## Requirements for the Bachelor of Science in Chemical Engineering

Accredited by the Engineering Accreditation Commission of ABET, [http://www.abet.org](http://www.abet.org)

### College of Engineering

The University of Oklahoma

For Students Entering the Oklahoma State System for Higher Education

Summer 2011 through Spring 2012

#### General Requirements

<table>
<thead>
<tr>
<th>REQUIREMENT</th>
<th>HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Credit Hours</td>
<td>126*</td>
</tr>
</tbody>
</table>

**Minimum Retention/Graduation Grade Point Averages:**

- Overall - Combined and OU: 2.00
- Major - Combined and OU: 2.00

A minimum grade of C is required for each course in the curriculum.

### OU encourages students to complete at least 32 hours of applicable coursework each year to have the opportunity to graduate in four years.

#### Freshman

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<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>
</tr>
<tr>
<td>CHEM 1315, General Chemistry (Core II)</td>
<td>5</td>
<td>EXPO</td>
<td></td>
</tr>
<tr>
<td>MATH 1823, Calculus &amp; Analytic Geometry I (Core I)</td>
<td>3</td>
<td>CHEM 1415, General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>HIST 1483, U.S., 1492-1865, or</td>
<td>3</td>
<td>MATH 2423, Calculus &amp; Analytic Geometry II</td>
<td>3</td>
</tr>
<tr>
<td>1493, U.S., 1865-Present (Core IV)</td>
<td>2</td>
<td>PHYS 2514, General Physics for Engineering &amp; Science</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 1411, Freshman Engineering Experience</td>
<td>1</td>
<td>Majors (Core II)</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credit Hours:** 15

#### Sophomore

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
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<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2433, Calculus &amp; Analytic Geometry III</td>
<td>3</td>
<td>MATH 2443, Calculus &amp; Analytic Geometry IV</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 2524, General Physics for Engineering &amp; Science Majors</td>
<td>4</td>
<td>MATH 3113, Introduction to Ordinary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>**CH E 2033, Chemical Engineering Fundamentals</td>
<td>3</td>
<td>CH E 3113, Momentum, Heat &amp; Mass Transfer I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 3053, Organic Chemistry I: Biological Emphasis</td>
<td>3</td>
<td>CHEM 3153, Organic Chemistry II: Biological Emphasis</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credit Hours:** 15

#### Junior

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
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</tr>
</thead>
<tbody>
<tr>
<td>CH E 3123, Momentum, Heat &amp; Mass Transfer II</td>
<td>3</td>
<td>CH E 2313, Structure and Properties of Materials</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 3473, Chemical Engineering Thermodynamics</td>
<td>3</td>
<td>CH E 3333, Separation Processes</td>
<td>3</td>
</tr>
<tr>
<td>CH E 3723, Numerical Methods for Engineering Computation</td>
<td>3</td>
<td>CH E 3432, Unit Operations Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 3423, Physical Chemistry I</td>
<td>3</td>
<td>CH E 4473, Kinetics</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 3421, Physical Chemistry Lab</td>
<td>1</td>
<td>ENGL 3153, Technical Writing</td>
<td>3</td>
</tr>
</tbody>
</table>

**Approved Elective, Core III: Social Science**

**Total Credit Hours:** 16

#### Senior

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>P SC 1113, American Federal Government (Core III)</td>
<td>3</td>
<td>*ENGR 2411, Applied Engineering Statics</td>
<td>1</td>
</tr>
<tr>
<td>CH E 4153, Process Dynamics and Control</td>
<td>3</td>
<td>*ENGR 2431, Electrical Circuits</td>
<td>1</td>
</tr>
<tr>
<td>CH E 4253, Chemical Engineering Design I</td>
<td>3</td>
<td>*ENGR 3431, Electromechanical Systems</td>
<td>1</td>
</tr>
<tr>
<td>CH E 4262, Chemical Engineering Design Lab</td>
<td>2</td>
<td>CH E 4273, Advanced Process Design (Capstone)</td>
<td>3</td>
</tr>
</tbody>
</table>

**$Technical Elective I**

**Total Credit Hours:** 17

#### 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.
- One of the Technical Elective I, Technical Elective II, or the Advanced Chemistry elective must be CH E. Prior faculty approval is needed.
- *Advanced chemistry elective must be pre-approved as having significant chemistry content. This elective may be chosen from but is not limited to the following: CHEM 3523, 3653, 4333; CHE E 5163, 5243, 5273, 5453, 5673.

**Total Credit Hours:** 15

### Chemical Engineering (Standard)

- Bachelor of Science in Chemical Engineering

### Note:

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.

Courses to be completed 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.

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- Technical Writing is a corequisite for CH E 3432.

- This course fulfills the Computer Literacy Requirement for graduation as required by the Oklahoma State Regents for Higher Education.

- It is recommended that ENGR 2411, 2431, and 3431 be taken in the same semester. The courses are offered in sequential five-week blocks during the spring semester.

- Chemical engineering courses are sequential and usually offered only in the semester shown above. Note prerequisites on the back of this page.

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COURSES IN CHEMICAL, BIOLOGICAL & MATERIALS ENGINEERING (CHE)

2002 Introduction to Chemical Engineering Computing. Prerequisite: 2033 or concurrent. Introduction to engineering computing and programming using prevalent engineering computing software; program design and development; application exercises in teamwork. (F, Sp)

2033 Chemical Engineering Fundamentals. Prerequisite: Chemistry 1415 or 1425 or equivalent. Matter balances involving physical equilibria and chemical reaction; energy balances; gas behavior involving vapor pressure and Raoult’s Law. (F)

3113 Structure and Properties of Materials. Prerequisite: Chemistry 1415, Physics 2524. The behavior of materials under the conditions and environments is correlated to atomic and molecular structure and bonding. (Sp)

1131 Momentum, Heat and Mass Transfer I. Prerequisite: 2033; Mathematics 2443 or concurrent enrollment in 2443, Physics 2524 and completion or concurrent enrollment in Mathematics 3113. The common mathematical and physical basis of these processes is presented. Calculation methods for all three processes are developed. Design procedures of equipment for fluid flow, heat transfer and diffusional processes are given. (Sp)

FG3123 Momentum, Heat and Mass Transfer II. Prerequisite: 3113 and Mathematics 2443, or concurrent enrollment in Mathematics 3113. The common mathematical and physical basis of these processes is presented. Calculation methods for all three processes are developed. Design procedures of equipment for fluid flow, heat transfer and diffusional processes are given. (F)

FG3333 Separation Processes. Prerequisite: 3123, 3473, 3723. Coverage of the fundamentals and modeling techniques of various separation processes found in the chemical process industry. Discussion of various computational approaches for binary and multicomponent separations; factors affecting efficiency, capacity and energy requirements. (Sp)

FG3432 Unit Operations Laboratory. Prerequisite: 3123, 3333 or concurrent enrollment in 3333, 3473, or 3723. Laboratory exercises on the calculation of processes involving fluid flow, heat and mass transfer, kinetics and process control. Process parameters and physical properties are measured. Laboratory (Sp)

FG4733 Chemical Engineering Thermodynamics. Prerequisite: CHE 2033, MATH 2443. Application of the first and second laws of thermodynamics to the analysis of phase change, solution behavior and chemical equilibrium and reaction. (F)

FG5723 CHE E Numerical Methods for Engineering Computation. Prerequisites: 2002 or Aerospace and Mechanical Engineering 2401, or Engineering 2002 or 2003, or Computer Science 1313 or 1322, and Mathematics 3113 or 3411. Course uses specific software applications tailored toward chemical engineering. Basic methods for obtaining numerical solutions with a digital computer. Included are methods for the solutions of algebraic and transcendental equations, simultaneous linear equations, ordinary and partial differential equations, and curve fitting techniques. The methods are compared with respect to computational efficiency and accuracy. Any student who earns credit for E 3723 cannot receive duplicate credit for AME 3723, CS 3723, or CH 3723. This course may not be taken for graduate credit within the College of Engineering. (F)

4153 Process Dynamics and Control. Prerequisite: 4473. Formulation of first-order models for storage and heat transfer, chemical reaction, and heated slosh tanks; transient, steady-state, process dynamics; three-mode control of unit operations; higher-order systems and counter-current operations; analog simulation and digital control of chemical processes. (F)

4253 Chemical Engineering Design I. Prerequisite: 3333, 3473, 4473 or concurrent enrollment in 4473, and 4253 or concurrent enrollment in 4253. Experimental techniques for the acquisition of pilot plant data, using unit operations equipment and reactors for use in process design. Laboratory (F)

4262 Chemical Engineering Design II. Prerequisite: 3333, 3432, 4473 or concurrent enrollment in 4473, and 4253 or concurrent enrollment in 4253. Simple techniques for the acquisition of pilot plant data, using unit operations equipment and reactors for use in process design. Laboratory (F)

5163 Catalysis. Prerequisite: 4473. Physical characterization of heterogeneous catalysts; catalytic activity of metals, semiconductors, solid acids, and shape-selective materials. Theories of catalytic activity, catalytic reactors, basics of catalyst surface characterization and activity measurement. (Irreg.)

5241 Biochemical Engineering (Crosslisted with Bioengineering 5243). Prerequisite: 3123 or permission. Current bioprocesses for reaction and separation with emphasis on fundamentals of process design and 1112 Advanced Chemical Engineering and microbiology. (Irreg.)

5453 Polymer Science (Crosslisted with Chemistry 5453). Prerequisite: graduate standing or permission. Nomenclature, synthesis, structure and properties of high polymers, survey of production, processing and uses of commercial polymeric materials. (Sp)

5673 Colloid and Surface Science (Crosslisted with Chemistry and Civil Engineering and Environmental Science 5673). Prerequisite: graduate standing or permission of instructor. Capillarity, surface thermodynamics, adsorption from vapor and liquid phases, contact angles, micelle formation, solubilization, emulsions and foams. Applications to be discussed include detergency, enhanced oil recovery, and processes for pollution control. (Irreg.)

5843 Advanced Chemical Engineering Thermodynamics. Prerequisite: 3473 or permission. Advanced thermodynamics as applied to engineering problems and design. (F)

1315 General Chemistry. Prerequisite: Mathematics 1503 or 1643, or math ACT equal to or greater than 19. First of 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) (II-LAB)

1415 General Chemistry (Continued). Prerequisite: 1315 with a minimum grade of C or a satisfactory score on the chemistry placement examination. Topics covered include: nature of solutions, equilibrium, thermodynamics, acid and base properties, kinetics and electrochemistry. Laboratory (F, Sp, Su)

3053 Organic Chemistry I: Biological Emphasis. Prerequisite: CHEM 1415 or CHEM 1425. Intended for life science majors. First course in a two-semester sequence (3053 and 3153). This course will cover the chemistry of organic compounds as applied to enzymes, carbohydrates, lipids, and proteins. (F, Sp, Su)

3152 Organic Chemistry Laboratory: Biological Emphasis. Prerequisite: CHEM 3053 or concurrent enrollment. Intended for life science majors. Laboratory course designed to accompany CHEM 3053 or CHEM 3153. Students selected experiments designed to illustrate the fundamental techniques used in organic chemistry, to develop familiarity with the properties of organic compounds and to introduce analytical techniques including spectroscopy. (F, Sp, Su)

3153 Organic Chemistry II: Biological Emphasis. Prerequisite: CHEM 3053 with a grade of C or better. Intended for life science majors. Second course in a two-semester sequence (3053 and 3153). This course will cover the chemistry of organic compounds as applied to enzymes, carbohydrates, lipids, and proteins. (F, Sp, Su)

FG4241 Physical Chemistry Laboratory. Prerequisite: 3423 or concurrent enrollment. Physicochemical measurements and calculations. (F, Sp, Su)

FG4263 Physical Chemistry I. Prerequisite: CHEM 1415 or CHEM 1425; MATH 2423 or MATH 2924 or concurrent enrollment. States of matter, chemical thermodynamics, equilibrium, etc. (F, Sp, Su)

G4323 Advanced Inorganic Chemistry—Periodic System. Prerequisite: CHEM 3053 or CHEM 3055 or CHM 3064. Chemistry of proteins, carbohydrates, lipids, and nucleic acids; enzyme kinetics; biochemical energetics; intermediary metabolism; regulatory processes. (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 following the lab hour. (F)

2002 Professional Development. Prerequisite: sophomore standing. Developing an understanding of engineering ethics, teamwork, leadership, and professional responsibility through the concepts of contemporary, social, and global issues. (F, Sp)

2411 Applied Engineering Statics. Prerequisites: Physics 2514 and Mathematics 2433 or concurrent enrollment in Mathematics 2433. Review of fundamentals of statics calculations and their applications to common engineering situations. (Sp)

2431 Electrical Circuits. Prerequisite: Mathematics 2423 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)

3431 Electromechanical Systems. Prerequisite: ENGR 2431. Introduction to basic principles of electromechanical systems. Topics include electric machines and motors, physical principles of mechanical and electrical systems, types of sensors and actuators, digital logic gates, signal conditioning, A/D and D/A conversion, and interfacing and communication protocols. (F, Sp)

3535 Calculus and Analytic Geometry III. Prerequisite: 2423. Polar coordinates, parametric equations, sequences, infinite series, vector analysis. (F, Sp)

COURSES IN ENGLISH (ENGL)

3153 Technical Writing. Prerequisite: 1213 and Engineering or hard science majors only. Focuses on the forms of report writing most frequently encountered in research and industry. (F, Sp, Su)

COURSES IN MATHEMATICS (MATH)

1823 Calculus and Analytic Geometry I. Prerequisite: 1523 at OU, or satisfactory score on the placement test, or, for incoming freshmen direct from high school, 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 1743. (F, Sp, Su) [I-M]

2423 Calculus and Analytic Geometry II. Prerequisite: 1823. Integration and its 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 2123. (F, Sp, Su) [I-M]

3833 Calculus and Analytic Geometry III. Prerequisite: 2423. Polar coordinates, parametric equations, sequences, infinite series, vector analysis. (F, Sp)

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 2105. Vectors, kinetic energy, work and energy of particle systems, energy of rigid body systems of particles, rotational kinematics and dynamics, oscillations, gravitation, fluid mechanics, waves. (F, Sp, Su) [II-LAB]

2524 General Physics for Engineering and Science Majors. Prerequisites: 2514 and Mathematics 2423. Not open to students with credit in 2105. Temperature, heat, thermodynamics, electricity, magnetism, optics. (F, Sp, Su)