

REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN INDUSTRIAL AND SYSTEMS ENGINEERING

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GALLOGLY COLLEGE OF ENGINEERING

THE UNIVERSITY OF OKLAHOMA

GENERAL REQUIREMENTS

Total Credit Hours 131•
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.

Industrial and Systems
 Engineering: Analytics
 B529
 Bachelor of Science in
 Industrial and Systems
 Engineering

For Students Entering the
 Oklahoma State System for
 Higher Education
**Summer 2018 through
 Spring 2019**

OU encourages students to complete at least 33 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) *CHEM 1315, General Chemistry (Core II) ❖MATH 1914, Differential & Calculus I (Core I) P SC 1113, American Federal Government (Core III) ENGR 1411, Freshman Engineering Experience	3 5 4 3 1	ENGL 1213, Prin. of English Composition (Core I), or EXPO 1213, Expository Writing (Core I) ❖MATH 2924, Differential & Integral Calculus II HIST 1483, U.S., 1492-1865, or 1493, U.S., 1865-Present (Core IV) PHYS 2514, General Physics for Engineering & Science Majors (Core II) C S 1323, Introduction to Computer Programming	3 3 4 3 4 3
	TOTAL CREDIT HOURS	16	TOTAL CREDIT HOURS	17
SOPHOMORE	❖MATH 2934, Differential & Integral Calculus III C S 2334, Programming Structures & Abstractions CEES 2113, Statics ISE 2823, Enterprise Engineering PHYS 2524, General Physics for Engineering & Science Majors	4 4 3 3 4	CEES 2153, Mechanics of Materials ISE 2303, Design & Manufacturing Processes ISE 2311, Computer Aided Design & Graphics Lab ISE 3293, Applied Engineering Statistics C S 2413, Data Structures MATH 2513, Discrete Mathematical Structures	3 3 1 3 3 3
	TOTAL CREDIT HOURS	18	TOTAL CREDIT HOURS	16
JUNIOR	ISE 3304, Design and Manufacturing II ISE 4113, Spreadsheet-Based Decision Support Systems ISE 4553, Data-Driven Decision Making I ISE 4623, Deterministic Systems Models C S 3202, Software Requirements and Specifications	4 3 3 3 2	ISE 4223, Fundamentals of Engineering Economy ISE 4563, Quality & Reliability Engineering ISE 4633, Probabilistic Systems Models ISE 4804, Ergonomics in Systems Design ENGR 2461, Thermodynamics ENGR 3441, Fluid Mechanics †Approved Elective: Artistic Forms (Core IV)	3 3 3 4 1 1 3
	TOTAL CREDIT HOURS	15	TOTAL CREDIT HOURS	18
SENIOR	ISE 4333, Production Systems and Operations ISE 4383, Systems Evaluation ISE 4663, Systems Analysis Using Simulation ISE 4853, Data-Driven Decision Making II ‡C S 4513 or other C S Elective ENGR 2431, Electrical Circuits	3 3 3 3 3 1	ISE 4393, Capstone Design Project (Capstone) ISE Elective †Approved Elective: Non-Western Culture (Core IV) †Approved Elective: Social Science (Core III) †Approved Elective: Western Civ. & Culture (Core IV)	3 3 3 3 3
	TOTAL CREDIT HOURS	16	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.

• 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 the C S Elective list available in the ISE office, CEC 116.

❖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 CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCE (CEES)

2113 Statics. Prerequisite: PHYS 2514 and MATH 2433 or MATH 2934 or concurrent enrollment in MATH 2433 or MATH 2934. Vector representation of forces and moments; general three-dimensional theorems of statics; centroids and moments of area and inertia. Free-body diagrams, equilibrium of a particle and of rigid bodies, distributed loads, friction and internal shear and moment loads. Analysis of trusses, frames, and machines. (F)

2153 Mechanics of Materials. Prerequisites: 2113 or AME 2113 or PE 2113. Basic principles of mechanics, including the definition of stress and strain, transformations and principal values for the stress and strain tensors, kinematic relations, review of conservation equations and the development and application of constitutive laws for idealized materials. Elementary elastostatics utilizing Hooke's law; constitutive relations for a linear-elastic continuum, including elastic parameters such as Young's modulus, shear and bulk moduli and Poisson's ratio. Solution of elementary one- and two-dimensional mechanics problems, including thermal stresses and strains, beam flexure, shear and deflections, pressure vessels and buckling of columns. (Sp)

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)

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)

2431 Electrical Circuits. Prerequisite: MATH 2423 or 2924; and PHYS 2524 or concurrent enrollment. Introduction to basic principles of electrical circuits. Topics include DC circuits analysis, DC transients, static electrical fields, static magnetic fields, capacitors, inductors, and filters. (F, Sp)

2461 Thermodynamics. Prerequisite: MATH 2433 or 2934; and PHYS 2524 or concurrent enrollment. Introduction to basic principles of thermodynamics. Topics include density, pressure, and temperature, the first law of thermodynamics for a system, the first law of thermodynamics for a control volume, the second law of thermodynamics, and psychometrics. (F)

3441 Fluid Mechanics. Prerequisite: Mathematics 2433 or 2934; and Physics 2524 or concurrent enrollment. Introduction to basic principles of fluid mechanics. Topics include fluid properties, fluid statics, dimensionless parameters and similitude, control volume equations, open channel flow, and external flow. (Sp)

COURSES IN INDUSTRIAL AND SYSTEMS ENGINEERING (ISE)

2303 Design & Manufacturing Process (Crosslisted with AME 2303). Prerequisite: AME 2113 or CEES 2113 or ENGR 2113. Mechanical and physical properties of engineering materials. Introduction to design concepts, manufacturing processes and equipment used in engineering. (Sp)

2311 Computer Aided Design and Graphics Laboratory for Industrial Engineers. Corequisite: 2303. Provides students with a basic understanding of technical graphics communication and computer-aided design for industrial engineering applications. By using computer-aided design/drafting software, SolidWorks/autoCAD, students will learn basic principles of engineering graphics and geometric modeling to assist in design problem visualization and planning. (Sp)

2823 Enterprise Engineering. Prerequisite: Sophomore standing. Introduction to the industrial engineering role as enterprise system integrator. Systems concepts, modeling and analysis; integrated product/service and operational process design; productivity and quality improvement; computer technology insertion; project, operations, and global supply chain management. (F)

†**G3293 Applied Engineering Statistics.** Prerequisite: MATH 2433 or MATH 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)

†**G3304 Design and Manufacturing II.** Prerequisite: 2303, 2311, Civil Engineering and Environmental Science 2153 (or concurrent enrollment) Or Aerospace and Mechanical Engineering 3143 (or concurrent enrollment). Dimensioning and tolerancing; tolerances-type, design and specification; assembly and fit design; tolerance standards, process planning-precedence representation in machining, operation and machine sequencing; jigs and fixtures-design and analysis; time and cost estimation for machining; automation; process/system integration. **Laboratory** (F)

4113 Spreadsheet-Based Decision Support Systems. Prerequisite: I E/ISE 4623 or concurrent enrollment in I E/ISE 4623, Computer Science 1313 or C S 1323, or permission of instructor. Covers all aspects of spreadsheet-based software functionality that are relevant to supporting decision-making. Microsoft Excel is used as the subject tool. Students will learn advanced functions of Excel that are available through the spreadsheet interface, the Visual Basic language and its integration with the spreadsheet environment, principles of decision-support systems studied in a variety of applications, including facility layout, warehousing, portfolio optimization, and various statistical inference problems. (F)

G4223 Fundamentals of Engineering Economy. Prerequisite: MATH 2423 or 2924 or permission of the department. Development and use of time value of money interest formulas. Inflation considerations and bond problems. Bases for comparison of alternatives, present worth, annual worth, rate of return and savings-investment ratio methods. Decision-making among independent, dependent, capital-constrained and un-equal lived projects. Depreciation methods and their effect on corporate income taxes, leading to after-tax cash flow analysis. Benefit-cost and cost effectiveness analysis. (Sp)

†**G4333 Production Systems/Operation.** Prerequisite: 2823 and 4623, or by permission. Operations-oriented topics for production systems. Supply chain process (tactical planning, operational scheduling and sequencing, management and planning, demand promising). Customer service process; E-Business and information technology applications for production systems. (F)

4383 Systems Evaluation. Prerequisite: I E/ISE 3304, I E/ISE 4223, I E/ISE 4563, I E/ISE 4633, I E/ISE 4804. Focuses on the development and evaluation of alternate system and process designs. Development of system goals, requirements, and performance measures; ranking of alternatives and decision analysis techniques. Review and development of trade studies. Applications in facility layout, maintenance, supply chain, and other contexts. (F)

4393 Capstone Design Project. Prerequisite: ISE 4333, ISE 4383, ISE 4663, and ISE 4853. Restricted to graduating industrial & systems engineering students; to be taken in the last semester. Current problems drawn from production and service organizations will be presented by personnel from these organizations. Students will solve these problems under the guidance of their instructor, using industrial engineering methodology. (F,Sp) [V]

4553 Data-Driven Decision Making I (Slashlisted with 5553). Prerequisite: ISE 3293. Fundamentals of statistical models for describing engineering systems and processes. Analysis of variance, multiple regression, logistic regression, time series, clustering. Emphasis is placed on decision making. No student may earn credit for both 4553 And 5553. (F)

4563 Quality & Reliability Engineering (Slashlisted with 5563). Prerequisite: ISE 3293 and ISE 4553. The use of statistical methods for quality control and improvement in product and process environments, as well as introductory applied probability for component and system reliability. Topics include philosophies of quality management, control chart theory and application, process capability, and performance metrics of reliability. Focus is given to decision making in engineering systems. No student may earn credit for both 4563 and 5563. (Sp)

4623 Deterministic Systems Models. Prerequisite: I E/ISE 2823. Problem solving using analytical models: theory, methodology, and application. Topics include linear programming, simplex algorithm and sensitivity analysis, integer programming, and dynamic programming. Practical applications in transportation networks, project management and scheduling, deterministic inventory models, decision making, and systems integration. Solution methods using computer software. (F)

4633 Probabilistic Systems Models. Prerequisite: I E 3293 or ISE 3293 AND I E 4623 or ISE 4623. Problem solving using stochastic models: theory, methodology, and application. Topics include probability distributions, Poisson processes, Markov chains and Markov decision processes, queuing theory, and Monte Carlo simulation. Practical applications in probabilistic inventory models, maintenance activities, decision making, and systems integration. Solution methods using computer software. (Sp)

4663 Systems Analysis Using Simulation. Prerequisite: Engineering 3293 or 3293, 4633. Implements the science of systems analysis through the use of simulation modeling and statistical analysis; inclusive of time study analysis for performing input modeling tasks. **Laboratory** (F)

4804 Ergonomics in Systems Design. Prerequisite: junior standing or permission of instructor. Human-systems integration, considering the impacts of the physical structure, the information flow, and the environmental conditions on human performance. Students learn how to design, evaluate and improve systems from the perspective of the human(s) working in and impacted by the system. (Sp)

4853 Data-Driven Decision Making II (Slashlisted with 5853). Prerequisite: 4553 and 4804.

Experimental methodology for empirical decision making. Includes the development of empirical hypotheses, designs, performance criteria, and analyses. Techniques for empirical reporting. The measurement of human performance is typically the vehicle used for students in this course. No student may earn credit for both 4853 and 5853. (F)

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)

2513 Discrete Mathematical Structures. Prerequisite: MATH 2423 or MATH 2924 or concurrent enrollment. A course for math majors or prospective math majors. Provides an introduction to discrete concepts such as finite sets and structures, and their properties and applications. Also exposes students to the basic procedures and styles of mathematical proof. Topics include basic set theory, functions, integers, symbolic logic, predicate calculus, induction, counting techniques, graphs and trees. Other topics from combinatorics, probability, relations, Boolean algebras or automata theory may be covered as time permits. (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)