REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN COMPUTER SCIENCE

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GALLOGLY COLLEGE OF ENGINEERING

THE UNIVERSITY OF OKLAHOMA

For Students Entering the Oklahoma State System for Higher Education
Summer 2016 through Spring 2017

GENERAL REQUIREMENTS

Total Credit Hours . . . . . **120-121•**
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.

Computer Science

B235

Bachelor of Science in Computer Science

OU encourages students to complete at least 29 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
	❖**MATH 1914**, Differential and Integral Calculus I (Core I)	4	**EXPO 1213**, Expository Writing (Core I)	
	P SC 1113, American Federal Government (Core III)	3		
	ENGR 1411, Freshman Engineering Experience	1	❖**MATH 2924**, Differential and Integral Calculus II	4
	§**C S 1323**, Intro. to Computer Programming	3	**C S 2334**, Programming Structures & Abstractions	4
	†Approved Elective: Artistic Forms (Core IV)	3	♠Approved Elective: Natural Science (Core II)	3-5
			♠Open Elective	0-2
	TOTAL CREDIT HOURS	**17**	**TOTAL CREDIT HOURS**	**16**
SOPHOMORE	❖**MATH 2934**, Differential and Integral Calculus III	4	**C S 2813**, Discrete Structures	3
	C S 2603, Applied Logic for Hardware & Software	3	**C S 2413**, Data Structures	3
	+**PHYS 1311**, General Physics Lab I	0-1	**C S 2613**, Computer Organization	3
	PHYS 2514, General Physics for Engineering & Science Majors (Core II)	4	♠Approved Elective: Natural Science (Core II)	3-5
	†Approved Elective: Social Science (Core III)	3	♠Open Elective	0-2
	TOTAL CREDIT HOURS	**14-15**	**TOTAL CREDIT HOURS**	**14**
JUNIOR	**MATH 3113**, Intro. to Ordinary Differential Equations, **or**	3	1 of the following 3 courses:	
	MATH 3413, Physical Mathematics I		**ENGL 3153**, Technical Writing, **or**	2-3
	COMM 2613, Public Speaking	3	**B C 2813**, Business Communication §, **or**	
	C S 3113, Intro. to Operating Systems	3	**ENGR 2002**, Professional Engineering Development♦	
	C S 3202, Software Requirements & Specifications	2	Open Elective (with ENGR 2002♦)	0-1
	C S 3823, Theory of Computation	3	**MATH 3333**, Linear Algebra	3
			C S 3053, Human Computer Interaction	3
			C S 3323, Principles of Programming Languages	3
			1 of the following 3 courses:	
			MATH 4753, Applied Statistical Methods, **or**	3
			ISE 3293, Applied Engineering Statistics, **or**	
			MATH 4743, Intro. to Mathematical Statistics	
	TOTAL CREDIT HOURS	**14**	**TOTAL CREDIT HOURS**	**15**
SENIOR	†Approved Elective: Western Civ. & Culture (Core IV)	3	**C S 4273**, Software Engineering II (Capstone)	3
	C S 4263, Software Engineering I	3	‡**C S** Approved C S Elective	3
	C S 4413, Algorithm Analysis	3	‡**C S** Approved C S Elective	3
	‡**C S** Approved C S Elective, **or**	3	**HIST 1483**, U.S., 1492-1865, **or**	3
	MATH 4073, Numerical Analysis		**1493**, U.S., 1865-Present (Core IV)	
	C S 4513, Database Management Systems	3	†Approved Elective: Non-Western Culture (Core IV)	3
	TOTAL CREDIT HOURS	**15**	**TOTAL CREDIT HOURS**	**15**

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. 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.

Students should read the College of Engineering Scholastic Regulations which are posted on the WSSC website under Advising (See Advising Syllabus): **http://www.ou.edu/content/coe/wssc/advising/where.html**.

• 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.

‡To be chosen from C S 4013, 4023, 4033, 4053, 4073, 4113, 4133, 4323, 4433, 4613, 4743, 4823, and 4973.

§Honors College students may substitute C S 3960 for ENGL 3153/B C 2813 and C S 3980 for an approved C S elective. Both C S 3960 and 3980 must be completed.

♠ Courses taken to fulfill the Natural Science requirement must be chosen from the **University-Wide General Education Approved Course List** (Core II). At least one of the Natural Science courses must be a non-Physics course. The number of credits in Core II Natural Science and open electives must be 14 credit hours or more. All science courses must be for science or engineering majors. Open electives are not required to be General Education approved.

+ Another laboratory science Core II course may be substituted for PHYS 1311.

❖MATH 1823, 2423, 2433, and 2443 sequence can be substituted for MATH 1914, 2924, and 2934. **NOTE:** See an adviser in the Arts and Sciences Advising Center (EL 124) about a possible minor in mathematics.

♦If selecting ENGR 2002, students must take or have an additional 1 hour of credit or open elective. Open electives are not required to be General Education approved however, they cannot be taken as the student elected Pass/No Pass option (S/U graded credits are acceptable). Please verify with the Gallogly College of Engineering, Williams Student Services Academic Advising Office, 112 Felgar Hall, (405) 325-4096.

COURSES IN COMPUTER SCENCE (C S)

1323 Introduction to Computer Programming. Prerequisite: MATH 1523 or concurrent enrollment, or placement into MATH 1743 or MATH 1823 or higher. Introduction to the design and implementation of computer software with an emphasis on abstraction and program organization. (F, Sp)

2334 Programming Structures and Abstractions. Prerequisite: 1323 and Mathematics 1523 or higher. The design and implementation of computer programs using disciplined methodologies. Use of abstract data types such as stacks, queues, lists, sets, maps. Software reuse through encapsulations, composition, aggregation, inheritance, polymorphism, and generics. Structured approached to graphical user interface development and error handling. Binary and character based file processing. 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: 2334 and Mathematics 1823 or 1914; and 2813 or Mathematics 2513, or concurrent enrollment in 2813 or Mathematics 2513. Representation, analysis and implementation of widely used data structures and associated algorithms. Discussion of algorithms employing data structures with analysis. Written communications required in some projects. Discussion of ethical issues including conputer crime, abuse, and hacker ethics. Tools and techniques used in writing secure applications will also be discussed. Windows operating system will be used. A debugging tool will be used. (F, Sp)

2603 Applied Logic for Hardware and Software. Prerequisite: 1323 and Mathematics 1823 or1914 with a C or better. Applications of logic in the analysis of hardware and software components. Topics include propositional and predicate calculus, Boolean algebra, combinational and sequential circuits, number systems and circuits for arithmetic, sets, inductive definitions, proof techniques including natural deduction, equational reasoning and mathematical induction. (F, Sp)

2613 Computer Organization. Prerequisite: 2603. An introduction to the architecture, organization and design of uniprocessor-based computer systems. Topics include processor, control and memory design and organization, pipelining and vector processing, computer arithmetic, I/O organization, and computer systems security. (F, Sp)

2813 Discrete Structures. Prerequisite: 2603 or Electrical and Computer Engineering 2213 or 2214. Introduction to the theory of discrete structures useful in computer science. Topics include combinatorics, relations, functions, computational complexity, recurrences, and graph theory. (F, Sp) **3053 Human Computer Interaction.** Prerequisite: 2413 and 2813 or Mathematics 2513. An introduction to human-computer interaction and graphical user interfaces. Topics include principles of human-computer interaction, human cognitive abilities, interface analysis and design, window systems, and social implications of computing. Current interface programming tools will be described and used. Oral presentations are required for some assignments. (Sp)

3113 Introduction to Operating Systems. Prerequisite: 2413 and 2813 or Mathematics 2513, and either 2613 or Electrical and Computer Engineering 3223. An introduction to the major concepts (including memory management, process management, information management, and computer security) and techniques of designing and implementing operating systems. Class projects require the design of medium-scale software systems. The Unix operating system will be used. A performance evaluation tool will be used. (F, Sp)

3202 Software Requirements and Specifications. Prerequisite: 2413 and 2813 or Mathematics 2513. Students gain technical and non-technical professional skills by performing requirements engineering, and learn the tools, techniques, and methods for modeling software systems. Topics include requirements elicitation, prototyping, functional and non-functional requirements, and tracking. Students practice written and oral communication skills in eliciting and documenting requirements from users, consider the impact of computing on individuals, organizations, and society in the creation of requirements and specifications for a computational system, and demonstrate their ability to engage in lifelong learning by gaining background in a domain outside of their own. (F)

3323 Principles of Programming Languages. Prerequisite: C S 2413, and C S 2813 or MATH 2513, and ENGL 3153 or BC 2813 as a prerequisite or concurrent enrollment. Study of the theoretical foundations and principles that form the basis of programming language design; introduction to the functional programming paradigm. (Sp)

3823 Theory of Computation. Prerequisite: CS 2813 or CS 5005 or MATH 2513. 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)

G4013 Artificial Intelligence (Slashlisted with 5013). Prerequisite: CS 2413 or CS 5005, and CS 2813 or CS 4005 or MATH 2513. Study of the methods of search, knowledge representation, heuristics, and other aspects of automating the solution of problems requiring intelligence. No student may earn credit for both 4013 and 5013. (Sp)

4023 Introduction to Intelligent Robotics (Slashlisted with 5023). Prerequisite: 2413, and2813 or Mathematics 2513. History of intelligent robotics; functional models approach; reactiverobots; ethol ogy for robotics; architectures and methodologies; implementation; sensing; hybrid deliberative/reactive robotics; multi-robot systems; navigation; topological path planning; metric pathplanning; localization and mapping. No student may earn credit for both 4023 and 5023. (F)

4033 Machine Learning. (Slashlisted with 5033). Prerequisites: 2413 and 2813 or Mathematics 2513, and Mathematics 4753 or Engineering 3293 or Industrial Engineering 3293 or Mathematics4743, and Mathematics 3333. Topics include decision trees, relational learning, neural networks,Bayesian learning, reinforcement learning, multiple-instance learning, feature selection, learning appropriate representations, clustering, and kernel methods. No student may earn credit for both 4033 and 5033. (F)

4053 Computer Graphics (Slashlisted with 5053). Prerequisite: 2413 and 2813 or Mathematics 2513,and Mathematics 3333. An introduction to computer graphics. Topics include coordinate systems, transformations, rendering in both two and three dimensions,and graphical programming. No student may earn credit for both 4053 and 5053. (F)

4073 Computer Game Development. Prerequisite: 3113, 4053, Mathematics 3333, and Physics 2514. Introduction to the process of developing, maintaining, enhancing, adapting, or refactoring a computer based game. Students will work in project teams using an existing game engine. A software development process will be used. Software development tools will be used. Students will practice oral and written communication skills. (Irreg.)

4113 Operating Systems Theory (Slashlisted with 5113). Prerequisite: 3113 and Mathematics4753 or ISE 3293 or Mathematics 4743 or Engineering 3293. Continuation of study from 3113. Advanced topics and examples and simulation techniques used in performance evaluation. No student may earn credit for both 4113 and 5113. (Sp)

4133 Data Networks (Slashlisted with 5133). Prerequisite: 3113 or permission of instructor. Comprehensive treatment of data networking principles including: layered protocol design and their functions, tools for performance analysis, multi-access communication, routing and flow control. No student may earn credit for both 4133 and 5133. (F)

4263 Software Engineering I. Prerequisite: C S 3323 and COMM 2613 and ENGL 3153 or B C 2813, and Computer Science major or minor. No students may obtain credit for CS 4263 and CS 5213. Methods and tools for software specification, design, and documentation. Emphasis on architectural modularity, encapsulation of software objects, and software development processes such as design review, code inspection, and defect tracking. Students working in teams apply these ideas to design and document software products. Study of professional ethics, responsibility, and liability. (F)

†G4273 Software Engineering II. Prerequisite: C S 3053 and C S 4263 and C S major or C S minor. No student may obtain credit for CS 4273 and CS 5213. Methods and tools for software development, testing, and delivery. Emphasis on data abstraction and reusable components. Students working in teams implement a significant software product, including design documents, user's guide, and process reports, using methods and processes studied in Software Engineering I. Students will practice oral and written communication skills. (Sp)

G4323 Compiler Construction. Prerequisite: 2413 and 3823. Introduction to the theory and implementation of programming language compilers and interpreters. Class projects require the design of medium scale software systems. (Sp)

G4413 Algorithm Analysis. Prerequisite: CS 2413 or CS 5005, and CS 2813 or CS 4005 or MATH 2513. Design and analysis of algorithms and measurement of their complexity. (F)

4433 Computational Methods in Discrete Optimization (Slashlisted with 5433). Prerequisite: Mathematics 3333 and 4413 or concurrent enrollment in 4413. Linear programming: simplex method for LP problems, degeneracy and anticycling strategies, duality theory and complementary slackness conditions, revised simplex method, sensitivity analysis and simplex method for general LP problems. Network optimization: the transshipment problem, network simplex methodd, shortest path algorithms, the maximum flow problem, and the primal dual method. No student may earn credit for both 4433 and 5433. (F)

G4513 Database Management Systems. Prerequisite: CS 2413 or CS 5005, and CS 2813 or CS 4005 or MATH 2513. The design and implementation of a DBMS including data models, query languages, entity-relationship diagrams, functional dependencies, normalization, storage structures, access methods, query processing, transaction management, web-enabled applications, and administration. The impact of databases on individuals, organizations, and society, and legal and professional responsibilities including security and privacy will be discussed. A commercial DBMS is used. Students practice written communication skills. (F)

G4613 Computer Architecture (Crosslisted with Electrical and Computer Engineering 4613). Prerequisite: 2613 or Electrical and Computer Engineering 3223, or 4004. Covers basic concepts of computer system design and communication between components, along with current and historical examples of computer architecture. (F, Sp)

4743 Scientific Computing I (Slashlisted with 5743). Prerequisite: Mathematics 3333 and AME3723 or Mathematics 4073 or Engineering 3723 or Computer Science 3723. Interaction between applications, architectures, and algorithms. Review of linear algebra, serial, pipelined vector processors, cluster of processors. Measures of proformance of parallel algorithms. Parallel algorithms for the solution oflinear systems. No student may earn credit for both 4743 and 5743. (F)

4823 Crytopgraphy (Slashlisted with 5823). Prerequisite: 3823 and 4413. Elementary number theory, time complexity for doing arithmetic, finite fields, RSA, discrete logarithm and Diffie-Hellman, zero-knowledge protocols and oblivious transfer. Basic elliptic curve cryptosystems, elliptic curve factorization and primality proving. No student may earn credit for both 4823 and 5823. (Sp)

4973 Special Topics. Prerequisite: 2413 and permission of instructor. May be repeated with change of subject matter; maximum credit nine hours. A special topics course necessitated by the rapidly changing nature of computer sciences. Topics offered under this number will be accepted as approved Computer Science electives for Computer Science majors. (Irreg.)

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 includ ing: 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)

COURSES IN MATHEMATICS (MATH)

1914 Differential and Integral Calculus I. Prerequisite: satisfactory score on the placement test or, for incoming freshmen direct from high school, satisfactory score on the ACT/SAT. Duplicates three hours of 1823 and one hour of 2423. Limits and continuity, differentiation, applications of differentiation to optimization and curve sketching, integration, the fundamental theorem of calculus, the substitu tion rule, applications of integration to computation of areas. (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. Further applications of integration, the natural logarithmic and exponential functions, indeterminate forms, techniques of integVectors ration, improper integrals, parametric curves and polar coordinates, infinite sequences and series. (F, Sp, Su)

2934 Differential and Integral Calculus III. Prerequisite: 2924 with a 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)

†G3413 Physical Mathematics I. Prerequisite: MATH 2443 or MATH 2934 or concurrent enrollment. Complex numbers and functions. Fourier series, solution methods for ordinary differential equations and partial differential equations, Laplace transforms, series solutions, Legendre's equation. Duplicates two hours of 3113. (F)

G4073 Numerical Analysis. Prerequisite: 3113 or 3413. Solution of linear and nonlinear equations, approximation of functions, numerical integration and differentiation, introduction to analysis of convergence and errors, pitfalls in automatic computation, one-step methods in the solutions of ordinary differential equations. (F)

4743 Introduction to Mathematical Statistics (Slashlisted with 5743). Prerequisite: 4733. Mathematical development of basic concepts in statistics: estimation, hypothesis testing, sampling from normal and other populations, regression, goodness-of-fit. No student may earn credit for both 4743 and 5743. (Sp)

G4753 Applied Statistical Methods. Prerequisite: MATH 2123 or MATH 2423 or MATH 2924 or permission of instructor. Estimation, hypothesis testing, analysis of variance, regression and correlation, goodness-of-fit, other topics as time permits. Emphasis on applications of statistical methods. (F, Sp, Su)