

# REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN COMPUTER ENGINEERING/MASTER OF SCIENCE

B.S. Portion of the Program 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 2018 through Spring 2019**

**GENERAL REQUIREMENTS**

Total Credit Hours . . . . . **144-147•**  
**Minimum Retention/Graduation Grade Point Averages:**  
 Overall - Combined and OU . . . . . **3.25**  
 Major - Combined and OU . . . . . **3.25**  
 Curriculum - Combined and OU . . . . . **3.25**  
**A minimum grade of C is required for each course in the curriculum.**

Computer Engineering and Computer Science  
**A225**  
 Bachelor of Science in Computer Engineering/Master of Science (Computer Science) **F235 Q147**

**OU encourages students to complete at least 29-30 hours of applicable coursework each year to have the opportunity to graduate in five years.**

Year	FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
<b>FRESHMAN</b>	ENGL 1113, Prin. of English Composition (Core I)	3	ENGL 1213, Prin. of English Composition (Core I), or EXPO 1213, Expository Writing (Core I)	3
	*CHEM 1315, General Chemistry	5	♦MATH 2924, Differential and Integral Calculus II	4
	♦MATH 1914, Differential and Integral Calculus I (Core I)	4	PHYS 2514, General Physics for Engineering & Science Majors (Core II)	4
	HIST 1483, U.S., 1492-1865, or 1493, U.S., 1865-Present (Core IV)	3	P SC 1113, American Federal Government (Core III)	3
	ENGR 1411, Freshman Engineering Experience	1	C S 1323, Intro. to Comp. Programming for Programmers	3
	<b>TOTAL CREDIT HOURS</b>	<b>16</b>	<b>TOTAL CREDIT HOURS</b>	<b>17</b>
<b>SOPHOMORE</b>	♦MATH 2934, Differential and Integral Calculus III	4	MATH 3113, Introduction to Ordinary Differential Equations	3
	PHYS 2524, General Physics for Engr. & Science Majors	4	C S 2413, Data Structures	3
	C S 2334, Programming Structures & Abstractions	4	C S 2813, Discrete Structures	3
	ECE 2214, Intro. to Digital Design	4	ECE 2713, Digital Signals and Filtering	3
			ECE 2723, Electrical Circuits I	3
			ENGR 2002, Professional Development	2
	<b>TOTAL CREDIT HOURS</b>	<b>16</b>	<b>TOTAL CREDIT HOURS</b>	<b>17</b>
<b>JUNIOR</b>	C S 3823, Theory of Computation	3	MATH 3333, Linear Algebra 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
	ECE 2523, Probability, Statistics and Random Processes	3	† Approved Elective, Core IV: Artistic Forms	3
	<b>TOTAL CREDIT HOURS</b>	<b>15</b>	<b>TOTAL CREDIT HOURS</b>	<b>15</b>
† Students are eligible to enter accelerated program after application is granted for unconditional enrollment in upper-division ECE courses and meeting minimum requirements, including a 3.50 retention and 3.50 combined retention grade point average.				
<b>SENIOR</b>	C S 3113, Intro. to Operating Systems	3	ECE 4773, Laboratory-Special Projects (Capstone)	3
	C S 4413, Algorithm Analysis	3	#C S G4000/5000 Approved Elective	3
	ECE 4273, Digital Design Laboratory	3	ECE 4613, Computer Architecture	3
	§ECE G4000 or higher Elective	3	† Approved Elective, Core III: Social Science	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>
<b>Students are eligible for graduate status upon graduation with the Bachelor of Science in Computer Engineering.</b>				
<b>FIFTH YEAR</b>	#5000-level Approved Elective	3	#5000-level Approved Elective	3
	#5000-level Approved Elective	3	▲5000-level C S Electives	3-6
	▲5000-level C S Elective	3	C S 5990 or C S seminar course	3
	<b>TOTAL CREDIT HOURS</b>	<b>9</b>	<b>TOTAL CREDIT HOURS</b>	<b>9-12</b>

† Note: Students may enter the accelerated program based on the undergraduate degree pattern offered in the year they first enrolled in the Oklahoma State System of Higher Education or later.

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, 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.

# Students must choose the following for these four C S electives: one C S theory elective, one C S systems elective, and two C S applications electives. No more than one of these courses may be at the G4000-level. Courses for the three areas are from an approved list from the School of Computer Science.

No more than two enrollments (six hours) in C S 5970, "Graduate Seminar" courses are allowed.

▲ Thesis option requires a total of 9 hours of 5000-level electives, which must include six hours of C S 5980. Non-thesis option requires a total of 12 hours of 5000-level electives.

♦ MATH 1823, 2423, 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)**

**1323 Introduction to Computer Programming for Programmers.** Prerequisite: MATH 1523 or concurrent enrollment or placement into MATH 1743 or MATH 1823 or higher and department permission. Introduction to the design and implementation of computer software with an emphasis on abstraction and program organization for students with some prior programming experience. Topics include: variables and constants, arithmetic and Boolean expressions, conditional statements, repetition, methods, arrays, linear and binary search, basic sorting algorithms, object-oriented programming, documentation, and testing. (F, Sp)

**2334 Programming Structures and Abstractions.** Prerequisite: C S 1323 or 1321 or 1324, and MATH 1523 or higher. The design and implementation of computer programs using disciplined methodologies. Use of several abstract data types. Software reuse through encapsulation, composition, aggregation, inheritance, polymorphism, and generics. Topics include recursion, GUI development, file processing, and unit testing. A program design tool will be used. Introduction to ethics in computer science, including philosophical ethics theories. Discussion of intellectual property rights and privacy. (F, Sp)

**2413 Data Structures.** Prerequisite: C S 2334 and MATH 1823 or 1914; and C S 2813 or MATH 2513, or concurrent enrollment in C S 2813 or MATH 2513. Representation, analysis and implementation of data structures and associated algorithms including: algorithm complexity, sorting algorithms, lists, stacks, queues, search trees (AVL, Red-Black, Splay, 2-3), Heaps, Graphs, and Hashing. Written communications required in some projects. Ethical issues and tools and techniques used in writing secure applications will also be discussed. The primary programming language is C++ with a debugging tool. (F, Sp)

**2813 Discrete Structures.** Prerequisite: C S 2334 and MATH 1823 or MATH 1914. Introduction to the theory of discrete structures useful in computer science. Topics include combinatorics, relations, functions, computational complexity, recurrences, and graph theory. (F, Sp)

**3113 Introduction to Operating Systems.** Prerequisite: C S 2413 and C S 2813 or MATH 2513, and C S 2614 or ECE 2214. An introduction to the major concepts and techniques of designing and implementing operating systems including: memory management, process management, information management, and computer security. Principles of performance evaluation. Class projects require the design and implementation of software systems. A UNIX family operating system will be used. (F)

**3823 Theory of Computation.** Prerequisite: CS 2413 and CS 2813 or MATH 2513 or CS 5005 or DSA 5005. Introduction to abstract machine theory and formal language theory. Topics include Turing machines, finite/pushdown automata, deterministic versus nondeterministic computations, context-free grammars, and mathematical properties of these systems. (F)

**G4413 Algorithm Analysis.** (Crosslisted with DSA 4413) Prerequisites: C S 2413 and C S 2813; or MATH 2513; or C S 5005. Design and analysis of algorithms and measurement of their complexity. This course introduces various algorithm design strategies: divide and conquer, greedy principle and dynamic programming to solve a variety of problems using algorithms of various types - deterministic and randomized, serial and parallel, centralized and decentralized, program based and circuit based. (F)

**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)

**2523 Probability, Statistics and Random Processes.** Prerequisite: ECE major or minor; MATH 2433 or MATH 2924. Covers the role of statistics in electrical and computer engineering and includes substantial exposure to applications appropriate to the discipline: basic probability; random variables, vectors and processes; time averages, expectations and laws of large numbers; stationarity, autocorrelation and spectral analysis; minimum mean squared error estimation; detection and linear filtering; IID, Markov, independent increment, counting, Gaussian and Poisson random processes. (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 filters, discrete Fourier A and Z transforms, sampling. (F, Sp)

**2723 Electrical Circuits I.** Prerequisite: ECE 2713 or concurrent enrollment in ECE 2713; Mathematics 2423 or 2924; Physics 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. Guest lectures introducing advanced topics. (F, Sp)

**3223 Microprocessor System Design.** Prerequisite: 2214. 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)

**†G3723 Electrical Circuits II.** Prerequisites: ECE 2713, ECE 2723; and, Mathematics 3113 or concurrent enrollment in MATH 3113. Analysis of electrical circuits in both the time and the 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: 2214 and either 3723 or enrollment in 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 2523, ECE 3723, ECE 3773, ECE 3813, and ENGR 2002 or ENGR 2003. Electronic analog circuit design, simulation, construction, debugging and measurement of circuit behavior and noise using advanced instrumentation techniques; statistics-based 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)

**G4613 Computer Architecture (Crosslisted with C S 4613).** Prerequisite: ECE 3223 or C S 2614. Covers basic concepts of computer system design and communication between components, along with current and historical examples of computer architecture. (F, Sp)

**†G4773 Laboratory (Special Project).** Prerequisite: 4273 or 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: ENGR 1410 or ENGR 1411, or ENGR 3511 or ENGR 3410 or concurrent enrollment; ENGL 1213 or EXPO 1213, and 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 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 2433 or MATH 2934 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: 2514 and Mathematics 2423 or Mathematics 2924 with a grade of C or better. Not open to students with credit in 1215. Temperature, heat, thermodynamics, electricity, magnetism, optics. (F, Sp, Su)