Electrical and Computer Engineering

Interim Chair: Leon Jololian, PhD

Degree Offered: Bachelor of Science in Electrical and Computer Engineering

Accreditation: The Bachelor of Science in Electrical and Computer Engineering degree program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the commission’s General Criteria and Program Criteria for Electrical, Computer, Communications, Telecommunication(s) and Similarly Named Engineering Programs.

Website: https://www.uab.edu/engineering/ece/undergrad

Program Director: Leon Jololian, PhD

Email: leon@uab.edu

Phone: 205 934-8440

The Department of Electrical and Computer Engineering offers a bachelor’s degree in electrical and computer engineering (BSECE), which provides the foundation for students to succeed in any of the areas of electrical or computer engineering, including electronics, biomedical instrumentation, digital computer systems, software systems, power systems, digital control, signal processing, and data analysis.

In addition to the Blazer Core, the program includes a strong foundation in mathematics and physical sciences including calculus-based physics, a core of courses in the breadth of electrical and computer engineering, electrical and computer engineering electives, and courses from other engineering disciplines.

Each student must complete a senior design team project that comprises six semester hours of coursework (EE 498 Team Design Project I and EE 499 Team Design Project II).

Vision
To be a nationally recognized Department of Electrical and Computer Engineering: the first choice for undergraduate and graduate education

Mission
To prepare graduates to be immediately productive and able to adapt to a rapidly changing environment while also creating and applying knowledge for the benefit of Birmingham, the state, and beyond

Program Educational Objectives
The Electrical and Computer Engineering undergraduate program prepares graduates to:

- Succeed in a career or graduate studies in electrical and computer engineering

Student Outcomes
Upon completion of the BSECE degree program, our graduates will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Bachelor of Science in Electrical and Computer Engineering Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Hours</th>
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<tbody>
<tr>
<td>Blazer Core Requirements</td>
<td>43</td>
</tr>
<tr>
<td>CH 115 &amp; 115R</td>
<td></td>
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<tr>
<td>&amp; CH 116 &amp; 116R</td>
<td></td>
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<tr>
<td>EH 101</td>
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<td>EH 102</td>
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<td>EGR 103</td>
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<td>EGR 200</td>
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<tr>
<td>MA 125 &amp; 125L</td>
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<tr>
<td>PH 221 &amp; 221L &amp; 221R</td>
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<tr>
<td>&amp; 222L &amp; 222R &amp; 222R</td>
<td></td>
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<tr>
<td>Academic Foundations: Reasoning</td>
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<tr>
<td>Thinking Broady: History &amp; Meaning</td>
<td></td>
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<tr>
<td>Thinking Broady: Creative Arts</td>
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<tr>
<td>Thinking Broady: Humans &amp; Their Societies</td>
<td></td>
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<tr>
<td>City as a Classroom</td>
<td>73</td>
</tr>
<tr>
<td>Other Required Courses</td>
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</tr>
<tr>
<td>CE 210</td>
<td></td>
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<tr>
<td>EE 210</td>
<td></td>
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<tr>
<td>EE 233</td>
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<tr>
<td>EE 254</td>
<td></td>
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<tr>
<td>EE 300</td>
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</tbody>
</table>

Bachelor of Science in Electrical and Computer Engineering

- Approach problem solving with an engineering mindset
- Grow professionally
Residency Requirement

In addition to UAB's residency requirement, to earn a bachelor of science in electrical and computer engineering from UAB, the ECE department requires that students complete the following courses at UAB:

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 421 Communication Systems</td>
<td>3</td>
</tr>
<tr>
<td>EE 426 Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>EE 431 Analog Integrated Electronics</td>
<td>4</td>
</tr>
<tr>
<td>EE 498 Team Design Project I</td>
<td>3</td>
</tr>
<tr>
<td>EE 499 Team Design Project II</td>
<td>3</td>
</tr>
<tr>
<td>Nine hours of EE 400-level electives</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td><strong>25</strong></td>
</tr>
</tbody>
</table>

Please refer to the School of Engineering overview for policies regarding admission; change of major; transfer credit; transient status; dual degree programs; reasonable progress; academic warning, probation, and suspension; reinstatement appeals; and graduation requirements.

Curriculum for the Bachelor of Science in Electrical and Computer Engineering (BSECE)

### Freshman

<table>
<thead>
<tr>
<th>First Term</th>
<th>Hours</th>
<th>Second Term</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 115 &amp; 115R</td>
<td>4</td>
<td>EE 210</td>
<td>3</td>
</tr>
<tr>
<td>MA 125 &amp; 125L</td>
<td>4</td>
<td>EGR 150</td>
<td>3</td>
</tr>
<tr>
<td>MA 126 &amp; 126L*</td>
<td>4</td>
<td>MA 126</td>
<td>4</td>
</tr>
<tr>
<td>PH 221 &amp; 221L*</td>
<td>4</td>
<td>EGR 194</td>
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</table>

#### Total Hours: 14

### Sophomore

<table>
<thead>
<tr>
<th>First Term</th>
<th>Hours</th>
<th>Second Term</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE 210</td>
<td>3</td>
<td>EE 233</td>
<td>3</td>
</tr>
<tr>
<td>EE 314 &amp; 314R</td>
<td>4</td>
<td>EE 316 &amp; 316L*</td>
<td>4</td>
</tr>
<tr>
<td>EGR 265 &amp; 265L*</td>
<td>4</td>
<td>EE 300</td>
<td>3</td>
</tr>
<tr>
<td>EH 102% &amp; 102%*</td>
<td>3</td>
<td>ME 251</td>
<td>2</td>
</tr>
<tr>
<td>PH 222 &amp; 222L*</td>
<td>4</td>
<td>Blazer Core: Reasoning*</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Total Hours: 17

### Junior

<table>
<thead>
<tr>
<th>First Term</th>
<th>Hours</th>
<th>Second Term</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 318 &amp; 318R</td>
<td>3</td>
<td>EE 254</td>
<td>3</td>
</tr>
<tr>
<td>EE 333 &amp; 333L*</td>
<td>4</td>
<td>EE 337</td>
<td>4</td>
</tr>
<tr>
<td>EE 351 &amp; 351L*</td>
<td>4</td>
<td>EE 341</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Total Hours: 15

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1. EGR 200 preferred; other FYE courses accepted
2. CE 280 preferred; other CAC courses accepted
3. May substitute MA 227 and MA 252 for EGR 265 and EE 254
Electrical and Computer Engineering

Prerequisites:
- accuracy versus precision and its relationship to data storage and numerical integration and differentiation methods, root finding methods, and theories laid out in prior courses. Topics include: Euler's Method, EE 254. Applied Numerical Methods. 3 Hours.
- engineering algebra. The applications to data reduction, data fitting, This course covers a broad spectrum of engineering applications using EE 250. Engineering Problem Solving I. 3 Hours.
- structures, development environments, and command line tools. debugging, documentation, file input and output, an introduction to data method, logic and algorithm development, C language coding, coding and design elements. Topics include: the software development EE 233. Engineering Programming Using Objects. 3 Hours.
- flip-flops, registers, and finite state machines. In class lab. Maps, combinational and sequential logic circuit design, clocked latches, systems, Boolean algebra, circuit minimization of multi-level logic, K-transformations. Topics include: the number EE 210. Digital Logic. 3 Hours.
- intended career. Students in a university recognized cooperative internship experience in preparation for the student's EE 011. Undergraduate Internship in EE. 0 Hours.
- Computer Engineering

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; Circuit solution 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: object-oriented design and programming in an object-oriented language, graphical user interface framework, project management skills, written and oral communication, Team work, 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, Input/output interfacing.
Prerequisites: EE 210 [Min Grade: C] and EE 233 [Min Grade: D]
EE 318. 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; applications of digital signal processing in engineering problems such as data acquisition and control.
Prerequisites: EE 318 [Min Grade: C]
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 which 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 selection 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.
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 during the student's final year of the program, in the term immediately after successfully completing EE 498.
Prerequisites: EE 498 [Min Grade: C]