

# REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

Accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>

## GALLOGLY COLLEGE OF ENGINEERING

### THE UNIVERSITY OF OKLAHOMA

For Students Entering  
the Oklahoma State  
System for Higher  
Education  
**Summer 2017 through  
Spring 2018**

#### GENERAL REQUIREMENTS

Total Credit Hours . . . . . **125•**  
**Minimum Retention/Graduation Grade Point Averages:**  
 Overall - Combined and OU . . . . . **2.00**  
 Major - Combined and OU . . . . . **2.00**  
 Curriculum - Combined and OU . . . . . **2.00**  
**A minimum grade of C is required for each course in the curriculum.**

#### Electrical Engineering

**B350**  
 Bachelor of Science in  
 Electrical Engineering

OU encourages students to complete at least 32 hours of applicable coursework each year to have the opportunity to graduate in four years.

Year	FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
FRESHMAN	ENGL 1113, Prin. of English Composition (Core I)	3	ENGL 1213, Prin. of English Composition (Core I), or	3
	*CHEM 1315, General Chemistry (Core II)	5	EXPO 1213, Expository Writing (Core I)	
	HIST 1483, U.S., 1492-1865, or	3	♦MATH 2924, Differential and Integral Calculus II	4
	1493, U.S., 1865-Present (Core IV)		P SC 1113, American Federal Government (Core III)	3
	♦MATH 1914, Differential and Integral Calculus I (Core I)	4	PHYS 2514, General Physics for Engineering & Science	4
	ENGR 1411, Freshman Engineering Experience	1	Majors (Core II)	
			C S 1313, Programming for Non-Majors with C	3
	<b>TOTAL CREDIT HOURS</b>	<b>16</b>	<b>TOTAL CREDIT HOURS</b>	<b>17</b>
SOPHOMORE	♦MATH 2934, Differential and Integral Calculus III	4	MATH 3113, Introduction to Ordinary Differential Equations	3
	PHYS 2524, General Physics for Engineering & Science Majors	4	ECE 2713, Digital Signals and Filtering	3
	ECE 2214, Intro. to Digital Design	4	ECE 2723, Electrical Circuits I	3
	ENGR 2002, Professional Development	2	ISE 3293, Applied Engineering Statistics	3
	†Approved Elective, Core III: Social Science	3	†Approved Elective, Core IV: Artistic Forms	3
	<b>TOTAL CREDIT HOURS</b>	<b>17</b>	<b>TOTAL CREDIT HOURS</b>	<b>15</b>
JUNIOR	PHYS 3223, Modern Physics for Engineers	3	MATH 3333, Linear Algebra I	3
	ECE 3613, Electromagnetic Fields I	3	ECE 3113, Energy Conversion I	3
	ECE 3723, Electrical Circuits II	3	ECE 3223, Microprocessor System Design	3
	ECE 3773, ECE Circuits Laboratory	3	ECE 3793, Signals and Systems	3
	ECE 3813, Introductory Electronics	3	ECE 3873, ECE Electronics Laboratory	3
	<b>TOTAL CREDIT HOURS</b>	<b>15</b>	<b>TOTAL CREDIT HOURS</b>	<b>15</b>
SENIOR	ECE 3323, Intro. to Solid State Electronic Devices	3	ECE 4773, Laboratory-Special Projects (Capstone)	3
	ECE 4273, Digital Design Lab	3	§ECE Elective	3
	§ECE 4000-level or higher Elective	3	§ECE 4000-level or higher Elective	3
	§ECE 4000-level or higher Elective	3	§Professional Elective	3
	†Approved Elective, Core IV: Western Civ. & Culture	3	†Approved Elective, Core IV: Non-Western Culture	3
	<b>TOTAL CREDIT HOURS</b>	<b>15</b>	<b>TOTAL CREDIT HOURS</b>	<b>15</b>

**NOTE:** Engineering transfer students may take ENGR 3511 in place of ENGR 1411.

Courses designated as Core I, II, III, IV, or Capstone are part of the General Education curriculum. Students must complete a minimum of 40 hours of General Education courses, chosen from the approved list.

†To be chosen from the **University-Wide General Education Approved Course List**. Three of these 12 hours must be upper-division (3000-4000). See list in the Class Schedule.

In the College of Engineering, in order to progress in your curriculum, and as a specific graduation requirement, a grade of C or better is required in each course in the curriculum. Any course for which a grade of C or better is not earned must be repeated the next semester enrolled in which it is offered, if a student plans to use the course in their curriculum. Please refer to the General Catalog for additional enrollment limitations.

Students must successfully complete prerequisite courses (with a minimum C grade) before proceeding to the next course.

• Two college-level courses in a single foreign language are required; this may be satisfied by successful completion of 2 years in a single foreign language in high school. Students who must take foreign language at the University will have an additional 6-10 hours of coursework.

§Electives to be selected from list available in the ECE Office, DEH-150.

♦MATH 1823, 2423, 2433, and 2443 sequence can be substituted for MATH 1914, 2924, and 2934.

\*CHEM 1315 can be substituted with CHEM 1335 (Fall only).

## COURSES IN CHEMISTRY AND BIOCHEMISTRY (CHEM)

**1315 General Chemistry.** Prerequisite: Mathematics 1503 or 1643, or math ACT equal to or greater than 23. General Chemistry is an overview of the chemical basis of natural phenomena. First of a two-semester sequence in general chemistry. Topics covered: basic measurement, atomic theory, electron configuration, periodicity, chemical reactivity and energetics, stoichiometry, gas laws and changes in state, bonding and molecular structure. A student may not receive credit for this course and CHEM 1335. **Laboratory.** (F, Sp, Su) [II-LAB]

## COURSES IN COMPUTER SCIENCE (C S)

**1313 Programming for Non-Majors with C.** Prerequisite: MATH 1523 or concurrent enrollment. Introduction to the design and implementation of computer programs. Emphasis on problem solving. Topics include: variables and constants, arithmetic and Boolean expressions, conditional statements, loops, procedures and functions, arrays, standard libraries, input and output, structures, and program documentation. (F, Sp)

## COURSES IN ELECTRICAL AND COMPUTER ENGINEERING (ECE)

**2214 Digital Design.** Prerequisite: MATH 1823 or MATH 1914. Number systems, Boolean algebra, minimization procedures, combinational logic functions, introduction to sequential logic design, finite state machines and clocked (synchronous) sequential circuits. Analysis, synthesis and implementation are appropriately emphasized. (F, Sp)

**2713 Digital Signals and Filtering.** Prerequisites: ENGR 1411 or ENGR 3511 or concurrent enrollment; CS 1313 or CS 1323 or concurrent enrollment; and MATH 2423 or 2924. Digital signals and filter, discrete Fourier A and Z transforms, sampling. (F,Sp)

**2723 Electrical Circuits I.** Prerequisites: ECE 2713 or concurrent enrollment in ECE 2713; MATH 2423 or 2924; PHYS 2524. Introduction to circuit elements and the laws of electrical science. Loop and nodal analysis solution methods. Thevenin and Norton equivalent circuits. Superposition and source transformation methods. Laplace transform analysis of electrical circuits. Guest lectures introducing advanced topics. (F, Sp)

†**G3113 Energy Conversion I.** Prerequisite: ECE 2723 and ECE 3613. Survey of methods of energy conversion; field-energy force relationships, equations of motion, incremental motion transducers, transformer theory; introduction to rotating machines. (Sp)

**3223 Microprocessor System Design.** Prerequisite: ECE 3773 or concurrent enrollment. Review of clocked sequential circuits; MSI/LSI devices and applications, including registers, busing, combinational functions; use of microprocessors and logic design using microprocessors. Emphasizes assembly of full functional units into workable systems. (F, Sp)

†**G3323 Introduction to Solid State Electronic Devices.** Prerequisite: 3613. Introduction to quantum mechanics, crystal properties and growth of semiconductors, energy bands in solids, charge carriers in semi-conductors, excess carriers in semiconductors, and introduction to diodes and transistors. (F, Sp)

**3613 Electromagnetic Fields I.** Prerequisite: ECE 2723 and MATH 2443 or MATH 2934 and Mathematics 3113. Electrostatic and magnetostatic fields and sources, boundary conditions; introduction to Laplace's and Poisson's equations; quasi-stationary and time-varying fields; Maxwell's equations and circuit concepts. (F, Sp)

†**G3723 Electrical Circuits II.** Prerequisites: ECE 2713, ECE 2723; and MATH 3113 or concurrent enrollment in MATH 3113. Analysis of electrical circuits in both time and frequency domains. Continuation of AC circuit theory, use of two port network theorems, impulse response, convolution, and differential equations. Laplace and Fourier transform analysis of electrical circuits. (F, Sp)

**3773 Electrical and Computer Engineering Circuits Laboratory.** Prerequisite: ECE 2214 and either ECE 3723 or concurrent enrollment in ECE 3723. Electrical laboratory procedures, circuit construction, debug and experimental Confirmation of the principles of circuit theory. Introduction to use of laboratory instrumentation, including skills in the use of the oscilloscope in the evaluation of DC and AC circuits. Use and application of diodes, operational amplifiers and programmable logic devices. (F, Sp)

†**G3793 Signals and Systems.** Prerequisites: ECE 2713, ECE 2723, MATH 3113; and MATH 3333 or concurrent enrollment in MATH 3333. Linear systems; time domain analysis; frequency domain analysis; Fourier, Laplace and Z-transforms; introduction to communications and control. (F, Sp)

†**G3813 Introductory Electronics.** Prerequisites: ECE 2713, and ECE 2723; CHEM 1315; and MATH 2443 or 2934 or concurrent enrollment in MATH 2443 or 2934. Small and large signal characteristics and models of electronic devices; analysis and design of elementary electronic circuits. (F, Sp)

**3873 Electrical and Computer Engineering Electronics Laboratory.** Prerequisite: ECE 3723, ECE 3773, ECE 3813, and Engineering 2002 or 2003. Electronic analog circuit design, simulation, construction, debugging and measurement of circuit performance quantities using advanced instrumentation techniques; circuit reliability theory; independent design skills development and technical writing. (F, Sp)

†**G4273 Digital Design Laboratory.** Prerequisites: ECE 3223 and ECE 3873. Design of digital systems with integrated circuits and MSI/LSI and microprocessor interfacing. **Laboratory** (F, Sp)

†**G4773 Laboratory (Special Projects).** Prerequisite: 4273 or concurrent enrollment in 4273.

Individually supervised special engineering problems of experimental nature. Laboratory (F, Sp) [V]

## COURSES IN ENGINEERING (ENGR)

**1411 Freshman Engineering Experience.** Prerequisite: declared major in Engineering or permission of instructor. Required of all entering freshmen with a declared Engineering major. Lecture hours cover a variety of topics including: majors and minors; career planning; advising; and extra-curricular activities. Students also work on multi-disciplinary engineering projects in smaller groups during the lab hour. (F)

**2002 Professional Development.** Prerequisite: sophomore standing. Develop an understanding of engineering ethics, teamwork, leadership, and professional responsibility through the concepts of contemporary, social, and global issues. (F, Sp)

## COURSES IN INDUSTRIAL AND SYSTEMS ENGINEERING (ISE)

†**G3293 Applied Engineering Statistics.** Prerequisite: MATH 2433 or 2924. Introduction to probability, one and higher dimensional random variates, function of random variables, expectation, discrete and continuous distributions, sampling and descriptive statistics, parameter estimation, use of statistical packages. (F, Sp)

## COURSES IN MATHEMATICS (MATH)

**1914 Differential and Integral Calculus I.** Prerequisite: satisfactory score on the math assessment.

Duplicates three hours of MATH 1823 and one hour of MATH 2423. Limits and continuity, differentiation, applications of differentiation to optimization and curve sketching, integration, the fundamental theorem of calculus, the substitution rule, applications of integration to computation of areas and volumes. (F, Sp, Su) [I-M]

**2924 Differential and Integral Calculus II.** Prerequisite: 1914 with a grade of C or better. Duplicates two hours of 2423 and two hours of 2433. The natural logarithmic and exponential functions, indeterminate forms, techniques of integration, improper integrals, parametric curves and polar coordinates, infinite sequences and series, vectors in two and three dimensions. (F, Sp, Su)

**2934 Differential and Integral Calculus III.** Prerequisite: 2924 with grade of C or better. Duplicates one hour of 2433 and three hours of 2443. Vectors and vector functions, functions of several variables, partial differentiation and gradients, multiple integration, line and surface integrals, Green-Stokes-Gauss theorems. (F,Sp,Su)

†**G3113 Introduction to Ordinary Differential Equations.** Prerequisite: MATH 2423 or MATH 2924. Duplicates two hours of 3413. First order ordinary differential equations, linear differential equations with constant coefficients, two-by-two linear systems, Laplace transformations, phase planes and stability. (F, Sp, Su)

†**G3333 Linear Algebra I.** Prerequisite: MATH 2123 or MATH 1823 or MATH 1914 or permission of instructor. Systems of linear equations, determinants, finite dimensional vector spaces, linear transformations and matrices, characteristic values and vectors. (F, Sp, Su)

## COURSES IN PHYSICS (PHYS)

**2514 General Physics for Engineering and Science Majors.** Prerequisite: Mathematics 1823 or Mathematics 1914 with grade of C or better. Not open to students with credit in 1205. Vectors, kinematics and dynamics of particles, work and energy systems of particles, rotational kinematics and dynamics, oscillations, gravitation, fluid mechanics, waves. (F, Sp, Su) [II-NL]

**2524 General Physics for Engineering and Science Majors.** Prerequisite: PHYS 2514 and MATH 2423 or MATH 2924 with grade of C or better. Not open to students with credit in PHYS 1215. Temperature, heat, thermodynamics, electricity, magnetism, optics. (F, Sp, Su)

†**G3223 Modern Physics for Engineers.** Prerequisite: Mathematics 3113 or equivalent. Relativity, atomic structure, nuclear theory, wave mechanics, statistical physics, solid state physics. (F)

# ELECTRICAL ENGINEERING ELECTIVES ADVISING SHEET

Bachelor of Science Electrical Engineering (BS EE)  
The University of Oklahoma - Gallogly College of Engineering  
School of Electrical and Computer Engineering

The information below provides information and restrictions about the different types of required electives for the [BS EE Degree \(B350\)](#). **Note:** All EE electives are 3-hour courses. See the check sheet for more information about the Accelerated Master's Degree program [A350: BS-EE/MS-ECE](#).

**Gen Ed Electives:** Each of the four Gen Ed elective courses (labeled with a 5 on the flowchart) must be selected from the University-wide lists of courses found at: <http://www.ou.edu/content/gened/courses.html>. One course must be taken from each of the following categories: **Social Science**, **Understanding Artistic Forms**, **Western Civilization & Culture**, and **Non-western Culture**. One Gen Ed elective is required to be upper division (i.e. 3000 level or higher level). Gen Ed questions should be addressed to Williams Student Services advisors.

**Professional Elective:** One professional elective course must be taken from the list of categories below:

1. ENGL 3153, MGT 3013, ENT 4503, MS 4223, or NS 4633
2. Any non-required, upper division course in PHYS, ECE, CS, ENGR, AME, CEES, CHE, ISE, P E
3. Any non-required, upper division course in MATH except MATH 4733 or MATH 4753
4. Other non-required 3000-level or higher course with ECE Undergraduate Studies Committee Approval

**Degree Restrictions:** The majority of your technical and professional electives should be classroom-based lecture courses that are focused on technical subject matter. To ensure this, the following restrictions apply to 4 technical electives and 1 professional elective:

- ✓ *No more than 6 total hours (2 of the 5 technical/professional elective courses) can be from the following courses: AME 3013, ECE 3440, ECE 3960, ECE 3970, ECE 3980, ECE 3990, ECE 4960, ECE 4970, ECE 4973, ECE 4990, ECE 5283, ECE 5880, ECE 5960, ECE 5970, ECE 5973, ECE 5990, ENGL 3153, MGT 3013, ENT 4503, NS 4633, ENGR 4003, ENGR 4013, or ENGR 4510.*

**Technical Electives:** EE students must take four ECE technical elective courses (see information below).

- All four of the ECE technical electives must be an ECE upper division, non-required course.
- One of the technical electives may be at the 3xxx level.
- The other 3 technical electives can be any ECE upper division, non-required course.
- Undergraduates can enroll in 5xxx level graduate courses if they have a GPA of 3.0 or better.
- BS/MS accelerated program students must enroll in the 5xxx level section of slash listed (4xxx level/5xxx level) courses. Other undergraduate students should enroll in the 4xxx level section of slash listed courses.

The following are some of the electives (separated by area of study) that are usually offered at least once per year.

- **Digital Systems** – ECE 4613: Computer Architecture, ECE 4/5623: Computer Hardware Design, ECE 4/5833: VLSI Digital System Design, ECE 5463 Advanced Computer Architecture, ECE 5873 Advanced VLSI Design
- **Communications** – ECE 4523: Communications, ECE 5123: Wireless Communication
- **Controls** – ECE 4413: Intro to Control Theory, ECE 4/5433: Measurement and Automation, ECE 5403: Linear Systems Analysis, ECE 5413: Control Theory
- **Bio-Medical Engineering** – ECE 4823: Principles of the Human Body, ECE 4/5853: Biomedical Signals & Systems, ECE 4/5863 Biomedical instrumentation, ECE 5843: Medical Imaging Systems
- **Electronics and Optics** – ECE 4/5363: Optical Engineering, ECE 4813: Electronics
- **Signals and Systems** – ECE 4/5213: Digital Signal Processing, ECE 5273: Digital Image Processing, ECE 5523: Random Signals
- **Radar/Applied Electromagnetics** – ECE 4/5653: Digital Radar Systems, ECE 4/5643 RF=Microwave Engineering, ECE 4/5663: Radar Engineering, ECE 4/5673 Weather Radar Theory & Practice, ECE 4/5693 Antennas, ECE 4/5703 EM Fields and Wave Propagation
- **Power Systems** – ECE 4113 Analysis of Electrical Transmission Systems, ECE 5113 Analysis of Faulted Power Systems
- **Solid State** – ECE 4/5383 IC Fabrication, ECE 5303 Solid State Electronics, ECE 5323 Opto-Electronics