register for courses the following semester.

Students will be advised by School advisors until the following are met:

- Completion of MA 125 Calculus I and MA 126 Calculus II with a “C” or better
- Twenty-four hours earned at UAB
- Minimum UAB and cumulative GPAs of 2.20 (2.50 for Biomedical Engineering students)

Once the above are met, students will be advised by faculty advisors in their respective program.

Pre-Health Program Option

Any undergraduate program in engineering can be configured to satisfy pre-health requirements but requires additional coursework. Further information on pre-health program options can be obtained from Dr. MK Sewell-Loftin, Pre-Health Program Coordinator, at mksewellloftin@uab.edu.

Blazer Core as Specified for Engineering Majors

Students in the School of Engineering follow the UAB Blazer Core Curriculum with the following specifications:

- **Local Beginnings:** Engineering students are encouraged to take EGR 200 Introduction to Engineering.
- **Academic Foundations: Quantitative Literacy**: Engineering students are required to successfully complete MA 125 Calculus I.
- **Academic Foundations: Communicating in the Modern World:** Engineering students are required to successfully complete EGR 103 Computer Aided Graphics and Design.
- **Thinking Broadly: Scientific Inquiry:** Engineering students are required to successfully complete CH 115 General Chemistry I, CH 115R General Chemistry I Recitation, CH 116 General Chemistry I Laboratory, PH 221 General Physics I, PH 222 General Physics II, or other approved Scientific Inquiry course.
- **City as Classroom:** Engineering students are encouraged to take CE 280 Sustainable Cities .

Reasonable Progress

In addition to UAB’s Progress toward Degree policy, all students in the School of Engineering must continually make reasonable progress toward the completion of their academic programs, which is defined as the successful completion of two courses applicable to their engineering program within an academic year. Additionally, if an Undeclared Engineering student has not selected an engineering major within 64 hours, the student may be dismissed from the School of Engineering.

Transfer Credit

The School of Engineering follows the UAB policy for transfer credit with additional considerations.

The School may accept a course for engineering credit from a two-year community college if the following conditions are satisfied:

- The appropriate UAB program has reviewed the course syllabus and determined that it satisfies the key requirements of the equivalent UAB course in terms of content, rigor, and prerequisites;
- The course is equivalent to a freshman or sophomore-level engineering course at UAB. No junior or senior-level courses will be accepted;
- The two-year community college offers engineering courses in partnership with or under the supervision of an ABET-accredited four-year Engineering program.

Please note that engineering technology courses are generally not accepted for engineering credit.

Academic Warning, Probation, and Suspension

The School of Engineering follows the UAB Policy for Academic Warning, Probation, and Suspension. In addition, the School of Engineering advises the following to promote student success:

- Students on Academic Warning or Probation are advised to register for no more than four courses per term.
- Students in Biomedical Engineering should refer to the BME program overview in this catalog for program-specific requirements.

Graduation Requirements

In addition to satisfying the University's graduation requirements, all engineering students must earn a minimum of 128 semester hours in specified coursework and a minimum engineering grade point average

(GPA) of 2.00 to graduate. The engineering grade point average includes all engineering coursework applicable to the degree attempted at UAB (after applying the University's grade forgiveness policy, if applicable). BME students must also have an institutional GPA of 2.50 or higher and have earned a grade of C or better in all BME courses to graduate.

Minors

Students who declare minors in the School of Engineering must develop a program of study in consultation with an academic advisor within the Engineering Dean's Office. Students should exercise care in the selection of courses to meet the requirements of their major as well as concurrently satisfying prerequisite requirements for engineering courses.

Students majoring in engineering may not select a minor offered by their engineering discipline. See minors below for specific restrictions. Engineering majors may not minor in engineering science.

To satisfy the minor requirements, a minimum grade point average of 2.00 is required for all engineering coursework attempted for all programs. Transfer students wishing to earn a minor in engineering must earn at least nine (9) semester hours at UAB and earn a minimum GPA of 2.00 in UAB engineering courses attempted. Students who are not majoring in biomedical engineering but wish to enroll in 300- or 400-level BME courses must fulfill course prerequisites, have an institutional (UAB) GPA of at least 3.00, and be approved by the BME Undergraduate Program Director.

Minor in Applied Mechanics

Not available to Civil Engineering Students

Requirements		Hours
Grade Requirement		
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn at least nine (9) semester hours at UAB and earn a minimum GPA of 2.00 in UAB engineering courses attempted.		
Required Engineering Courses		**12**
CE 210	Statics	
CE 220	Mechanics of Solids	
CE 360	Structural Analysis	
ME 215	Dynamics	
Civil Engineering Electives		
Select three of the following courses:		9
CE 420	Advanced Mechanics	
CE 460	Structural Mechanics	
CE 461	Introduction to the Finite Element Method	
CE 462	Advanced Structural Analysis	
CE 464	Structural Dynamics	

Minor in Biomedical Engineering

Not available to Biomedical Engineering Students

Requirements		Hours
Grade Requirement		
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn at least nine (9) semester hours at UAB and earn a minimum GPA of 3.00 in UAB engineering courses attempted. Students who are not majoring in biomedical engineering but wish to enroll in 300- or 400-level BME courses must fulfill course prerequisites, have an institutional (UAB) GPA of at least 3.00, and be approved by the BME Undergraduate Program Director.		
Required Biomedical Engineering Courses		**4**
BME 210	Engineering in Biology	
BME 401	Undergraduate Biomedical Engineering Seminar	
Required Engineering Course		**1**
EGR 194	Engineering Explorations	
Biomedical Engineering Electives		**15**
Select three of the following courses:		
BME 310	Biomaterials	
BME 312	Biocomputing	
BME 313	Bioinstrumentation	
BME 333	Biomechanics of Solids	
BME 350	Biological Transport Phenomena	
BME 370	Integrated Physiology	
Select two of the following courses:		
BME 420	Implant-Tissue Interactions	
BME 423	Living Systems Analysis and Biostatistics	
BME 435	Tissue Engineering	
BME 443	Medical Image Processing	
BME 450	Computational Neuroscience	
BME 462	Cardiac Electrophysiology	
BME 471	Continuum Mechanics of Solids	
Total Hours		**20**

Minor in Civil Engineering

Not available to Civil Engineering Students

Requirements		Hours
Grade Requirement		
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn a minimum GPA of 2.00 in UAB engineering courses attempted.		
Required Civil Engineering Courses		**12**
CE 210	Statics	
CE 220	Mechanics of Solids	
CE 230	Plane Surveying	
CE 236	Environmental Engineering	
Civil Engineering Electives		**9**
Select three of the following courses:		
CE 332	Soil Engineering	
CE 345	Transportation Engineering	
CE 360	Structural Analysis	
CE 395	Engineering Economics	
CE 450	Structural Steel Design	
CE 453	Design of Wood Structures	
CE 455	Reinforced Concrete Design	
Total Hours		**21**

Minor in Electrical Engineering

Not available to Electrical Engineering Students

Requirements		Hours
Grade Requirement		
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn a minimum GPA of 2.00 in UAB engineering courses attempted.		
Required Electrical Engineering Courses		**20**
EE 210	Digital Logic	
EE 233	Engineering Programming Methods	

EE 300	Engineering Problem Solving II	
EE 314 & 314R	Electrical Circuits and Electrical Circuits Recitation	
EE 316 & 316L	Electrical Networks and Electrical Networks Laboratory	
EE 351 & 351L	Electronics and Electronics Laboratory	
Required Engineering Course		**3**
EGR 150	Computer Methods in Engineering	
Total Hours		**23**

Minor in Engineering Design

Not available to Engineering Design Students

Requirements		**Hours**
Grade Requirement		
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn at least nine (9) semester hours at UAB and earn a minimum GPA of 3.00 in UAB engineering courses attempted.		
Required Engineering Design Courses		**12**
EGR 117	Engineering Design & Innovation I: Design Thinking	
EGR 217	Engineering Design & Innovation II: Prototyping	
EGR 317	Engineering Design & Innovation III: Project Implementation	
ARS 280	Creativity and Imagination	
100-Level Art Studio Course: Choose One		**3**
ARS 100	Drawing: Observations and Perceptions	
ARS 101	Two-Dimensional Design Foundations	
ARS 102	Spatial Solutions	
200-Level Art Studio Course: Choose One		**3**
ARS 200	Beginning Drawing	
ARS 220	Beginning Sculpture	
ARS 240	Beginning Printmaking	
ARS 250	Beginning Graphic Design	
Total Hours		**18**

Minor in Engineering Science

Not Available to Engineering Students

Requirements		**Hours**
Grade Requirement		
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn at least nine (9) semester hours at UAB and earn a minimum GPA of 3.00 in UAB engineering courses attempted.		
Required Engineering Courses		**12**
CE 210	Statics	
EE 312	Electrical Systems	
ME 241 & 241R	Thermodynamics I and Thermodynamics Recitation	
MSE 280	Engineering Materials	
Required Introduction to Engineering Course(s)		**1**
EGR 194	Engineering Explorations	
Engineering Electives		**6**
Select two of the following courses:		
EE 210	Digital Logic	
ME 215 & 215R	Dynamics and Dynamics Recitation	
ME 321	Introduction to Fluid Mechanics	
MSE 281 & 281L	Physical Materials I and Physical Materials I Laboratory	
Total Hours		**19**

Minor in Engineering World Health

Requirements		**Hours**
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn at least nine (9) semester hours and a minimum GPA of 2.00 in UAB engineering courses attempted. Students who are not majoring in biomedical engineering but wish to enroll in 300- or 400-level BME courses must fulfill course prerequisites, have an institutional (UAB) GPA of at least 3.00, and be approved by the BME Undergraduate Program Director.		
Choose 3 of the following Engineering courses		**9**
BME 310	Biomaterials	
BME 312	Biocomputing	
BME 313	Bioinstrumentation	
CE 220	Mechanics of Solids	
CE 230	Plane Surveying	
CE 236	Environmental Engineering	
CE 337 & 337L	Hydraulics and Hydraulics Laboratory	
CE 430 & 430L	Water Supply/Drainage Design and Water Supply/Drainage Design Laboratory	
CE 433	Solid and Hazardous Wastes Management	
CE 434	Air Quality Modeling and Monitoring	
CE 446	Green Infrastructure and Transportation	
CE 447	Principles of Sustainable Development	
CE 480	Introduction to Water and Wastewater Treatment	
EE 305	Fundamentals of Electrical Engineering	
ME 251	Introduction to Thermal Sciences	
ME 302	Overview of Mechanical Components	
MSE 280	Engineering Materials	
MSE 350	Introduction to Materials	
Choose 3 of the following Public Health courses		**9**
GHS 429	Intensive Global Health Training - SIFAT	
PUH 201	Introduction to Public Health	
PUH 202	Introduction to Global Health	
PUH 302	Epidemiology	
PUH 220	Environmental Factors in Public Health	
PUH 250	Biostatistics	
PUH 321	Workplace Environment	
PUH 322	Environmental Justice and Ethics	
PUH 333	Food, Water, and Air	
PUH 421	Nature vs. Nurture: Genes, Environment and Health	
PUH 422	Fundamentals of Toxicology	
Total Hours		**18**

Minor in Environmental Engineering

Not available to Civil Engineering Students

Requirements		**Hours**
Grade Requirement		
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn at least nine (9) semester hours and a minimum GPA of 2.00 in UAB engineering courses attempted.		
Required Civil Engineering Courses		**12**

CE 236 & 236L	Environmental Engineering and Environmental Engineering Laboratory	
CE 337 & 337L	Hydraulics and Hydraulics Laboratory	
CE 430 & 430L	Water Supply/Drainage Design and Water Supply/Drainage Design Laboratory	
CE 480	Introduction to Water and Wastewater Treatment	
Civil Engineering Electives		**9**
Select three of the following courses:		
CE 344	Civil Engineering Analysis I	
CE 395	Engineering Economics	
CE 446	Green Infrastructure and Transportation	
CE 447	Principles of Sustainable Development	
CE 485	Engineering Hydrology	
Total Hours		**21**

Minor in Materials Engineering

Not available to Materials Engineering Students

Requirements		**Hours**
Grade Requirement		
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn at least nine (9) semester hours and a minimum GPA of 2.00 in UAB engineering courses attempted.		
Required Materials Engineering Courses		**20**
MSE 280	Engineering Materials	
MSE 281 & 281L	Physical Materials I and Physical Materials I Laboratory	
MSE 380	Thermodynamics of Materials	
MSE 381	Physical Materials II	
MSE 382	Mechanical Behavior of Materials	
MSE 465 & 465L	Characterization of Materials and Characterization of Materials Laboratory	
Materials Engineering Electives		**3**
Select one of the following courses:		
MSE 413	Composite Materials	
MSE 430 & 430L	Polymeric Materials and Polymeric Materials Laboratory	
MSE 464 & 464L	Metals and Alloys and Metals and Alloys Laboratory	
MSE 470 & 470L	Ceramic Materials and Ceramic Materials Laboratory	
Total Hours		**23**

Minor in Mechanical Engineering - Thermal Systems

Not available to Mechanical Engineering Students

Requirements		**Hours**
Grade Requirement		
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn at least nine (9) semester hours and a minimum GPA of 2.00 in UAB engineering courses attempted.		
Required Engineering Courses		**12**
ME 241 & 241R	Thermodynamics I and Thermodynamics Recitation	
ME 242	Thermodynamics II	
ME 321	Introduction to Fluid Mechanics	
ME 322	Introduction to Heat Transfer	
Mechanical Engineering Electives: Choose Three		**9**
ME 361	Thermo-Fluids Systems	
ME 411	Intermediate Fluid Mechanics	
ME 421	Introduction to Computational Fluid Dynamics Basics	
ME 445	Combustion	
ME 447	Internal Combustion Engines	
ME 454	Heating, Ventilating and Air Conditioning	
ME 455	Thermal-Fluid Systems Design	
Total Hours		**21**

Minor in Mechanical Engineering - Mechanical Systems

Not available to Mechanical Engineering Students

Requirements		**Hours**
Grade Requirement		
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn at least nine (9) semester hours and a minimum GPA of 2.00 in UAB engineering courses attempted.		
Required Engineering Courses		**15**
CE 210	Statics	
CE 220	Mechanics of Solids	
ME 215 & 215R	Dynamics and Dynamics Recitation	
ME 370	Kinematics and Dynamics of Machinery	
ME 371	Machine Design	
Engineering Electives		**6**
Select two of the following courses:		
ME 430	Vehicular Dynamics	
ME 431	Introduction to Vehicle Drive Systems Engineering	
ME 432	Introduction to Electric and Hybrid Vehicle Engineering	
ME 461 & 461L	Mechanical Systems and Mechanical Systems Laboratory	
ME 477	Systems Engineering	
ME 478	Automated Manufacturing	
ME 480	Instrumentation and Measurements	
ME 464	Introduction to Finite Element Method	
ME 475	Mechanical Vibrations	
MSE 401	Materials Processing	
Total Hours		**21**

Minor in Neuroengineering

Requirements		**Hours**
Grade Requirement		
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn at least nine (9) semester hours and a minimum GPA of 2.00 in UAB engineering courses attempted. Students who are not majoring in biomedical engineering but wish to enroll in 300- or 400-level BME courses must fulfill course prerequisites, have an institutional (UAB) GPA of at least 3.00, and be approved by the BME Undergraduate Program Director.		
Required Courses		**15**
EGR 150	Computer Methods in Engineering	
BME 312	Biocomputing	
BME 450	Computational Neuroscience	
NBL 355	Synapses, Neurons and Brains	
NBL 356	Mechanisms of Sensation, Movement & Cognition	
Select one of the following:		**3**

NBL 425	Methods in Human Neuroimaging	
NBL 454	Mind/Brain Course	
Total Hours		**18**

Minor in Software Engineering

Not available to Electrical Engineering Students

Requirements		**Hours**
Grade Requirement		
A minimum GPA of 2.00 is required for all engineering coursework. Transfer students must earn at least nine (9) semester hours and a minimum GPA of 2.00 in UAB engineering courses attempted.		
Required Electrical Engineering Courses		**16**
EE 210	Digital Logic	
EE 233	Engineering Programming Methods	
EE 333	Engineering Programming Using Objects	
EE 337 & 337L	Introduction to Microprocessors and Introduction to Microprocessors Laboratory	
EE 432	Introduction to Computer Networking	
Required Engineering Course		**3**
EGR 150	Computer Methods in Engineering	
Electrical Engineering Electives		
Select two of the following courses:		3
EE 433	Engineering Software Solutions	
EE 444	Real-Time Process & Protocols	
EE 447	Internet/Intranet Application Development	
EE 452	Digital Systems Design	
Total Hours		**22**

Honors in Engineering

Purpose

The honors programs are intended to enrich educational opportunities for talented students in the School of Engineering.

Benefits

Students who complete an engineering honors program will have earned nine credit hours in honors coursework. Honors research beyond the required six hours may be applied as graduate credit. Three credit hours of honors research may be applied as an undergraduate elective according to departmental policy. Students who complete an honors program in engineering with a minimum cumulative GPA of 3.0 will receive a bachelor's degree "with Honors" in addition to any University honors designations.

Eligibility

In order to be eligible to participate in Engineering honors programs, students must meet the following:

- Minimum institutional (UAB) GPA of 3.25 and minimum cumulative GPA of 3.00 (BME students must earn a minimum institutional (UAB) GPA and cumulative GPA of 3.75)
- Completion of MA 227 Calculus III or EGR 265 Math Tools for Engineering Problem Solving with a C or better
- Enrollment as a full-time UAB student for a minimum of one semester
- Program endorsement

Invitations are extended by the Dean's office.

Requirements

Honors programs require nine credit hours of honors coursework.

- Students enroll in EGR 301 Honors Research I, a one-hour course, during the fall term following acceptance into honors. Students participating in the Science and Technology Honors program are not required to take EGR 301.
- Students enroll in two one-hour seminars which can be taken at any time in their course of study.
- Students complete six hours of credit in program honors research.
- Individual programs may vary in the way credit is awarded. For information regarding program requirements, contact the appropriate honors coordinator listed below.

Contact

Honors Programs are offered by all undergraduate degree programs in the School of Engineering.

- Biomedical Engineering (Dr. (dfeldman@uab.edu) MK Sewell-Loftin (mksewellloftin@uab.edu))
- Civil Engineering (Dr. Chris Waldron (cwaldron@uab.edu))
- Electrical Engineering (Dr. Mohammad Haider)
- Engineering Design (Dr. Tim Wick)
- Materials Engineering (Dr. Manoj Mahapatra (mkmanoj@uab.edu))
- Mechanical Engineering (Dr. Pasquale Cinnella (pc1@uab.edu))

BME-Biomedical Engineering Courses

BME 011. Undergraduate Internship in BME. 0 Hours.
Engineering internship experience in preparation for the student's intended career. Students in a university recognized cooperative education experience should register for COP 011 or COP 012.

BME 210. Engineering in Biology. 3 Hours.
Application of engineering to the study of biology on the cellular and molecular level. Engineering solutions in genomics, proteomics, and nanotechnology to investigate cellular and molecular process.
Prerequisites: BY 123 [Min Grade: C]

BME 221. Clinical Innovation I. 3 Hours.
The goals of this class are to develop an understanding of the concept of clinical innovation and develop skills in written and oral communication of innovation in the context of a business proposal/presentation.

BME 289. Undergraduate Research in Biomedical Engineering I. 1 Hour.
Undergraduate research experiences in biomedical engineering. Must have sophomore standing.
Prerequisites: EGR 194 [Min Grade: C] or EGR 200 [Min Grade: C] or EGR 111 [Min Grade: C] or HC 111 [Min Grade: C] and (MA 125 [Min Grade: C] or MA 225 [Min Grade: C])

BME 310. Biomaterials. 3 Hours.
Introduction to wide range of materials used for biomedical applications. Physical, chemical and mechanical properties of biomaterials.
Prerequisites: MSE 280 [Min Grade: C] and BME 210 [Min Grade: C]

BME 311. Biomaterials for Non-Majors. 3 Hours.
Wide range of materials used for biomedical applications. Physical, chemical and mechanical properties of biomaterials.
Prerequisites: MSE 280 [Min Grade: C]

BME 312. Biocomputing. 3 Hours.
Introduction to computational techniques used in biomedical engineering.
Prerequisites: EGR 150 [Min Grade: C] and EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and MA 260 [Min Grade: C](Can be taken Concurrently)

BME 313. Bioinstrumentation. 3 Hours.
An introduction to instrumentation used to make biological and physiological measurements. Techniques include acquisition and analysis of bioelectric signals and instrument control.
Prerequisites: EE 312 [Min Grade: C] and (MA 227 [Min Grade: C] and MA 252 [Min Grade: C] or EGR 265 [Min Grade: C])

BME 333. Biomechanics of Solids. 3 Hours.
Application of mechanics of solids principles to biomedical engineering problems; stress-strain of bone, viscoelasticity and constitutive equations of tissues, mechanics of the cell, introduction to molecular mechanics.
Prerequisites: CE 210 [Min Grade: C] or EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and ME 215 [Min Grade: C](Can be taken Concurrently)

BME 350. Biological Transport Phenomena. 3 Hours.
Basic mechanisms and mathematical analysis of transport processes with biological and biomedical applications. Analysis of flow, transport and reaction processes for biological fluids and biological molecules with applications towards development of artificial organs, drug delivery systems and tissue engineering products.
Prerequisites: CE 210 [Min Grade: C] and EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and BME 210 [Min Grade: C] and BME 370 [Min Grade: C](Can be taken Concurrently) or BY 409 [Min Grade: C](Can be taken Concurrently) and ME 215 [Min Grade: C](Can be taken Concurrently)

BME 370. Integrated Physiology. 3 Hours.
Integrated Physiology will introduce undergraduate students to mathematical models of major physiological systems. Basic anatomy will be reviewed in pre-recorded videos to be watched prior to coming to synchronous lectures. Lectures will include discussions, derivations of relevant equations, and development of models to demonstrate understanding of biological systems. In-class activities will be used as means to provide interactive content that will be assessed via Assignments and Exams. The course will culminate in a final project where teams of students select a pathological condition and model it in Matlab, including comparing to normal conditions and with currently-available clinical interventions. Open to junior and senior level Biomedical Engineering students.
Prerequisites: EGR 150 [Min Grade: C] and BME 210 [Min Grade: C]

BME 389. Undergraduate Research in Biomedical Engineering II. 1-2 Hour.
Undergraduate research experiences in biomedical engineering.

BME 401. Undergraduate Biomedical Engineering Seminar. 1 Hour.
Undergraduate seminar.

BME 420. Implant-Tissue Interactions. 3 Hours.
An overview of implant biocompatibility including tissue histology, histopathology of implant response and the regulatory process for medical devices. Emphasis placed on ethical issues related to design, development, and implementation of biomedical implants. Ethics and Civic Responsibility are significant components of this course.
Prerequisites: BME 310 [Min Grade: C] or BME 311 [Min Grade: C]

BME 423. Living Systems Analysis and Biostatistics. 3 Hours.
Basic concepts and techniques of measurement processing and analysis of data from living systems. Statistics, analysis of variance and regression analysis. Emphasis is placed on data analysis and presentation of group projects.
Prerequisites: BME 312 [Min Grade: C]

BME 424. Current Topics in Stem Cell Engineering. 3 Hours.
Topics include stem cells, regenerative medicine, and tissue engineering using stem cells and stem cell derived cells. The role of stem cells in tissue growth and development, the theory behind the design and in vitro construction of tissue and organ replacements, and the applications of biomedical engineering principles to the treatment of tissue-specific diseases. Hands on experience on culturing and analyzing stem cells, stem cell differentiation, analysis of functional and physiological properties of differentiated cells, and fabricating basic engineered-tissues.
Prerequisites: BY 123 [Min Grade: C] and (BY 210 [Min Grade: C] or BY 212 [Min Grade: C] or BY 115 [Min Grade: C])

BME 435. Tissue Engineering. 3 Hours.
Principles underlying strategies for regenerative medicine such as stem-cell based therapy, scaffold design, proteins or genes delivery, roles of extracellular matrix, cell-materials interactions, angiogenesis, tissue transplantation, mechanical stimulus and nanotechnology.
Prerequisites: BME 310 [Min Grade: C] or BME 311 [Min Grade: C]

BME 443. Medical Image Processing. 3 Hours.
Fundamental topics of medical image processing to practical applications using conventional computer software.
Prerequisites: BME 312 [Min Grade: C](Can be taken Concurrently) and PH 222 [Min Grade: C]

BME 444. Machine Learning for Biomedical Engineering Applications. 3 Hours.
Introduction to the practical aspects of machine learning in simple biomedical engineering problems. The principle of machine learning 'thinking process' for the next machine learning – AI courses and more in-depth machine learning studies. Fundamental differences between Machine Learning and Data Mining. Fundamental theories in machine learning to be able to develop new machine learning techniques and research machine learning in biomedical engineering.
Prerequisites: EGR 150 [Min Grade: C]

BME 450. Computational Neuroscience. 3 Hours.
This course examines the computational principles used by the nervous system. Topics include: biophysics of axon and synapse, sensory coding (with an emphasis on vision and audition), planning and decision-making, and synthesis of motor responses. There will be an emphasis on systems approach throughout. Homework includes simulations.
Prerequisites: BME 312 [Min Grade: C]

BME 462. Cardiac Electrophysiology. 3 Hours.
Experimental and computational method associated with cardiac electrophysiology, ionic current, action potentials, electrical propagation, the electrocardiogram, electromechanical coupling, cardiac arrhythmias, effects of electric fields in cardiac tissue, defibrillation and ablation.
Prerequisites: BME 312 [Min Grade: C]

BME 465. Mechanobiology. 3 Hours.
The overall course objective is to develop understanding of mechanobiological processes in cells as they relate to both development and disease pathways, focusing on cancer and vascular biology. Students will learn molecular biology techniques for characterizing mechanobiology and cell phenotype, and describe biomechanical analysis protocols including micropipette aspiration, atomic force microscopy, traction force microscopy, and optical/magnetic tweezers. The course will include comprehensive literature reviews relevant to the subject area. Students will present formal presentations on articles discussing mechanobiology topics and prepare a written commentary article on a published journal article discussing a relevant mechanobiological project.

BME 471. Continuum Mechanics of Solids. 3 Hours.
Matrix and tensor mathematics, fundamentals of stress, momentum principles, Cauchy and Piola-Kirchoff stress tensors, static equilibrium, invariance, measures of strain, Lagrangian and Eulerian formulations, Green and Almansi strain, deformation gradient tensor, infinitesimal strain, constitutive equations, finite strain elasticity, strain energy methods, 2-D Elasticity, Airy Method, viscoelasticity, mechanical behavior of polymers.
Prerequisites: EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and (BME 333 [Min Grade: C] or CE 220 [Min Grade: C])

BME 489. Undergraduate Research in Biomedical Engineering III. 1-2 Hour.
Undergraduate research experiences in biomedical engineering. Must have senior standing.

BME 490. Special Topics in Biomedical Engineering. 1-3 Hour.
Special Topic in Biomedical Engineering.

BME 491. Individual Study in Biomedical Engineering. 1-6 Hour.
Individual Study in Biomedical Engineering.

BME 494. Honors Research I. 1-3 Hour.
Research experiences for undergraduates enrolled in the Biomedical Engineering Honors Program. The student will write a proposal and make an oral presentation to their thesis committee based on the proposal.
Prerequisites: EGR 301 [Min Grade: C] or STH 201 [Min Grade: C]

BME 495. Honors Research II. 1-3 Hour.
Research opportunities for undergraduate students in the Biomedical Engineering Honors Program. The student should write a thesis and make an oral presentation to their thesis committee defending the thesis.
Prerequisites: BME 494 [Min Grade: C]

BME 496. Biomedical Engineering Honors Seminar. 1 Hour.
Must be enrolled in an Honors Program.
Prerequisites: BY 123 [Min Grade: B] and BY 286 [Min Grade: B]

BME 498. Capstone Design I Product Development. 3 Hours.
Design and development of medical-products. Through experiential learning, students go through the early phases of engineering design innovation for medical products, starting with clinical immersion to determine a critical health-care need. Engineering students work in teams to develop design concepts, culminating in a written design proposal. Designs take into account client needs as well as legal, regulatory, and marketing requirements. Emphasis is placed on communication in both oral and written format to targeted audiences.
Prerequisites: (BME 310 [Min Grade: C] and BME 312 [Min Grade: C]) or (BME 310 [Min Grade: C] and BME 313 [Min Grade: C]) or (BME 310 [Min Grade: C] and BME 333 [Min Grade: C]) or (BME 310 [Min Grade: C] and BME 350 [Min Grade: C]) or (BME 312 [Min Grade: C] and BME 313 [Min Grade: C]) or (BME 312 [Min Grade: C] and BME 333 [Min Grade: C]) or (BME 312 [Min Grade: C] and BME 350 [Min Grade: C]) or (BME 313 [Min Grade: C] and BME 333 [Min Grade: C]) or (BME 313 [Min Grade: C] and BME 350 [Min Grade: C]) or (BME 333 [Min Grade: C] and BME 350 [Min Grade: C]) or BME 370 [Min Grade: C]

BME 499. Capstone Design II. 3 Hours.
Capstone design project; a continuation of BME 498. Through experiential learning, student teams complete the engineering design process for their client-based prototype incorporating engineering standards and realistic constraints. Student teams develop a functional prototype and a commercialization strategy based on a business model. Additional skills learned in this part of the design process include: project planning and scheduling, project execution and resource scheduling, communication of design, and interim and final design reviews. Emphasis is placed on communication of design and design justification in both an oral and written format to targeted audiences.
Prerequisites: BME 498 [Min Grade: C] and BME 310 [Min Grade: C] and BME 312 [Min Grade: C] and BME 313 [Min Grade: C] and BME 333 [Min Grade: C](Can be taken Concurrently) and BME 350 [Min Grade: C] (Can be taken Concurrently) and BME 423 [Min Grade: C](Can be taken Concurrently)

CE-Civil Engineering Courses

CE 011. Undergraduate Internship in CE. 0 Hours.
Engineering internship experience in preparation for the student's intended career. Students in a university recognized cooperative education experience should register for COP 011 or COP 012.

CE 200. Engineering Geology. 2 Hours.
Fundamentals and advanced topics of geology including plate tectonics, mineral formation, sedimentary / igneous / metamorphic rocks, structural deformations, weathering and erosion, groundwater migration, and slope stability.

CE 210. Statics. 3 Hours.
Newton's laws of motion. Scalar and vector quantities, vector algebra, and the concepts of position and moment vectors. Two-dimensional systems: forces, moments, couples, and resultants. Three-dimensional systems and equivalent force systems, free body diagrams, and equations of equilibrium. Construction of shear force and bending moment diagrams. Analysis of pin-connected beams, plane trusses, and frames: method of joints and method of sections. Friction and properties of surfaces. Center of mass, center of gravity, and area moment of inertia. Quantitative Literacy is a significant component of this course.
Prerequisites: (MA 126 [Min Grade: C] or MA 126 [Min Grade: P] or MA 226 [Min Grade: C]) and (PH 221 [Min Grade: C] or PH 221 [Min Grade: P])

CE 220. Mechanics of Solids. 3 Hours.
Variation of stress at a point. Equilibrium requirements and body force concepts. Variation of strain at a point. Stress-strain relationships. Stress transformation and Mohr's Circle for plane stress. Analysis of axially loaded bars, circular shafts in torsion, shear and bending of beams, and buckling of columns. Analysis of simple, statically determinate and indeterminate structures.
Prerequisites: CE 210 [Min Grade: C]

CE 221. Mechanics of Solids Laboratory. 1 Hour.
Standard tensile, torsion, bending, and column tests. Installation and applications of strain gages and rosettes. Measurement of forces, displacements, strains, and other variables. Writing is a significant component of this course.
Prerequisites: CE 220 [Min Grade: D](Can be taken Concurrently)

CE 222. Civil Engineering Materials Laboratory. 1 Hour.
Testing properties of construction materials such as cement, aggregate, concrete, and asphalt. Design of Portland cement concrete mixes. Writing is a significant component of this course.
Prerequisites: CE 220 [Min Grade: D](Can be taken Concurrently)

CE 230. Plane Surveying. 3 Hours.
Fundamental topics of surveying including care and use of surveying instruments, surveying methods, error theory, traversing, stadia, mapping techniques, circular and parabolic curves, areas, and volumes. CE 230L must be taken concurrently.
Prerequisites: MA 125 [Min Grade: C] or MA 225 [Min Grade: C]

CE 230L. Plane Surveying Laboratory. 0 Hours.
Principles of land measurement, the instruments and techniques used in surveying, theory of errors and mathematical precision in engineering analysis and design. Introduction to route surveying and the principles of horizontal and vertical curves. Companion to CE 230 and must be taken concurrently.

CE 236. Environmental Engineering. 3 Hours.
Introduction to environmental engineering principles. Air and water pollution, solid waste, quality of environment, environmental health, regulations and legal considerations, and ethics and civic responsibility. Design of testing protocols.
Prerequisites: MA 125 [Min Grade: C](Can be taken Concurrently) or MA 225 [Min Grade: C](Can be taken Concurrently) and CH 115 [Min Grade: C]

CE 236L. Environmental Engineering Laboratory. 0 Hours.
Laboratory equipment and methods. Chemical and physical tests to determine characteristics of water and wastewater. Companion lab to CE 236 and must be taken concurrently.

CE 280. Sustainable Cities. 3 Hours.
Students learn how the built environment affects a variety of quality-of-life factors, including the natural environment, personal health, and broader measures of community health and well-being. Classroom lectures are reinforced through field activities, data collection, and direct interaction with the Birmingham government and community organizations. Classes focus on built environment elements such as urban design, building materials, green building design, green spaces, transportation infrastructure, and advanced technologies. Each course offered under this proposal will requires a final project that combines course topics with data collection/activities conducted in Birmingham communities. This course meets Blazer Core City as Classroom requirement with a flag in Sustainability and Service Learning.

CE 332. Soil Engineering. 4 Hours.
Soil identification and properties, stress concepts, permeability settlement analysis, soil compaction, bearing capacity, shear strength of soil, and slope stability. CE 332L must be taken concurrently.
Prerequisites: CE 200 [Min Grade: D] and CE 220 [Min Grade: D]

CE 332L. Soil Engineering Laboratory. 0 Hours.
Soil classification, strength and shear tests, and permeability and consolidation tests. Companion to CE 332 and must be taken concurrently.

CE 337. Hydraulics. 3 Hours.
Fundamentals of hydraulics, fluids, and flow in pipe systems. Topics covered in fluid flow include hydrostatics, laws of fluid motion, kinematics, dynamics, energy balance, and dimensionless groups. Topics covered in pipe flow include incompressible flow, compressibility, pumps, viscosity, boundary layers, turbulence, and losses. The course includes appropriate laboratory experiments and computer applications.
Prerequisites: MA 126 [Min Grade: C] or MA 226 [Min Grade: C]

CE 337L. Hydraulics Laboratory. 0 Hours.
The laboratory exercises are designed to assist the student in the investigation of fluid properties, fluid statics, and application of flow measurement techniques, application of conservation laws of mass, momentum and energy, major and minor losses, and pipe networks. Companion lab to CE 337 and must be taken concurrently.

CE 344. Civil Engineering Analysis I. 3 Hours.
Inspection and treatment of data using exploratory data analysis. Descriptive statistics. Introduction to probability and commonly used distributions. Basic data analysis using regression analysis, hypothesis testing, and analysis of variance. Quantitative literacy is a significant component of this course.
Prerequisites: MA 126 [Min Grade: C] or MA 226 [Min Grade: C]

CE 345. Transportation Engineering. 3 Hours.
Principles of transportation engineering and urban transportation planning. Traffic flow characteristics, traffic control, capacity analysis of basic highway sections and intersections, geometric design, and travel demand forecasting.
Prerequisites: PH 221 [Min Grade: C]

CE 360. Structural Analysis. 3 Hours.
Reactions, shears, moments, and axial forces in determinate and indeterminate structures. Influence lines; moment area and energy methods of computing deflections; methods of truss and frame analysis. Computer applications.
Prerequisites: CE 210 [Min Grade: C]

CE 371. Engineering Communication. 2 Hours.
Introduces communication skills necessary for professional development. Topics include forms of technical writing and oral communication, report writing and organization, plan reading, professional practice, and ethics.
Prerequisites: EH 102 [Min Grade: D]

CE 395. Engineering Economics. 3 Hours.
Fundamental concepts of engineering economy. Introduction to cost and revenue estimating and cash flow analysis for engineering projects. Choosing between alternatives taking into account the time value of money, depreciation, inflation, income taxes and risk factors.
Prerequisites: MA 125 [Min Grade: C] or MA 225 [Min Grade: C]

CE 410. FE Review for Civil Engineers. 0 Hours.
Review concepts of the engineering core and civil engineering in preparation for the Fundamentals of Engineering (FE) exam.

CE 415. Building Information Modeling (BIM). 3 Hours.
Introduction to virtual design and construction using AutoCAD and Revit software. An emphasis is placed on the use of these tools and their practical applications to real world engineering and design projects. Students are provided with the software required to complete a multi-step project.
Prerequisites: EGR 103 [Min Grade: D] or ME 102 [Min Grade: D]

CE 420. Advanced Mechanics. 3 Hours.
Variation of stress at point including determination of principal and maximum shear stresses. Strain gages and rosettes. Failure theories. Inelastic stress-strain behavior of axially loaded bars. Torsion of noncircular sections and plastic torque. Curved beams. Elastic and plastic analysis for unsymmetrical bending. Shear center. Beams on elastic foundations.
Prerequisites: CE 220 [Min Grade: D]

CE 426. Foundation Engineering. 3 Hours.
Design of foundations including bearing capacity and settlement of spread footings, mats, single piles, and pile groups. Site investigation and evaluation of data from field and tests. Estimation of stresses in soil masses, lateral resistance of piles and pile groups. Design of retaining walls, sheet piles, and cofferdams.
Prerequisites: CE 332 [Min Grade: D] and CE 455 [Min Grade: D]

CE 430. Water Supply/Drainage Design. 3 Hours.
Water requirements; wastewater characteristics. Hydraulics and design of sewers; distribution and reuse of water. Development of water supplies; design considerations.
Prerequisites: CE 337 [Min Grade: C]

CE 430L. Water Supply/Drainage Design Laboratory. 0 Hours.
The laboratory exercises are designed to assist the student in the investigation of water supply and drainage design including the analysis of water networks, pipe network design, storm-water and sewer collection network design, flow path visualization, hydraulic jump, flow over weirs, channel design, and basin modeling. Companion lab to CE 430 and must be taken concurrently.

CE 431. Energy Resources. 3 Hours.
Overview of primary energy resources, including oil, natural gas, coal, nuclear, hydro, solar, geothermal, biomass, wind, and tidal. Resources are discussed in terms of supply, distribution, recovery and conversion, environmental impacts, economies, policy, and technology. Concepts and opportunities for energy conservation are examined, including electric power generation, transportation applications, and energy use in developing countries.
Prerequisites: CE 236 [Min Grade: D]

CE 433. Solid and Hazardous Wastes Management. 3 Hours.
Overview of waste characterizations, regulations, and management options. Fundamentals of landfill design, recycling, incineration, emerging disposal technologies, federal and state laws, hazardous waste treatment, and ultimate disposal of hazardous waste.
Prerequisites: CE 236 [Min Grade: D]

CE 434. Air Quality Modeling and Monitoring. 3 Hours.
Overview of atmospheric pollutant effects, reactions, and sources. Introduction to air dispersion modeling and ambient air quality monitoring.

Prerequisites: ME 251 [Min Grade: D]

CE 440. Civil Engineering Honors Research. 3 Hours.
Departmental honors students work closely with faculty researchers and graduate students in departmental concentration specialties to develop research skills. Enrollment is limited to undergraduate students enrolled in CCEE Departmental Honors Program.

CE 441. Civil Engineering Honors Seminar. 1 Hour.
Seminar focusing on student research and guest presentations of various topics of interest to civil and environmental engineering students.

CE 443. Pavement Design and Construction. 3 Hours.
Analysis of stresses and strains in pavement systems. Design and construction of flexible and rigid pavements, base courses, and subgrades. Effects of loading on pavement life.
Prerequisites: CE 345 [Min Grade: D]

CE 445. Engineering the Built Environment. 3 Hours.
This service learning course explores the effects the built environment has on urban function, connectivity, community health, and the well-being of its residents. Students work directly in local neighborhoods learning how to assess components of the built environment, including transportation, green spaces, lighting, and blight, and to estimate their impacts on community health and well-being. Students propose engineering solutions, develop cost estimates, assess potential benefits, and develop implementation plans. Registration restricted to Junior or Senior standing.

CE 446. Green Infrastructure and Transportation. 3 Hours.
Policy and technical issues related to sustainable transportation. Examines the concepts, viewpoints, and fundamentals essential for understanding sustainable transportation planning and the tools used to assess sustainability of transportation facilities and neighborhoods. Design options in support of green infrastructure and transportation, including livable street design and traffic calming applications. Registration restricted to Junior or Senior standing.

CE 447. Principles of Sustainable Development. 3 Hours.
Concepts, viewpoints, and fundamentals essential for understanding the urban sustainable development agenda. Review of basic earth sciences to better evaluate the impact of anthropogenic activities on the natural environment and how to minimize adverse future outcomes. Case studies of sustainable developments are used to illustrate the value, challenges, and limitations of this concept.
Prerequisites: CE 236 [Min Grade: D]

CE 450. Structural Steel Design. 3 Hours.
Tension members, columns, beams, and beam columns. Simple connections. Load Resistance Factor Design (LRFD) approaches.
Prerequisites: CE 220 [Min Grade: D] and CE 221 [Min Grade: D](Can be taken Concurrently) and CE 360 [Min Grade: C]

CE 453. Design of Wood Structures. 3 Hours.
Properties of structural wood materials, both sawn lumber and engineered wood materials. Design of wood structures including beams, columns, connections, roof diaphragms, and shear walls. The requirements of the National Design Specification for Wood Structures will be addressed.
Prerequisites: CE 220 [Min Grade: D] and CE 360 [Min Grade: C]

CE 454. Design of Masonry Structures. 3 Hours.
Design and detailing of masonry structures. Nomenclature, properties, and specifications for components. Design of assemblages, simple masonry structures, unreinforced and reinforced elements, and complex masonry structures.
Prerequisites: CE 220 [Min Grade: D] and CE 360 [Min Grade: C]

CE 455. Reinforced Concrete Design. 3 Hours.
Behavior, strength, and design of reinforced concrete structural members (beams, columns, one-way slabs, and continuous beams) subjected to moment, shear, and axial forces according to the American Concrete Institute Building Code Requirements for Structural Concrete (ACI 318). Crack control and serviceability considerations. Introduction to the design of reinforced concrete structures.
Prerequisites: CE 220 [Min Grade: D] and CE 2022 [Min Grade: D](Can be taken Concurrently) and CE 360 [Min Grade: C]

CE 456. Prestressed Concrete Design. 3 Hours.
Principles and concepts of design in prestressed concrete including elastic and ultimate strength analyses for flexural, shear, bond, and deflection. Principles of concordance and linear transformation for indeterminate prestressed structures.
Prerequisites: CE 455 [Min Grade: D]

CE 460. Structural Mechanics. 3 Hours.
Elastic beam deflections, beam columns, lateral torsional buckling, column stability, plastic design, plate bending, and yield line theory.
Prerequisites: CE 220 [Min Grade: D] and CE 360 [Min Grade: C]

CE 461. Introduction to the Finite Element Method. 3 Hours.
Concepts and applications of finite element method (FEM). Review of statics, equilibrium, compatibility, and constitutive relations. Direct stiffness method, principle of virtual work, concept of stiffness, and matrix methods: planar trusses, beams, and planar frames. Support settlements, three-dimensional systems; development and application of basic finite elements. Software use.
Prerequisites: CE 220 [Min Grade: D] and CE 360 [Min Grade: C]

CE 462. Advanced Structural Analysis. 3 Hours.
Analysis of indeterminate structures utilizing both classical and matrix methods. Use of computer structural analysis programs.
Prerequisites: CE 220 [Min Grade: D] and CE 360 [Min Grade: C]

CE 464. Structural Dynamics. 3 Hours.
Closed form and numerical solutions to single-degree-of-freedom structural models. Analysis of multistory frames. Response of single and multiple degree of freedom models to harmonic, periodic, impulse and arbitrary time-dependent loads. Computer applications and seismic analysis. Techniques of modal analysis.
Prerequisites: CE 220 [Min Grade: D] and CE 360 [Min Grade: C] and ME 215 [Min Grade: D]

CE 465. CE Construction Documents. 3 Hours.
Introduction to Civil Engineering design and construction documents including drawings, specifications, contracts, and testing reports. Overview of civil infrastructure and project types, including the civil engineer's role in the preparation, certification, and use of construction documents. Construction topics include measurement, quantity estimating, and engineering budgets.

CE 467. Wind and Seismic Loads. 3 Hours.
Methods for calculating loads on structures caused by extreme winds and earthquakes. Calculation of wind loads on various types of structures according to theory and codes. Determination of earthquake loads on structures using structural dynamics and codes.
Prerequisites: CE 220 [Min Grade: D] and CE 360 [Min Grade: C]

CE 468. Bridge Engineering. 3 Hours.
Bridge loads, steel beam bridges, composite beam bridges, bridge bearings, reinforced and prestressed concrete slab and T-beam bridges, bridge evaluations and ratings, and upgrade methodologies. Computer applications.
Prerequisites: CE 220 [Min Grade: D] and CE 360 [Min Grade: C]

CE 470. International Research Experience. 3 Hours.
The International Research Experience for Students (IRES) program provides the opportunity for undergraduate and graduate students to participate in hands-on engineering research in an international setting. Students perform research on an approved topic related to civil engineering design in an international environment. Students perform a detailed literature review and work with mentors from UAB and the international host institution to develop research objectives and a detailed research plan. The course will culminate in a 6-8 week visit to the international host institution, during which time students will conduct hands-on research with their mentors and prepare final reports.

CE 475. Construction Safety and Health Management. 3 Hours.
This course covers various causes of construction accidents and the adopted strategies to prevent worksite injuries and illnesses. Other topics covered include workers' compensation, OSHA standards for the construction industry, economics of construction safety management, temporary structures, system safety, ergonomic applications, health hazards, and the development of a safety program.
Prerequisites: CE 344 [Min Grade: D]

CE 480. Introduction to Water and Wastewater Treatment. 3 Hours.
Examination of chemical/biological unit processes for water and wastewater treatment. Design of wastewater treatment facilities and unit processes. Treatment and disposal of sludge.
Prerequisites: CE 236 [Min Grade: C]

CE 485. Engineering Hydrology. 3 Hours.
Hydrologic principles including the hydrologic cycle, precipitation data and stream-flow measurements. Applications to engineering problems: stream-flow analysis, and watershed management.
Prerequisites: CE 337 [Min Grade: C]

CE 489. Undergraduate Engineering Research. 0 Hours.
Undergraduate research experiences in civil, construction and/or environmental engineering.
Prerequisites: (EGR 194 [Min Grade: D] or EGR 111 [Min Grade: D]) or EGR 200 [Min Grade: D] or HC 111 [Min Grade: D] and MA 125 [Min Grade: C] or MA 225 [Min Grade: C] and PH 221 [Min Grade: C](Can be taken Concurrently)

CE 490. Special Topics in Civil Engineering. 1-3 Hour.
Special Topics in Civil Engineering.

CE 491. Individual Study in Civil Engineering. 1-6 Hour.
Individual Study in Civil Engineering.

CE 497. Construction Engineering Management. 3 Hours.
Study of construction management services including project planning, scheduling, estimating, budgeting, contract administration, agreements, and ethics. Emphasis is on the management of manpower, materials, money, and machinery.
Prerequisites: CE 395 [Min Grade: D]

CE 499. Capstone Design Project. 3 Hours.
Students work in teams to solve a complex engineering problem that incorporates real-world aspects of civil engineering design including structural, geotechnical, environmental, transportation, and construction management components. The course also includes lectures and assignments related to professionalism including engineering ethics, leadership, and management. Students must sit for the FE exam as part of course requirements. Normally taken during last term before graduation.
Prerequisites: CE 332 [Min Grade: D] and CE 337 [Min Grade: C] and CE 345 [Min Grade: D] and (CE 450 [Min Grade: D] or CE 455 [Min Grade: D]) and CE 430 [Min Grade: D](Can be taken Concurrently) and CE 497 [Min Grade: D](Can be taken Concurrently)

EE-Electrical Computer Egr Courses

EE 011. Undergraduate Internship in EE. 0 Hours.
Engineering internship experience in preparation for the student's intended career. Students in a university-recognized cooperative education experience should register for COP 011 or COP 012.

EE 210. Digital Logic. 3 Hours.
This course introduces the basic principles of how computers do computations using digital components. Topics include: the number systems, Boolean algebra, circuit minimization of multi-level logic, K-Maps, combinational and sequential logic circuit design, clocked latches, flip-flops, registers, and finite state machines. In-class lab.

EE 233. Engineering Programming Methods. 3 Hours.
This course covers fundamentals of computer programming including coding and design elements. Topics include: the software development method, logic and algorithm development, C language coding, debugging, documentation, file input and output, an introduction to data structures, development environments, and command line tools.
Prerequisites: EGR 150 [Min Grade: C]

EE 250. Engineering Problem Solving I. 3 Hours.
This course covers a broad spectrum of engineering applications using engineering algebra. The applications to data reduction, data fitting, circuit, signal, and image analysis are shown.

EE 254. Applied Numerical Methods. 3 Hours.
This course covers applications of numerical mathematical techniques and theories laid out in prior courses. Topics include: Euler's Method, numerical integration and differentiation methods, root finding methods, accuracy versus precision and its relationship to data storage and algorithm efficiency.
Prerequisites: EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and EGR 150 [Min Grade: C]

EE 300. Engineering Problem Solving II. 3 Hours.
This course covers fundamental mathematical background on complex functions, linear algebra, and the theory of probability and statistics which are indispensable in many electrical and computer engineering sub-fields such as signal and image processing, circuit design, and control systems.

Prerequisites: (MA 126 [Min Grade: C] or MA 226 [Min Grade: C])

EE 305. Fundamentals of Electrical Engineering. 3 Hours.
This course provides a survey of topics fundamental to the field of electrical engineering. For non-engineering majors. Not available for credit toward engineering major.
Prerequisites: MA 109 [Min Grade: C]

EE 312. Electrical Systems. 3 Hours.
This course introduces how electrical circuits work and how to analyze them. Topics include: introduction to DC circuit analysis, AC steady-state analysis, first-order transient analysis, ideal transformers, and electrical safety. For non-EE majors.
Prerequisites: MA 126 [Min Grade: C] or MA 226 [Min Grade: C]

EE 314. Electrical Circuits. 3 Hours.
This course covers electrical circuits and their analysis. Topics include: DC circuit analysis, AC steady-state analysis, first-order transient analysis, and electrical safety. For EE Majors.
Prerequisites: (MA 126 [Min Grade: C] or MA 226 [Min Grade: C])

EE 314R. Electrical Circuits Recitation. 0 Hours.
A problem-solving course designed to reinforce concepts in EE 314.

EE 316. Electrical Networks. 4 Hours.
This course expands the Electrical Circuits course with advanced circuits and teaches how to report the results of experiments (emphasis on quantitative literacy). Topics include: Analysis of circuits using classical differential/integral techniques; Laplace transforms; Two-port network parameters; Ideal operational amplifiers; and circuit solutions using simulation.
Prerequisites: EE 314 [Min Grade: D] and EH 101 [Min Grade: C] and (MA 126 [Min Grade: C] or MA 226 [Min Grade: C])

EE 316L. Electrical Networks Laboratory. 0 Hours.
Electrical Networks laboratory component.

EE 318. Signals and Systems. 3 Hours.
This course provides fundamental mathematical background for extraction of useful information from signals and for modeling dynamic systems in the frequency domain. Topics include: time-domain and frequency-domain methods for modeling and analyzing continuous-time and discrete-time signals and systems, Fourier, Laplace, and Z transform methods.
Prerequisites: EE 300 [Min Grade: D] and EE 314 [Min Grade: D]

EE 333. Engineering Programming Using Objects. 3 Hours.
This course covers object-oriented thinking and applies it to creating software for engineering applications. Topics include: objected-oriented design and programming in an object-oriented language, graphical user interface framework, project management skills, written and oral communication, teamwork, and introduction to ethics and intellectual property issues.
Prerequisites: EE 233 [Min Grade: D]

EE 337. Introduction to Microprocessors. 4 Hours.
This course covers computer hardware, interfaces, and programming in assembly and C languages with applications of microcomputers to engineering problems, such as data acquisition and control. Topics include: CPU architecture, assembly language, and input/output interfacing.
Prerequisites: EE 210 [Min Grade: C] and EE 233 [Min Grade: D]

EE 337L. Introduction to Microprocessors Laboratory. 0 Hours.
Introduction to Microprocessors laboratory component.

EE 341. Electromagnetics. 3 Hours.
This course introduces mathematical techniques used to solve problems in antenna design, high-frequency circuit design, and communications. Topics include: Maxwell equations, dynamic and static problems, electromagnetic wave propagation.
Prerequisites: EGR 265 [Min Grade: C](Can be taken Concurrently) or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C])

EE 351. Electronics. 4 Hours.
This course covers fundamentals of solid-state electronics, PN junction diode and diode circuits, bipolar junction transistor (BJT) and field-effect transistor (FET) properties, biasing, frequency response, amplifier configurations, single and multistage amplifier circuits. Students will work on projects in areas such as Internet-of-Things (IoT), and sensor instrumentation.
Prerequisites: EE 316 [Min Grade: C]

EE 351L. Electronics Laboratory. 0 Hours.
Electronics laboratory component.

EE 361. Machinery I. 4 Hours.
This course covers single and multi-phase electrical machines with an introduction to industrial applications. Topics include: fundamentals and applications of polyphase circuits; magnetic circuits; transformers; polyphase synchronous and asynchronous machines.
Prerequisites: EE 316 [Min Grade: C]

EE 361L. Machinery I Laboratory. 0 Hours.
Machinery I laboratory component.

EE 412. Practical Computer Vision. 3 Hours.
This course covers the fundamentals and applications of image analysis. Topics include: image preprocessing, detection, segmentation, classification and recognition, visual tracking, and deep learning.
Prerequisites: EE 318 [Min Grade: C]

EE 418. Wireless Communications. 3 Hours.
This course covers the principles and current applications of wireless technology. Topics include propagation models, modulation, multiple access, and channel and signal coding. Applications of wireless for cellular and Internet of Things (IoT) will also be covered.
Prerequisites: EE 316 [Min Grade: C]

EE 421. Communication Systems. 3 Hours.
This course covers the mathematics of modulation and demodulation of radio signals to transmit and receive information. It focuses on various forms of amplitude modulation (AM), phase and frequency modulation (FM). This course builds on mathematics from the signals and systems course to study how to represent and manipulate these signals in both the time and frequency domains. It also studies the effects of sampling, and how these systems operate in the presence of noise.
Prerequisites: EE 318 [Min Grade: C]

EE 423. Digital Signal Processing. 3 Hours.
This course covers the theory and practice of using computers to process and analyze signals. The topics include digital filter analysis and design; Fast Fourier Transform (FFT) algorithms; and applications of digital signal processing in engineering problems such as data acquisition and control.
Prerequisites: EE 318 [Min Grade: C]

EE 426. Control Systems. 3 Hours.
This course covers modeling and control of mechanisms or circuits to satisfy stability and performance criteria. Topics include: the theory of linear feedback control systems using complex frequency techniques, block diagram manipulation, performance measures, stability, analysis and design using root locus, and Z-transform methods.
Prerequisites: EE 318 [Min Grade: C]

EE 427. Industrial Control. 3 Hours.
This course covers power control devices and applications, relay logic and translation to other forms, programmable logic controllers (PLCs), proportional-integral-derivative (PID) and other methods for process control, modern laboratory instrumentation, and human-machine interface (HMI) software.
Prerequisites: EE 233 [Min Grade: C] and EE 318 [Min Grade: C] and EE 351 [Min Grade: C]

EE 431. Analog Integrated Electronics. 4 Hours.
This course covers advanced analysis and design using op-amps, differential amplifier, half-circuit analysis, error analysis and compensation. Applications include signal conditioning for instrumentation, instrumentation amplifiers, nonlinear and computational circuits, analog filter design, voltage regulator design, oscillators, and circuit configurations for A-to-D and D-to-A conversion methods. Laboratory exercises emphasize design techniques for projects in areas such as Internet-of-Things (IoT).
Prerequisites: EE 318 [Min Grade: C] and EE 351 [Min Grade: C]

EE 432. Introduction to Computer Networking. 3 Hours.
This course covers the fundamentals of modern computer networks including current applications such as the Internet of Things (IoT). Topics Include: hardware and software level network protocols, network architecture and topology including WANs and LANs, client-server relationships, distributed computing, data transfer, security, virtualization of hardware, multi-tier network configuration examples, and certifications will be addressed.
Prerequisites: EE 233 [Min Grade: C]

EE 433. Engineering Software Solutions. 3 Hours.
This course covers the fundamentals of software design, architecture, and implementation for future software engineers. Topics include customer-focused requirements gathering, project planning, team tools, architectural patterns, environment and component selection, quality assurance, sustainability, versioning. Various development methodologies are discussed with a project demonstrating at least one release cycle.
Prerequisites: EE 333 [Min Grade: C]

EE 434. Power Semiconductor Electronics. 3 Hours.
This course covers the fundamentals of power electronics such as principles of static power conversions, basic power converter architectures, power semiconductor switches, steady-state equivalent circuit modeling, DC transformer model, basic AC equivalent circuit modeling, linearization, and perturbation. Pulse width modulation and controller design, circuit design considerations, and applications of power electronics. The course project emphasizes computer-aided analysis and design of power electronic circuits.
Prerequisites: EE 316 [Min Grade: C] and EE 318 [Min Grade: D] and EE 351 [Min Grade: D]

EE 437. Introduction to Embedded Systems. 3 Hours.
This course provides an applied introduction to the design of embedded systems, including hardware and software aspects. Topics include: various embedded hardware platforms, interfacing industrial bus systems, sensors, actuators, low-power wireless communication, and the application of the Internet-of-Things (IoT).
Prerequisites: EE 314 [Min Grade: D] and EE 337 [Min Grade: D]

EE 438. Computer Architecture. 3 Hours.
Advanced microprocessor topics include a comparison of advanced contemporary microprocessors, cache design, pipelining, superscalar architecture, design of control units, microcoding, and parallel processors. Basic knowledge of microprocessors is recommended.
Prerequisites: EE 210 [Min Grade: C] and EE 233 [Min Grade: D] and EE 337 [Min Grade: D]

EE 444. Real-Time Process & Protocols. 3 Hours.
Hands-on laboratory course covering topics in real-time computer systems such as algorithms, state-machine implementations, communication protocols, instrumentation, and hardware interfaces.
Prerequisites: EE 233 [Min Grade: D] and EE 337 [Min Grade: D]

EE 447. Internet/Intranet Application Development. 3 Hours.
This course covers the development of software models and applications using Internet/Intranet technologies. Topics include web client-server relationships, multi-tier design models, scripting and validation, basic TCP/IP networking, separation of concerns, markup and data description languages. Projects will allow the opportunity for the use of a range of tools and development platforms.
Prerequisites: EE 233 [Min Grade: C]

EE 448. Software Engineering Projects. 3 Hours.
This course covers practical applications of software engineering including the development of applications for the Internet of Things (IoT). Topics include requirements gathering, design matrices, environment selection, relevant architectural patterns, networking basics, databases, service endpoints, embedded systems selections and security. Projects with a software emphasis will be utilized to demonstrate the principles of IoT applications.
Prerequisites: EE 333 [Min Grade: C]

EE 452. Digital Systems Design. 3 Hours.
This course covers the design of customized complex digital systems using Field Programmable Gate Array (FPGA) based platforms, using modern design tools for simulation, synthesis, and implementation. Topics include hardware design and development languages such as Verilog or VHDL.
Prerequisites: EE 337 [Min Grade: C] and EE 351 [Min Grade: C]

EE 458. Medical Instrumentation. 3 Hours.
This course covers the fundamental operating principles, applications, safety, and design of electronic instrumentation used in the measurement of physiological parameters.
Prerequisites: EE 351 [Min Grade: C]

EE 461. Machinery II. 3 Hours.
Physical principles of DC machines. Mathematical analysis of generator designs using equivalent circuits and magnetization curves. Calculation of motor speed, torque, power, efficiency, and starting requirements. Solid-state speed control systems.
Prerequisites: EE 361 [Min Grade: D]

EE 463. Medical Image Analysis. 3 Hours.
A lab-based introduction to processing, analysis, and display techniques for medical imaging.
Prerequisites: EE 318 [Min Grade: D]

EE 467. Brain Machine Interface. 3 Hours.
This course explores the brain-machine interfaces, particularly the technologies that directly stimulate and/or record neural activity. This course is divided into three major components: 1) neuroscience and electrode interfaces, 2) brain recording and stimulating front-end circuits, and 3) circuit modeling, simulation, and optimization.
Prerequisites: EE 233 [Min Grade: C] and EE 351 [Min Grade: C]

EE 471. Power Systems I. 3 Hours.
Components of power systems. Performance of modern interconnected power systems under normal and abnormal conditions. Calculation of inductive and capacitive reactances of three-phase transmission lines in a steady state.
Prerequisites: EE 361 [Min Grade: D]

EE 472. Power Systems II. 3 Hours.
Modeling of generators, transformers, and transmission lines for system studies. Introduction to symmetrical components. Calculation of short-circuit currents due to balanced and unbalanced faults. Determination of interrupting ratings of circuit breakers. Transient stability of power systems. Derivation of swing equation and solution by numerical method. Equal area criterion.
Prerequisites: EE 471 [Min Grade: D]

EE 473. Protective Relaying of Power Systems. 3 Hours.
Operating principles of protective relays. Protection of transmission lines, generators, motors, transformers, and buses.
Prerequisites: EE 361 [Min Grade: D]

EE 485. Engineering Operations. 3 Hours.
This course covers the principles and standards of engineering design from ideation to final design. Topics include product development process, problem definition and need identification, embodiment and detail design, design for specific criterion, modeling and cost evaluation. Emphasis is placed on ethics and civil responsibilities in design including environmental, and social issues, liability, sustainability, and reliability through the lens of engineering design.
Prerequisites: EE 312 [Min Grade: D] or EE 314 [Min Grade: D]

EE 489. Undergraduate Engineering Research. 1-3 Hour.
Undergraduate research experiences in electrical and computer engineering under faculty guidance.
Prerequisites: EGR 194 [Min Grade: D] or EGR 111 [Min Grade: D] or EGR 200 [Min Grade: D]

EE 490. Special Topics in Electrical Engineering. 1-3 Hour.
This course covers contemporary topics in Electrical Engineering selected by faculty.

EE 491. Individual Study in Electrical Engineering. 1-6 Hour.
Faculty-guided self-study of special topic in electrical and computer engineering.

EE 492. Honors Research I. 4 Hours.
Departmental honors students work closely with faculty to develop research skills.
Prerequisites: EGR 301 [Min Grade: C](Can be taken Concurrently)

EE 493. Honors Research II. 4 Hours.
Departmental honors students work closely with faculty to develop research skills.
Prerequisites: EGR 492 [Min Grade: C]

EE 498. Team Design Project I. 3 Hours.
This course is the first part of a two-semester team design project. The deliverables include detailed design, documentation, and project plan for completion in EE 499. Design projects are chosen from analog/digital systems, machine learning, embedded systems, signal processing, Internet of Things (IoT), and others. Course taken during the student's final year of the program.
Prerequisites: EE 333 [Min Grade: D] and EE 337 [Min Grade: D] and EE 351 [Min Grade: D](Can be taken Concurrently) and EE 485 [Min Grade: D](Can be taken Concurrently)

EE 499. Team Design Project II. 3 Hours.
This course is the second part of a two-semester team design project focusing on project implementation. Teams are required to complete a written design report and a final oral and poster presentation. Course is taken the during the student's final year of the program, in the term immediately after successfully completing EE 498.
Prerequisites: EE 498 [Min Grade: C]

EGR-Engineering Courses

EGR 010. Internship Readiness. 0 Hours.
This course will prepare you for internships and other experiential learning opportunities as well as future career goals. Our focus will be on developing the skills needed to succeed professionally and to execute a successful job search. Students will gain an understanding of networking, career management, strategic job searching, and interview fundamentals. All activities, exercises, and assigned materials are designed to help you succeed as a job seeker. This course complements other undergraduate coursework as well as opportunities offered by Engineering Career Services. Internship readiness course for first-semester sophomore students or transfer students seeking internship, co-op, or research placement.

EGR 011. Undergraduate Internship in Engineering. 0 Hours.
Engineering internship experience in preparation for the student's intended career. Students in a university recognized cooperative education experience should register for COP 011 or COP 012.

EGR 102. Engineering LLC Seminar. 0 Hours.
The Engineering Living Learning Community (LLC) is designed to strengthen students' first year of college while fostering a sense of community. The living-learning community extends learning from the classroom into the residence hall where students participate in structured programs built around academics, common interests, and shared goals. This program will provide scholars with a solid foundation for the successful completion of an engineering degree. Programming within the LLC is a partnership between the Office of Student Housing and Residence Life and the UAB School of Engineering.

EGR 103. Computer Aided Graphics and Design. 3 Hours.
Basic concepts in technical sketching, computer-aided drawing and design, projections, sections, and dimensioning. This course satisfies Blazer Core Communicating in the Modern World.
Prerequisites: MA 105 [Min Grade: C](Can be taken Concurrently) or MA 106 [Min Grade: C](Can be taken Concurrently) or MA 107 [Min Grade: C](Can be taken Concurrently) or MA 125 [Min Grade: C](Can be taken Concurrently)

EGR 117. Engineering Design & Innovation I: Design Thinking. 3 Hours.
The ability to innovate is an essential skill that drives existing economies, creates new markets, and generates new jobs. In this class, student teams engineer a device, app, product or system using Design Thinking to iterate a solution to a client's real-world problem. Throughout the course, students develop problem solving, critical thinking, team building, client management, communication, and presentation skills that improve their confidence and career-readiness. By the end of the course, each team will be able to succinctly articulate and defend the team's design concept and prototype invention in the form of an 'investment pitch.' This course is approved for the Blazer Core Curriculum Communicating in the Modern World.
Prerequisites: MA 106 [Min Grade: C](Can be taken Concurrently) and (EGR 110 [Min Grade: C] or EGR 200 [Min Grade: C](Can be taken Concurrently)

EGR 150. Computer Methods in Engineering. 3 Hours.
An introduction to engineering computation using MATLAB language and Excel. Basic programming skills using built-in functions are emphasized. Generation and manipulation of matrices, operations on matrices, plotting, and iterations calculations. If/else and other logical constructs, and data input/output are covered. Engineering applications are used throughout the course.
Prerequisites: (MA 125 [Min Grade: C] or MA 225 [Min Grade: C])

EGR 194. Engineering Explorations. 1 Hour.
The objective of this course is to explore engineering specialties, engineering ethics, career preparation, and the industries in which engineers work. May include lab tours, guest speakers, and lab activities.
Prerequisites: MA 102 [Min Grade: C] or MA 105 [Min Grade: C] (Can be taken Concurrently) or MA 106 [Min Grade: C](Can be taken Concurrently) or MA 107 [Min Grade: C](Can be taken Concurrently) or MA 125 [Min Grade: C](Can be taken Concurrently) or MA 225 [Min Grade: C](Can be taken Concurrently)

EGR 200. Introduction to Engineering. 3 Hours.
Introduction to the profession of engineering, ethics and safety, engineering specialties, career opportunities, educational requirements, and student success strategies; introduction to teamwork, technical communication, and present and future societal demands on the profession. This course satisfies Blazer Core Local Beginnings requirement with flags in Collaborative Assignments & Projects and First Year Experience.
Prerequisites: (MA 102 [Min Grade: C] or MA 105 [Min Grade: C] (Can be taken Concurrently) or MA 106 [Min Grade: C](Can be taken Concurrently) or MA 107 [Min Grade: C](Can be taken Concurrently) or MA 125 [Min Grade: C](Can be taken Concurrently) or MA 225 [Min Grade: C](Can be taken Concurrently)

EGR 217. Engineering Design & Innovation II: Prototyping. 3 Hours.
Students will learn how and when to use paper and other low-fidelity prototyping techniques as well as more advanced techniques such as 3D Printing, laser cutting, metal fabrication/welding, microcontroller programming, machining, and computer-aided design. These prototyping tools will be used to iteratively design, build and prototype a product or process that meets the client's design criteria and constraints using the principles of Design Thinking.
Prerequisites: EGR 117 [Min Grade: D] and (EGR 103 [Min Grade: D] or ME 102 [Min Grade: D])

EGR 265. Math Tools for Engineering Problem Solving. 4 Hours.
Designed to allow engineering majors to utilize the terminology and problem-solving approaches inherent to engineering, while completing their mathematical preparation.
Prerequisites: MA 126 [Min Grade: C] or MA 226 [Min Grade: C]

EGR 281. Project Lab I. 1-2 Hour.
Students work on a team to design and prototype a device, product, or app that solves a client's real-world problem.

EGR 301. Honors Research I. 1 Hour.
Introduces students to research methodology, ethics, data analysis, and technical communication. Students must be invited into program in order to enroll.
Prerequisites: (MA 227 [Min Grade: C] or EGR 265 [Min Grade: C])

EGR 317. Engineering Design & Innovation III: Project Implementation. 3 Hours.
In this course, students will use Design Thinking methodology to ideate and iterate a solution to a client's real-world problem considering safety, regulatory and other constraints as well as social, environmental, and economic factors. Students will learn to identify and address key issues related to project management and scheduling, engineering ethics, intellectual property management, business model development, and risk assessment and risk management.
Prerequisites: EGR 217 [Min Grade: D] and (EGR 265 [Min Grade: D] or MA 227 [Min Grade: D](Can be taken Concurrently) and (CE 210 [Min Grade: D] or EE 312 [Min Grade: D] or EE 314 [Min Grade: D] or MSE 280 [Min Grade: D])

EGR 375. Engineering Outreach. 0-3 Hours.
Outreach to community, K-12 students, and teachers to increase exposure to the engineering profession through hands-on projects. An emphasis will be placed on opportunities in STEM as well as its importance in everyday life.

EGR 381. Project Lab II. 1-2 Hour.
Students work on a team to design and prototype a device, product, or app that solves a client's real-world problem.

EGR 481. Interdisciplinary Project Lab. 1-3 Hour.
Multidisciplinary student teams (engineering, business, arts) engineer devices based on client needs. The project team will collaborate with the client to establish an appropriate engineering design to meet user needs. Students are trained in product development, product design, and engineering validation and will develop training and documentation market analysis, a business plan and a go-to-market strategy as appropriate for the project.

EGR 490. Special Topics in Engineering. 0-3 Hours.
Special Topics in Engineering.

EGR 491. Individual Study in Engineering. 1-6 Hour.
Individual Study in Engineering.

EGR 494. Undergraduate Honors Research in Engineering I. 1-3 Hour.
Research opportunities for undergraduate students in the Engineering Design Honors Program.
Prerequisites: EGR 301 [Min Grade: C] or STH 201 [Min Grade: C]

EGR 495. Undergraduate Honors Research in Engineering II. 1-3 Hour.
Research opportunities for undergraduate students in the Engineering Design Honors Program.
Prerequisites: EGR 494 [Min Grade: C]

EGR 498. Capstone Design I. 3 Hours.
Through experiential learning, students go through the early phases of engineering design innovation. Engineering students will work in multi-disciplinary teams to develop design concepts for both a client-based prototype and a commercializable version. Designs take into account client and user needs as well as legal, regulatory, and marketing requirements. Business ethics are also covered. Emphasis is placed on communication to targeted audiences in both oral and written formats.
Prerequisites: EGR 317 [Min Grade: D]

EGR 499. Capstone Design II. 3 Hours.
Capstone design project; a continuation of EGR 498. Through experiential learning, student teams complete the engineering design process for their client-based prototype incorporating engineering standards and realistic constraints. Student teams develop a business plan to present to potential business partners and product development teams from established companies. Additional skills learned in this part of the design process include: development of business proposals, project planning and scheduling, project execution and resource scheduling, communication of design, and interim and final design reviews. Emphasis is placed on communication of design and design justification in both an oral and written format to targeted audiences.
Prerequisites: EGR 498 [Min Grade: D]

ME-Mechanical Engineering Courses

ME 011. Undergraduate Internship in ME. 0 Hours.
Engineering internship experience in preparation for the student's intended career. Students in a university recognized cooperative education experience should register for COP 011 or COP 012.

ME 215. Dynamics. 3 Hours.
Kinematics of particles in Cartesian, cylindrical, and polar coordinates. Simple relative motion. Second law application in rectilinear translation. Projectile motion. Energy and momentum principles for particles and for rigid bodies in plane motion. Impact and conservation of linear momentum.
Prerequisites: CE 210 [Min Grade: C]

ME 215R. Dynamics Recitation. 0 Hours.
An application-based course designed to reinforce concepts from ME 215.

ME 241. Thermodynamics I. 3 Hours.
Thermodynamic definitions, properties of a pure substance, ideal, and real gases, work, and heat. Fundamental laws of thermodynamics, entropy, reversible cycles, and irreversibility.
Prerequisites: PH 221 [Min Grade: C] and (CH 115 [Min Grade: C] or CH 125 [Min Grade: C]) and MA 126 [Min Grade: C](Can be taken Concurrently) or MA 226 [Min Grade: C](Can be taken Concurrently)

ME 241R. Thermodynamics Recitation. 0 Hours.
An application-based course designed to reinforce concepts from ME 241.

ME 242. Thermodynamics II. 3 Hours.
Application of thermodynamic principles to engineering systems; vapor power cycles; gas turbine cycles; Otto and Diesel cycles; refrigeration cycles; mixtures of ideal gases; psychrometrics.
Prerequisites: ME 241 [Min Grade: D] and EGR 150 [Min Grade: D] and (MA 126 [Min Grade: C] or MA 226 [Min Grade: C])

ME 251. Introduction to Thermal Sciences. 2 Hours.
Introduction to thermodynamics and heat transfer for non-mechanical engineering majors.
Prerequisites: (MA 126 [Min Grade: C] or MA 226 [Min Grade: C]) and PH 221 [Min Grade: C]

ME 302. Overview of Mechanical Components. 3 Hours.
An introduction to statics, dynamics, strength of materials, and engineering design. Transformation of energy, thermodynamics, heat transfer, and fluid mechanics. For non-engineering majors. Not available for credit toward engineering major.

ME 321. Introduction to Fluid Mechanics. 3 Hours.
Fluid properties, fluid statics, fluid in motion (control volume method), pressure variation in flowing fluids (Bernoulli equation), principles of momentum and energy transport, dimensional analysis and similitude, internal flow and external flow.
Prerequisites: ME 241 [Min Grade: D] and (MA 227 [Min Grade: D] and MA 252 [Min Grade: D] or EGR 265 [Min Grade: D]) and CE 210 [Min Grade: D] and EGR 150 [Min Grade: D]

ME 322. Introduction to Heat Transfer. 3 Hours.
Fundamentals of heat transfer and their application to practical problems, including steady and transient heat conduction, external and internal forced convection, natural convection and radiation.
Prerequisites: ME 321 [Min Grade: D]

ME 360. Introduction to Mechatronic Systems Engineering. 3 Hours.
Control systems, feedback, and transfer function concepts. Laplace transform of mechatronic systems. Stability, steady state, and transient response. Systems modeling and analysis in time and frequency domain. Root locus and Nyquist Bode plots. Actuators, sensors, and controllers for various engineering applications. Fundamentals of mechanical and electrical/electronic component integration with controls and mechatronic system design.
Prerequisites: ME 215 [Min Grade: D] and ME 364 [Min Grade: D]

ME 361. Thermo-Fluids Systems. 3 Hours.
Pressure, temperature, fluid flow, and heat transfer instrumentation and their application to measurements of mass, heat, and momentum transport, flow characterization, heat engine and refrigeration cycles, and other thermal-fluids experiments. Experimental uncertainty analysis. Writing proficiency is required. ME 361L must be taken concurrently.
Prerequisites: ME 242 [Min Grade: D](Can be taken Concurrently) and ME 322 [Min Grade: D](Can be taken Concurrently)

ME 361L. Thermo-Fluids Systems Laboratory. 0 Hours.
Lab component for ME 361 Thermo-Fluids Systems. ME 361 must be taken concurrently.

ME 364. Linear Algebra and Numerical Methods. 3 Hours.
Linear equations and matrices, real vector bases, matrix decompositions, linear transformations; determinants, eigenvalues, eigenvectors; numerical methods for linear systems of equations, integration, ordinary differential equations; approximation, interpolation, least squares fits.
Prerequisites: (MA 227 [Min Grade: D] and MA 252 [Min Grade: D] or EGR 265 [Min Grade: D]) and EGR 150 [Min Grade: D]

ME 370. Kinematics and Dynamics of Machinery. 3 Hours.
Displacement, velocity and acceleration analysis, synthesis and design of linkages and mechanisms for various engineering applications on the basis of motion requirements. Static and dynamic force analysis of linkages, balancing of rotors and reciprocating machines. Significant consideration is given to designing geometry of gear sets: spur, helical, worm, and bevel gears. Analysis of planetary gear sets and drivetrains completes the course. Computer workshops support the learning process of main technical components.
Prerequisites: (EGR 103 [Min Grade: D] or ME 102 [Min Grade: D]) and ME 215 [Min Grade: D]

ME 371. Machine Design. 3 Hours.
Body stress, deflection and fatigue strength of machine components. Failure theories, safety factors and reliability, surface damage. Application to the design of gears, shafts, bearings, welded joints, threaded fasteners, belts and chains, keys, pins, springs, as well as mechanical design and selection of other machine components. Software applications, design projects, and exposure to hardware and systems are used to reinforce concepts.
Prerequisites: CE 220 [Min Grade: D] and EGR 150 [Min Grade: D] and ME 215 [Min Grade: D]

ME 411. Intermediate Fluid Mechanics. 3 Hours.
Applications of fluid dynamic principles to engineering flow problems such as turbo-machinery flow and one-dimensional compressible flow. Vorticity, potential flow, viscous flow, Navier-Stokes solutions, and boundary layers.
Prerequisites: ME 321 [Min Grade: D] and ME 364 [Min Grade: D]

ME 421. Introduction to Computational Fluid Dynamics Basics. 3 Hours.
Governing equations for fluid flows, classifications of flow regimes, and approaches to analyze fluid flow problems. Introduction to Computational Fluid Dynamics (CFD), mesh generation, boundary conditions, numerical solution of equations governing fluid flows, and visualization. Hands-on exercises using a commercial CFD solver.
Prerequisites: ME 321 [Min Grade: D]

ME 430. Vehicular Dynamics. 3 Hours.
Introduction to the fundamentals of mechanics and analytical methods for modeling vehicle dynamics and performance. Topics include tire-road interaction modeling, vehicle longitudinal dynamics and traction performance, lateral dynamics, handling, stability of motion and rollover, as well as contribution of the drivetrain system, steering system and suspension configurations to the dynamics of a vehicle. Software applications, projects, and exposure to hardware and systems are used to reinforce concepts.
Prerequisites: ME 215 [Min Grade: D]

ME 431. Introduction to Vehicle Drive Systems Engineering. 3 Hours.
Engineering fundamentals of mechanical and mechatronic, hybrid-electric, and electric drive systems. Applications to passenger cars and commercial vehicles. Drive system and component design, including main clutches and torque converters, transmissions, transfer cases, and drive axles. Introduction to plug-in hybrid-electric vehicles.
Prerequisites: ME 215 [Min Grade: D] and ME 370 [Min Grade: D](Can be taken Concurrently)

ME 432. Introduction to Electric and Hybrid Vehicle Engineering. 3 Hours.
Introduction to fully electric and hybrid vehicle engineering. Mechatronic system and component design. Batteries and energy storage devices. Plug-in hybrid electric vehicles.
Prerequisites: ME 215 [Min Grade: D] and ME 360 [Min Grade: D](Can be taken Concurrently)

ME 445. Combustion. 3 Hours.
Evaluation of the impact of fuel characteristics and operating conditions on the performance of coal-fired electric utility steam-raising plant and the prospects for continued reliance on coal as fuel for electric power generation. The phenomena emphasized are the behavior of turbulent jets; ignition, devolatilization and combustion of coal particles; radiative heat transfer and the effect of ash deposits on heat transfer; formation of air pollutants and their removal from combustion products; integrated gasification combined cycle; and capture and sequestration of carbon dioxide.
Prerequisites: ME 242 [Min Grade: D] and ME 322 [Min Grade: D]

ME 447. Internal Combustion Engines. 3 Hours.
Fundamentals of reciprocating internal combustion engines: engine types, engine components, engine design and operating parameters, thermochemistry of fuel-air mixtures, properties of working fluids, ideal models of engine cycles, engine operating characteristics, gas-exchange processes, fuel metering, charge motion within the cylinder, combustion in spark-ignition and compression ignition engines.
Prerequisites: ME 215 [Min Grade: D] and ME 242 [Min Grade: D]

ME 454. Heating, Ventilating and Air Conditioning. 3 Hours.
Fundamentals and practice associated with heating, ventilating, and air conditioning; study of heat and moisture flow in structures, energy consumption, and design of practical systems.
Prerequisites: ME 242 [Min Grade: D] and ME 322 [Min Grade: D]

ME 455. Thermal-Fluid Systems Design. 3 Hours.
Comprehensive design problems requiring engineering decisions and code/Standard compliance. Emphasis on energy system components: piping networks, pumps, heat exchangers. Includes fluid transients and system modeling.
Prerequisites: ME 242 [Min Grade: D] and ME 322 [Min Grade: D]

ME 461. Mechanical Systems. 3 Hours.
This course concentrates on main technical principles and aspects of mechanical systems design. The course also provides fundamental knowledge on test equipment and experimental techniques for experimenting on main technical principles of mechanical design. This course discusses data acquisition systems and signal conditioning, and design of experiments. Writing proficiency is required. ME 461L must be taken concurrently.
Prerequisites: CE 220 [Min Grade: D] and ME 215 [Min Grade: D]

ME 461L. Mechanical Systems Laboratory. 0 Hours.
Lab Component of ME 461 Mechanical Systems. ME 461 must be taken concurrently.

ME 464. Introduction to Finite Element Method. 3 Hours.
Concepts and applications of finite element method. Development and applications of basic elements used in engineering mechanics. Use of finite element analysis software. Application of finite element concept to several areas of mechanics.
Prerequisites: CE 220 [Min Grade: D] and ME 364 [Min Grade: D]

ME 475. Mechanical Vibrations. 3 Hours.
Development of equations of motion for free and forced single-degree-of-freedom (SDOF) systems. Multi-degree-of-freedom systems. Transient response, support motion and vibration isolation for SDOFs. Vibration absorbers, generalized mass and stiffness, orthogonality of normal modes, and root solving and Gauss elimination procedures. Cholesky decomposition and Jacobi diagonalization methods.
Prerequisites: (MA 227 [Min Grade: D] and MA 252 [Min Grade: D] or EGR 265 [Min Grade: D]) and ME 215 [Min Grade: D]

ME 477. Systems Engineering. 3 Hours.
Exposure to the field of systems engineering, mission design, requirements development, trade studies, project life cycle, system hierarchy, risk analysis, cost analysis, team organization, design fundamentals, work ethics, compare and evaluate engineering alternatives, systems thinking. Registration is restricted to junior or higher standing.

ME 478. Automated Manufacturing. 3 Hours.
Introduction to automated manufacturing technology. Components of automated systems (controllers, sensors and actuators) and automated manufacturing sub-systems (3D printer, CNC, robot and computer vision) will be studied in a lecture\lab environment with hands on activities.
Prerequisites: (EGR 103 [Min Grade: D] or ME 102 [Min Grade: D]) and EGR 150 [Min Grade: D]

ME 480. Instrumentation and Measurements. 3 Hours.
Thorough exploration of fundamental measurement concepts and techniques for data acquisition and validation. Explanation of important selection criteria for the identification and configuration of commercially available data acquisition devices. Students will get hands-on experience following best practices for data acquisition (high speed vs low speed) relevant to their field of study or career. Many types of sensors, their underlying technology, and measurement techniques will be discussed (i.e. accelerometers, load cells, Digital Image Correlation, etc.) to demonstrate best practices for sensor selection for a wide range of specialized applications. Registration is restricted to junior or higher standing.

ME 489. Undergraduate Research in Mechanical Engineering. 1-6 Hour.
Undergraduate research experiences in mechanical engineering.
Prerequisites: (EGR 194 [Min Grade: D] or EGR 200 [Min Grade: D] or HC 111 [Min Grade: D]) and (MA 125 [Min Grade: C] or MA 225 [Min Grade: C]) and PH 221 [Min Grade: C](Can be taken Concurrently)

ME 490. Special Topics in Mechanical Engineering. 1-3 Hour.
Special Topics in Mechanical Engineering.

ME 491. Individual Study in Mechanical Engineering. 1-6 Hour.
Individual Study in Mechanical Engineering.

ME 496. Honors Research. 1-6 Hour.
Research opportunities for undergraduate students in the Mechanical Engineering Honors Program.
Prerequisites: EGR 301 [Min Grade: C]

ME 498. Capstone Design Project I. 3 Hours.
Capstone design project: interdisciplinary design teams, ethics, materials selection, design process, development of proposal, project planning and scheduling, project execution and resource scheduling, and communication of design.
Prerequisites: (ME 322 [Min Grade: D] and ME 360 [Min Grade: D]) or (ME 322 [Min Grade: D] and ME 370 [Min Grade: D]) or (ME 322 [Min Grade: D] and ME 371 [Min Grade: D]) or (ME 360 [Min Grade: D] and ME 370 [Min Grade: D]) or (ME 360 [Min Grade: D] and ME 371 [Min Grade: D]) or (ME 370 [Min Grade: D] and ME 371 [Min Grade: D]) and MSE 401 [Min Grade: D](Can be taken Concurrently)

ME 499. Capstone Design Project II. 3 Hours.
Continuation of ME 498. Capstone interim and final design reviews with written and oral reports. ME 498 must be taken the term immediately before ME 499.
Prerequisites: (ME 322 [Min Grade: D] or ME 360 [Min Grade: D] or ME 370 [Min Grade: D] or ME 371 [Min Grade: D]) and (ME 322 [Min Grade: D] or ME 360 [Min Grade: D] or ME 370 [Min Grade: D] or ME 371 [Min Grade: D]) and (ME 322 [Min Grade: D] or ME 360 [Min Grade: D] or ME 370 [Min Grade: D] or ME 371 [Min Grade: D]) and ME 498 [Min Grade: D]

MME-Materials and Mech Egr Courses

MME 494. Mechanical and Materials Seminar. 1 Hour.
Seminars by experts in areas of mechanical engineering, materials science and materials/metallurgical engineering will be conducted. The students will get a regular chance to listen and interact with industry engineers/scientists and academic professors outside of the class room experiences and get real-world connectivity in engineering applications.

MME 495. Mechanical and Materials Honors Seminar. 1 Hour.
Seminars by experts in areas of mechanical engineering, materials science and materials/metallurgical engineering will be conducted. The students will get a regular chance to listen and interact with industry engineers/scientists and academic professors outside of the class room experiences and get real-world connectivity in engineering applications.

MME 496. MME Honors Seminar. 1 Hour.
Seminars by experts in areas of mechanical engineering, materials science and materials/metallurgical engineering will be conducted. The students will get a regular chance to listen and interact with industry engineers/scientists and academic professors outside of the class room experiences and get real-world connectivity in engineering applications.

MSE-Material Science Egr Courses

MSE 011. Undergraduate Internship in MSE. 0 Hours.
Engineering internship experience in preparation for the student's intended career. Students in a university recognized cooperative education experience should register for COP 011 or COP 012.

MSE 280. Engineering Materials. 3 Hours.
Fundamentals of materials engineering, including terminology, mechanical testing and behavior, heat treating, and processing of metals, ceramics, polymers, and composites. Degradation of materials and criteria for materials selection. Course requires completion of 4 credits of Area III Science.

MSE 281. Physical Materials I. 4 Hours.
Structure of metals, ceramics and polymers; crystal bonding; phase diagrams, diffusion, dislocations and grain boundaries. Applications to the iron-carbon system, including heat treatment. MSE 281L must be taken concurrently.
Prerequisites: (MA 125 [Min Grade: C] or MA 225 [Min Grade: C]) and MSE 280 [Min Grade: C]

MSE 281L. Physical Materials I Laboratory. 0 Hours.
Laboratory component of MSE 281 and must be taken concurrently with MSE 281.

MSE 350. Introduction to Materials. 3 Hours.
Concepts and applications, crystal structure of materials, formation of microstructures, and selected structure-property relationships. Not available for credit toward engineering major. For non-engineering majors only.

MSE 380. Thermodynamics of Materials. 3 Hours.
First, second, and third laws of thermodynamics. Gibbs free energy, heat capacity, enthalpy, entropy, and relationships between thermodynamic functions. Free-energy versus composition relationships; behavior of ideal and non-ideal solutions; concept of thermodynamic activity of components in solution. Applications to materials systems.
Prerequisites: CH 117 [Min Grade: D] and CH 118 [Min Grade: D] and (MA 126 [Min Grade: C] or MA 226 [Min Grade: C]) and MSE 280 [Min Grade: D]

MSE 381. Physical Materials II. 3 Hours.
Microstructural changes in response to temperature and time; vacancies, annealing, diffusion, nucleation and growth kinetics. Equilibrium and non-equilibrium microstructures. Applications to precipitation hardening and solidification of metals.
Prerequisites: MSE 281 [Min Grade: D]

MSE 382. Mechanical Behavior of Materials. 3 Hours.
Microscopic deformation mechanisms in materials leading to macroscopic properties of fatigue; creep; ductile, transitional, and brittle fracture; friction; and wear. CE 220 (Mechanics of Solids) is recommended as a prerequisite for this course.
Prerequisites: MSE 281 [Min Grade: D]

MSE 401. Materials Processing. 3 Hours.
Processing of metals, ceramics, polymers, and composites. Casting, forging, rolling, welding, powder processing, 3D printing, compression molding, and other advanced methods. Ethics and Civic Responsibility are significant components of this course.
Prerequisites: MSE 280 [Min Grade: D] or BME 333 [Min Grade: D] or CE 220 [Min Grade: D]

MSE 405. Frontiers of Automotive Materials. 3 Hours.
Advanced lightweight automotive materials, manufacturing and modeling techniques. Technology advancements in cost-effective carbon, glass and related reinforcements; "green" and sustainable materials, crashworthiness and injury protection of occupants and pedestrians, metal castings, heavy truck, mass transit, fuel cell and hybrid vehicles.
Prerequisites: MSE 281 [Min Grade: D]

MSE 408. Nanobiomaterials. 3 Hours.
Basic tools of nanotechnology, building blocks of nanostructured materials. Behavior of materials with nanoscale structures and their technological applications, including automotive, medical, and electronic applications. Introduction to biomaterials and nanobiomaterials, concepts in tissue engineering with special focus on nanoscaffolds for tissue engineering, nanoparticles in drug delivery and safety and toxicity of nanomaterials.
Prerequisites: MSE 280 [Min Grade: D]

MSE 409. Principles of Metal Casting. 3 Hours.
Engineering theory and practice on the production of cast ferrous (gray iron, ductile iron, steel) and non-ferrous metals (brass, bronze, aluminum). Producer requirements/responsibilities such as part and mold design, material specifications, and testing requirements are discussed. Laboratory on common testing and production methods and analysis and handling techniques required to produce high quality castings.
Prerequisites: MSE 280 [Min Grade: D]

MSE 409L. Principles of Metal Casting Laboratory. 0 Hours.
Laboratory component of MSE 409 and must be taken concurrently with MSE 409.

MSE 413. Composite Materials. 3 Hours.
Processing, structure, and properties of metal-, ceramic-, and polymer-matrix composite materials. Roles of interfacial bond strength, reinforcement type and orientation, and matrix selection in physical and mechanical properties of composite materials. MSE 382 (Mechanical Behavior of Materials) is recommended as a prerequisite for this course. Writing is a significant component of this course.
Prerequisites: MSE 281 [Min Grade: D]

MSE 425. Statistics and Quality. 3 Hours.
This course is arranged to reflect the sequential steps an engineer or scientist take to assess process capability and implement process improvement studies. There is a focus on connecting the theoretical equations to practical examples as well as interpreting and communicating of statistical results.
Prerequisites: MSE 281 [Min Grade: D]

MSE 430. Polymeric Materials. 3 Hours.
Processing methods, structure/engineering/property relationships, and applications of polymeric materials.
Prerequisites: MSE 281 [Min Grade: D] and (CH 117 [Min Grade: D] or CH 127 [Min Grade: D]) and (CH 118 [Min Grade: D] or CH 128 [Min Grade: D])

MSE 430L. Polymeric Materials Laboratory. 0 Hours.
Laboratory component of MSE 430 and must be taken concurrently with MSE 430.

MSE 433. Nondestructive Evaluation of Materials. 3 Hours.
This course reviews the principles, history, applications, and strengths/weaknesses of the five primary NDE techniques (RT, UT, EC, MP, and LP) with an emphasis on the fundamentals and techniques of each testing method. Importance of NDE on part performance and engineering design is also discussed.
Prerequisites: MSE 281 [Min Grade: D]

MSE 462. Composites Manufacturing. 3 Hours.
Principles of manufacturing and processing of polymeric matrix composites. Production techniques including filament winding, pultrusion, and liquid infusion techniques combined with design, environmental and manufacturing issues of polymer matrix composites.
Prerequisites: MSE 281 [Min Grade: D]

MSE 464. Metals and Alloys. 4 Hours.
Microstructures, properties, heat treatment, and processing of ferrous and nonferrous materials.
Prerequisites: MSE 281 [Min Grade: D]

MSE 464L. Metals and Alloys Laboratory. 0 Hours.
Laboratory component of MSE 464 and must be taken concurrently with MSE 464.

MSE 465. Characterization of Materials. 4 Hours.
Theory and practice of materials characterization, with emphasis on optical metallography, quantitative metallography, scanning electron microscopy, crystallography, and x-ray diffraction. Specific applications in metals and ceramics considered. MSE 465L must be taken concurrently.
Prerequisites: MSE 281 [Min Grade: D]

MSE 465L. Characterization of Materials Laboratory. 0 Hours.
Laboratory component of MSE 465 and must be taken with MSE 465.

MSE 470. Ceramic Materials. 4 Hours.
Structure, processing, properties, and uses of ceramic compounds and glasses. Mechanical, thermal, and electrical behavior of ceramic materials in terms of microstructure and processing variables.
Prerequisites: MSE 281 [Min Grade: D] and CH 117 [Min Grade: D] and CH 118 [Min Grade: D]

MSE 470L. Ceramic Materials Laboratory. 0 Hours.
Laboratory component of MSE 470 and must be taken concurrently with MSE 470.

MSE 474. Metals and Alloys II. 3 Hours.
Production and physical metallurgy of ferrous and non-ferrous alloys including: steel alloys, inoculation and production of ductile, gray, compacted and malleable iron; advanced heat treatments of steel and iron; conventional and ultra-high strength aluminum alloys; wrought and cast copper alloys; wrought and cast magnesium alloys.
Prerequisites: MSE 281 [Min Grade: D] and MSE 464 [Min Grade: D] (Can be taken Concurrently)

MSE 489. Undergraduate Research in MSE. 0 Hours.
Undergraduate research experiences in materials science and/or engineering.
Prerequisites: (EGR 194 [Min Grade: D] or EGR 111 [Min Grade: D]) or EGR 200 [Min Grade: D] or HC 111 [Min Grade: D] and (MA 125 [Min Grade: C] or MA 225 [Min Grade: C]) and PH 221 [Min Grade: C](Can be taken Concurrently)

MSE 490. Special Topics in Materials Engineering. 1-6 Hour.
Special Topics in Materials Engineering.

MSE 491. Individual Study in Materials Engineering. 1-6 Hour.
Individual Study in Materials Engineering.

MSE 497. MSE Honors Research. 2-6 Hours.
Honor students develop materials engineering research skills by working closely with faculty and graduate students.
Prerequisites: EGR 301 [Min Grade: C](Can be taken Concurrently)

MSE 498. Capstone Design Project I. 3 Hours.
Capstone design project: interdisciplinary design teams, ethics, materials selection, design process, development of proposal, project planning and scheduling, project execution and resource scheduling, and communication of design. Writing is a significant component of this course.
Prerequisites: MSE 401 [Min Grade: D](Can be taken Concurrently) and (MSE 413 [Min Grade: D] or MSE 430 [Min Grade: D] or MSE 465 [Min Grade: D] or MSE 470 [Min Grade: D])

MSE 499. Capstone Design Project II. 3 Hours.
Continuation of MSE 498 which must be taken in the previous term. Interim and final design reviews with written and oral reports. Writing is a significant component of this course.
Prerequisites: MSE 498 [Min Grade: D]