OU encourages students to complete at least 31 hours of applicable coursework each year to have the opportunity to graduate in four years.

<table>
<thead>
<tr>
<th>Year</th>
<th>FIRST SEMESTER</th>
<th>Hours</th>
<th>SECOND SEMESTER</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRESHMAN</td>
<td></td>
<td></td>
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<tr>
<td>ENGL 1113, Prin. of English Composition (Core I)</td>
<td>3</td>
<td>ENGL 1213, Prin. of English Composition (Core I), or</td>
<td>3</td>
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<tr>
<td>CHEM 1315, General Chemistry (Core II)</td>
<td>5</td>
<td>EXPO 1213, Expository Writing (Core I)</td>
<td>3</td>
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<tr>
<td>MATH 2433, Calculus &amp; Analytic Geometry III</td>
<td>3</td>
<td>MATH 2423, Calculus &amp; Analytic Geometry II (Core I)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>PHYS 2524, General Physics for Engineering &amp; Science Majors</td>
<td>4</td>
<td>CEES 2113, Statics and Dynamics</td>
<td>3</td>
<td></td>
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<tr>
<td>ENGR 1410, Freshman Engineering Orientation I</td>
<td>0</td>
<td>ENGR 2303, Design &amp; Manufacturing Processes</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>I E 2823, Enterprise Engineering</td>
<td>3</td>
<td>I E 2311, Computer Aided Design &amp; Graphics Lab</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>TOTAL CREDIT HOURS</td>
<td>14</td>
<td>TOTAL CREDIT HOURS</td>
<td>16</td>
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</tr>
</tbody>
</table>

| SOPHOMORE | | | | |
| MATH 2433, Calculus & Analytic Geometry III | 3 | MATH 2443, Calculus & Analytic Geometry IV | 3 |
| PHYS 2524, General Physics for Engineering & Science Majors | 4 | CEES 2113, Statics and Dynamics | 3 |
| ENGR 2003, Engineering Practice I | 3 | I E 2303, Design & Manufacturing Processes | 3 |
| I E 2823, Enterprise Engineering | 3 | I E 2311, Computer Aided Design & Graphics Lab | 1 |
| TOTAL CREDIT HOURS | 16 | TOTAL CREDIT HOURS | 16 |

| JUNIOR | | | | |
| I E 3304, Design and Manufacturing II | 4 | I E 4223, Fundamentals of Engineering Economy | 3 |
| I E 4553, Engineering Experimental Design | 3 | I E 4563, Quality Engineering | 3 |
| I E 4623, Systems Modeling and Optimization | 3 | I E 4633, Applied Engineering Optimization | 3 |
| §MATH Elective | 3 | I E 4824, Ergonomics | 4 |
| †Approved Elective: Artistic Forms (Core IV) | 3 | †Approved Elective: Non-Western Culture (Core IV) | 3 |
| TOTAL CREDIT HOURS | 16 | TOTAL CREDIT HOURS | 16 |

| SENIOR | | | | |
| I E 4333, Production Systems and Operations | 3 | I E 4363, Facility Planning, Warehousing, and Material Handling | 3 |
| I E 4663, Systems Analysis Using Simulation | 3 | I E 4593, Capstone Design Project (Capstone) | 3 |
| I E 4853, Applied Research Methods | 3 | I E Elective | 3 |
| ENGR 2431, Electrical Circuits | 1 | ‡I E Technical Elective | 3 |
| ENGR 2461, Thermodynamics | 1 | ‡I E Technical Elective | 3 |
| ENGR 3441, Fluid Mechanics | 1 | †Approved Elective: Western Civ. & Culture (Core IV) | 3 |
| †I E Elective | 3 | | |
| TOTAL CREDIT HOURS | 15 | TOTAL CREDIT HOURS | 15 |

NOTE: Engineering transfer students may take ENGR 3410 in place of ENGR 1410 and ENGR 1420.

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 approved list of math electives consisting of MATH 2513, 3113, 3333, 3413, 3513, 3613, 4433, or C S 1813.

†To be chosen from an approved list of IE electives available in the IE office, CEC 116.

‡To be chosen from an approved list of IE technical electives available in the IE office, CEC 116.

*This course fulfills the Computer Literacy Requirement for graduation as required by the Oklahoma State Regents for Higher Education.
 Industrial Engineering—0913A—Page 2

COURSES IN CHEMISTRY AND BIOCHEMISTRY (CHEM)
1315 General Chemistry. Prerequisite: Mathematics 1503 or 1643, or math ACT equal to or greater than 23. First of a two-semester sequence in general chemistry. Topics covered: basic measurement, gas laws and changes in state, stoichiometry, atomic theory, electron configuration, periodicity, bonding, molecular structure and thermochromy. Laboratory (F, Sp, Su) [IP-LAB]

COURSES IN CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCE (CEES)
2113 Statics and Dynamics. Prerequisites: Physics 2514 and Mathematics 2433 or concurrent enrollment. Vectorial representation of forces and moments; general three-dimensional theorems of statics and dynamics; centroids and moments of area and inertia. Free-body diagrams, equilibrium of a particle and of rigid bodies, principles of work and energy, principle of impulse-momentum. Motion of particles and rigid bodies in translating and rotating reference frames. Newton's law of motion and Lagrange's equation, including application to lumped-parameter systems. Analyses of trusses, frames and machines. (F)
2513 Mechanics of Materials. Prerequisites: 2113. Basic principles of mechanics, including the definitions of stress, strain, and the constitutive relations. Solution of statically determinate problems; kinematic relations, review of conservation equations and the development and application of constitutive laws for idealized materials. Elementary elastostatics utilizing Hook'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 mechanical problems, including thermal stresses and strains, beam flexure, shear and deflections, pressure vessels and buckling of columns. (Sp)

COURSES IN COMPUTER SCIENCE (CS)
1323 Introduction to Computer Programming. Prerequisite: Mathematics 1523 or equivalent. Introduction to the design and implementation of computer software with an emphasis on abstraction and program organization. (F, Sp)

COURSES IN ENGINEERING (ENGR)
1410 Freshman Engineering Orientation I. Prerequisite: declared major in engineering. All entering freshmen with a declared engineering major are required to enroll. One hour of this seminar a week is a large group setting where all students meet and cover course, program, and general engineering issues. A second hour is a required small group setting with an upper-class mentor from the College of Engineering Dean's Leadership Council. This second hour will focus on basic enrollment and retention strategies such as adding and dropping classes and choosing electives in addition to a weekly topic. (F)
1420 Freshman Engineering Orientation II. Prerequisite: declared major in engineering. All entering freshmen with a declared engineering major in this seminar will cover course, program, and general engineering issues. A second hour is a required small group setting with an upper-class mentor from the College of Engineering Dean's Leadership Council. This second hour will focus on basic enrollment and retention strategies such as adding and dropping classes and choosing electives in addition to a weekly topic. (Sp)
2003 Engineering Practice I. Prerequisite: 1410, 1420, and English 1213. Introduction to basic principles of successful engineering enterprise. (F, Sp)
2431 Electrical Engineering Laboratory. Prerequisite: Mathematics 2423 and Physics 2524 or concurrent enrollment. Introduction to basic principles of electrical circuits. Topics include circuits (DC circuits, AC circuits, resonance, AC transients, DC transients) static electrical fields, static magnetic fields, and electronics (diodes, operational amplifiers). (F, Sp)
2461 Thermodynamics. Prerequisite: Mathematics 2433 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 psychrometry. (F)
3441 Fluid Mechanics. Prerequisite: Mathematics 2433. 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 ENGINEERING (I E)
2303 Materials, Design and Manufacturing Processes (Crosslisted with Aerospace and Mechanical Engineering 2303). Prerequisite: Aerospace and Mechanical 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. (F, 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/prototyping software, SolidWorks/AutoCAD, students will learn basic principles of engineering graphics and geometric modeling to assist in design problem visualization and planning. (F)
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)
1G2393 Applied Engineering Statistics. Prerequisite: Mathematics 2433. Introduction to probability, random variables, distribution functions, sampling distribution, statistical inference, point estimation, and confidence intervals. (F, Sp, Su)[I-M]

COURSES IN MECHANICAL ENGINEERING (ME)
2313 Manufacturing Processes (Crosslisted with Aerospace and Mechanical Engineering 2313). Prerequisite: Aerospace and Mechanical 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. (F, Sp)
3G1364 Design and Manufacturing II. Prerequisite: 2303, 2313, Civil Engineering and Environmental Science 2113 (or concurrent enrollment) or Aerospace and Mechanical Engineering 2313 (or concurrent enrollment). Dimensioning and tolerancing, tolerances—type, design and specification; assembly and fit design; tolerance standards; process planning—predecision representation in machining, operation and machine sequencing; jig and fixtures—design and analysis; time and motion studies—application for machining; automation; processes/systems integration. Laboratory (F, Sp, Su)
4G223 Fundamentals of Engineering Economy. Prerequisite: Mathematics 2423. Introduction to concepts of economic analysis to optimize benefits utilizing multivariant, multistaged mathematical models. Topics include cost and worth comparison, capital costs and sources, time value of money, risk and uncertainty, economics, taxes, economic efficiency of alternate designs, minimum costs and maximum benefits, risk and uncertainty and economics of work schedules. (Sp)
4G333 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, management and planning, demand promising). Customer service process; E-Business and information technology applications for production systems. (F)
4363 Facility Planning, Warehousing, and Material Handling (Crosslisted with 5363). Prerequisite: 4623. Facility location and layout models, design, analysis, and improvement of warehouse operations, material handling systems in manufacturing and warehousing operations, information technologies for management of operations, supply chain relationships. No student may earn credit for both 4363 and 5363. (Sp)
4393 Capstone Design Project. Prerequisite: 4333, 4563, 4663, and 4853. Restricted to graduating industrial 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. (Sp, F)
4553 Engineering Experimental Design (Crosslisted with 5553). Prerequisite: 1293 or Engineering 3293. Fundamentals of design of experiments Analysis of variance models for single factor and blocking factors and multi-factor designs, including factorial and nested designs. Fixed, random and mixed models. Analysis of covariance models. No student may earn credit for both 4553 and 5553. (F)
4563 Quality Engineering (Crosslisted with 5563, 5564). Prerequisite: 1293 or Engineering 3293, and 4553 or both. Quality control methods for improving the quality of products and processes. Measurement and control of process variation: quality control charts and other tools for improving quality control and productivity. Use of statistical methods in product and process quality improvement and control. Multivariable quality improvement: multiple simultaneous quality characteristics, quality loss functions. Quality assurance for new products and processes. Quality improvement teams. (Sp)
4623 Systems Modeling and Optimization. Prerequisite: 2823. Problem solving using analytical models. Introduction to optimization, linear programming, integer, dynamic programming, and goal programming methods. Simplex method and sensitivity analysis. Practical applications using optimization software such as LINDO, LINGO, EXCEL SOLVER. Analytical decision making, integer programming, dynamic programming. (F)
4633 Applied Engineering Optimization. Prerequisite: Engineering 3293 or 1293, 4623. Data mining techniques, heuristics and applications of operations research to financial engineering, site selection, transportation, transhipment and assignment problems. Routing techniques, facility layout models, queuing models and applications, Monte Carlo simulations and applications. (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; use of time study analysis for performing input modeling tasks. Laboratory (F)
1G4624 Ergonomics. Prerequisite: junior standing or permission of instructor. The measurement of human physical capabilities and limitations. Measurement of the environment and elicited human responses. Workplace, equipment and job design with regard to human performance efficiency, health, and safety. Laboratory (Sp)
4853 Applied Research Methods (Crosslisted with 5853). Prerequisite: 4533 and 4824. Experimental methodology for empirical investigation, including problem formulation. The development and measurement of performance criteria, experimental and oral communication. 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)
1823 Calculus and Analytic Geometry I. Prerequisite: 1523 at OU, or satisfactory score on the placement test, or satisfactory score on the ACT/SAT. Topics covered include equations of straight lines; conic sections; functions, limits and continuity; differentiation; maximum-minimum theory and curve sketching. A student may not receive credit for this course and 1741. (F, Sp, Su) [I-M]
2423 Calculus and Analytic Geometry II. Prerequisite: 1823. Integration and applications; the calculus of transcendental functions; techniques of integration; and the introduction to differential equations. A student may not receive credit for this course and 2141. (F, Sp, Su) [I-M]
2433 Calculus and Analytic Geometry III. Prerequisite: 2423. Polar coordinates, parametric equations, sequences, infinite series, vector analysis. (F, Sp, Su)
2443 Calculus and Analytic Geometry IV. Prerequisite: 2433. Vector calculus; functions of several variables; partial derivatives; gradients, extreme values and differentials of multivariable functions; multiple integrals; line and surface integrals. (F, Sp, Su)

COURSES IN PHYSICS (PHYS)
2514 General Physics for Engineering and Science Majors. Prerequisite: Mathematics 1203. Not open to students with credit in 2105. 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. Not open to students with credit in 2105. Temperature, heat, thermodynamics, electricity, magnetism, optics. (F, Sp, Su)