REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN INDUSTRIAL AND SYSTEMS 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 2016 through Spring 2017

GENERAL REQUIREMENTS

Total Credit Hours . . . . . **152•**
Minimum Retention/Graduation Grade Point Averages:
Overall - Combined and OU **3.00**
Major - Combined and OU **3.00**
Curriculum - Combined and OU **3.00**
A minimum grade of C is required for each course in the curriculum.

Industrial and Systems Engineering: Analytics
A529
Bachelor of Science in Industrial and Systems Engineering/Master of Science (Ind. Engr.) **F529**

OU encourages students to complete at least 31 hours of applicable coursework each year to have the opportunity to graduate in five 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)	
	❖MATH 1914, Differential & Integral Calculus I (Core I)	4	**❖MATH 2924**, Differential & Integral Calculus II	4
	P SC 1113, American Federal Government (Core III)	3	**HIST 1483**, U.S., 1492-1865, **or**	3
	ENGR 1411, Freshman Engineering Experience	1	**1493**, U.S., 1865-Present (Core IV)	
			PHYS 2514, General Physics for Engr. & Science Majors (Core II)	4
			C S 1323, Introduction to Computer Programming	3
	TOTAL CREDIT HOURS	**16**	**TOTAL CREDIT HOURS**	**17**
SOPHOMORE	**❖MATH 2934**, Differential & Integral Calculus III	4	**CEES 2153**, Mechanics of Materials	3
	C S 2334, Programming Structures & Abstractions	4	**ISE 2303**, Design & Manufacturing Processes	3
	CEES 2113, Statics	3	**ISE 2311**, Computer Aided Design & Graphics Lab	1
	PHYS 2524, General Physics for Engineering & Science Majors	4	**ISE 3293**, Applied Engineering Statistics	3
	ISE 2823, Enterprise Engineering	3	**C S 2413,** Data Structures	3
			MATH 2513, Discrete Mathematical Structures	3
				3
	TOTAL CREDIT HOURS	**18**	**TOTAL CREDIT HOURS**	**16**
JUNIOR	**ISE 3304**, Design and Manufacturing II	4	**ISE 4223**, Fundamentals of Engineering Economy	3
	ISE 4113, Spreadsheet-Based Decision Support Systems	3	**ISE 4563**, Quality and Reliability Engineering	3
	ISE 4553, Data-Driven Decision Making I	3	**ISE 4633**, Probabilistic Systems Models	3
	ISE 4623, Deterministic Systems Models	3	**ISE 4804**, Ergonomics in Systems Design	4
	C S 3202, Software Requirements & Specifications	2	**ENGR 2461**, Thermodynamics	1
			ENGR 3441, Fluid Mechanics	1
			†Approved Elective: Artistic Forms (Core IV)	3
	TOTAL CREDIT HOURS	**15**	**TOTAL CREDIT HOURS**	**18**
	✦ Admission to the accelerated program is by application and requires a minimum OU GPA and combined GPA of 3.25.			
SENIOR	**ISE 4333**, Production Systems and Operations	3	**ISE 4393**, Capstone Design Project (Capstone)	3
	ISE 4663, Systems Analysis Using Simulation	3		
	♦ISE 5383, Systems Evaluation	3	**ISE 5033,** Systems Engineering	3
	♦ISE 5853, Data-Driven Decision Making II	3		
			†Approved Elective: Non-Western Culture (Core IV)	3
	‡C S 4513, or other C S Elective	3	†Approved Elective: Social Science (Core III)	3
	ENGR 2431, Electrical Circuits	1	†Approved Elective: Western Civ. & Culture (Core IV)	3
	TOTAL CREDIT HOURS	**16**	**TOTAL CREDIT HOURS**	**15**
	Students are eligible for graduate status upon graduation with the Bachelor of Science in Industrial Engineering.			
FIFTH YEAR	***ISE** 5000-Level Graduate Elective	3	***ISE** 5000-Level Graduate Elective	3
	Graduate Elective	3	Graduate Elective	3
	Graduate Elective	3	**ISE 5980**, Thesis Research	3
	ISE 5980, Thesis Research	3		
	TOTAL CREDIT HOURS	**12**	**TOTAL CREDIT HOURS**	**9**

✦ 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.

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

†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.

* Must be approved by the Thesis Committee in accordance with current Master of Science requirements available in the ISE office, CEC 116.

♦These courses are dual-counted, fulfilling requirements for both the undergraduate and graduate Industrial and Systems Engineering degrees.

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

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. Prerequisites: Physics 2514 and Mathematics 2433 or 2934 or concurrent enrollment in Mathematics 2433 or 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 Aerospace and Mechanical Engineering 2113 or Petroleum Engineering 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. Prerequisite: MATH 1523 or concurrent enroll ment, 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 organiza tion. (F, Sp)

2334 Programming Structures and Abstractions. Prerequisite: 1323 and MATH 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 encapsulation, composition, aggregation, inheritance, polymorphism, and generics. Structured approaches 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, in cluding philosophical ethics theories. Discussion of intellectual property rights and privacy. (F, Sp)

2413 Data Structures. Prerequisite: 2334 and MATH 1823 or 1914; and MATH 2813 or MATH 2513, or concurrent enrollment in 2813 or 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 computer 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)

3202 Software Requirements & Specifications. Prerequisite: CS 2413; and CS 2813 or MATH 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)

4513 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)

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)

2431 Electrical Circuits. Prerequisite: Mathematics 2423 or 2924; and Physics 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: Mathematics 2433 or 2934; and Physics 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. 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. (F)

COURSES IN INDUSTRIAL AND SYSTEMS ENGINEERING (ISE)

2303 Design and Manufacturing Process (Crosslisted with Aerospace and Mechanical Engineering 2303). Prerequisite: Aerospace and Mechani cal Engineering 2113 or Civil Engineering and Environmental Science 2113 or Engineering 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 Engineer ing. Prerequisite: sophomore standing. Introduction to the industrial engineering role as enterprise system integrator. Systems concepts, modeling and analysis; integrated product/service and opera tional process design; productivity and quality improvement; computer technology insertion; project, operations, and global supply chain management. (F)

†G3293 Applied Engineering Statistics. Prerequisite: Mathematics 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 Mechani cal Engineering 3143 (or concurrent enrollment). Dimensioning and tolerancing; tolerances—type, design and specification; assembly and fit design; tolerance standards; process planning—predence representation in machining, operation and machine sequencing; jigs and fixtures—design and analysis; time and cost estimation for machining; automation; processes/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. Development and use of time value of money interest formulas. Inflation considerations and bond problems. Bases for comparison of alternatives, including 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.

†G4333 Production Systems and Operations. Prerequisite: 2823 and 4623, or by permission. Operations-oriented topics for production systems. Supply chain process (tactical planning, operational scheduling and sequencing, mangement and planning, demand promising). Customer service process; E-Business and information technology applications for production systems. (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: I E/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 and Reliability Engineering (Slashlisted with 5563). Prerequisite: I E/ISE 3293, and I E/ISE 4553 or I E/ISE 5553. 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 ac tivities, 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. **Laboratory** (Sp)

G5033 Systems Engineering. Prerequisite: graduate standing. The complexities of systems, design, sustainment, and modernization in the context of systems engineering. (Irreg.)

G5383 Systems Evaluation (Slashlisted with 4383). Prerequisite: permission of department. 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. No student may earn credit for both 4383 and 5383. (F)

G5853 Applied Research Methods (Slashlisted with 4853). Prerequisite: 4553 and 4804. Experimental methodology for empirical investigation. Includes the development and measurement 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)

G5980 Research for Master's Thesis. Variable enrollment, two to nine hours; maximum credit applicable toward degree, six hours. (F, Sp, Su)

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 substitution 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)

2513 Discrete Mathematical Structures. Prerequisite: 2423 or 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 mathemati cal proof. Topics include basic set theory, functions, integers, symbolic logic, predi cate 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: 2514 and Mathematics 2423 or 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)