REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING/MASTER OF SCIENCE

(Accredited by the Accreditation Board for Engineering and Technology)

COLLEGE OF ENGINEERING

THE UNIVERSITY OF OKLAHOMA

For Students Entering the Oklahoma State System for Higher Education
Summer 2007 through Spring 2008

GENERAL REQUIREMENTS

Total Credit Hours . . . . . **144•**

Minimum Retention/Graduation Grade Point Averages:

Overall - Combined and OU **3.25**

Major - Combined and OU **3.25**

Curriculum - Combined and OU **3.25**

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

Chemical Engineering (Standard) — **0906H**
Bachelor of Science in Chemical Engineering/ Master of Science

OU encourages students to complete at least 32 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 1823, Calculus & Analytic Geometry I (Core I)	3	**CHEM 1415**, General Chemistry	5
	HIST 1483, U.S., 1492-1865, **or**	3	**MATH 2423**, Calculus & Analytic Geometry II	3
	1493, U.S., 1865-Present (Core IV)		**PHYS 2514**, General Physics for Engineering & Science Majors (Core II)	4
	ENGR 1410, Freshman Engineering Orientation I	0	**ENGR 1420**, Freshman Engineering Orientation II	0
	TOTAL CREDIT HOURS	**14**	**TOTAL CREDIT HOURS**	**15**
SOPHOMORE	**MATH 2433**, Calculus & Analytic Geometry III	3	**MATH 2443**, Calculus & Analytic Geometry IV	3
	PHYS 2524, General Physics for Engineering & Science Majors	4	**MATH 3113**, Introduction to Ordinary Differential Equations	3
			ENGR 2003, Engineering Practice I	3
	***CH E 2002**, Intro. to Chemical Engineering Computing	2	**CH E 3113**, Momentum, Heat & Mass Transfer I	3
	✤CH E 2033, Chemical Engineering Fundamentals	3	**CHEM 3153**, Organic Chemistry	3
	CHEM 3053, Organic Chemistry	3	**CHEM 3152**, Organic Chemistry Lab	2
	TOTAL CREDIT HOURS	**15**	**TOTAL CREDIT HOURS**	**17**
JUNIOR	**CH E 3123**, Momentum, Heat & Mass Transfer II	3	**CH E 2313,** Structure and Properties of Materials	3
	CH E 3473, Chemical Engineering Thermodynamics	3	**CH E 3333**, Separation Processes	3
	CH E 3723, Numerical Methods for Engineering Computation	3	**CH E 3432**, Unit Operations Laboratory‡	2
	CHEM 3423, Physical Chemistry I	3	**CH E 4473,** Kinetics	3
	CHEM 3421, Physical Chemistry Lab	1	**ENGL 3153**, Technical Writing	3
	†Approved Elective, Core III: Social Science	3	†Approved Elective, Core IV: Artistic Forms	3
	TOTAL CREDIT HOURS	**16**	**TOTAL CREDIT HOURS**	**17**
Students must be admitted to the accelerated program before the beginning of the senior year.				
SENIOR	**P SC 1113**, American Federal Government (Core III)	3	**CH E 2153,** Electrical and Mechanical Engineering Concepts and Applications	3
	CH E 4153, Process Dynamics and Control	3		
	CH E 4253, Chemical Engineering Design I	3	**CH E 4273**, Advanced Process Design (Capstone)	3
	CH E 4262, Chemical Engineering Design Lab	2	§Technical Elective II	3
	§Technical Elective I	3	#Advanced Chemistry Elective	3
	†Approved Elective, Core IV: Western Civ. & Culture	3	†Approved Elective, Core IV: Non-Western Culture	3
			CH E 5971, Seminar in Chem. Engineering Research	**1**
	TOTAL CREDIT HOURS	**17**	**TOTAL CREDIT HOURS**	**16**
Students are eligible for graduate status upon graduation with the Bachelor of Science in Chemical Engineering.				
FIFTH YEAR	**CH E 5183**, Graduate Transport Phenomena	**3**	**CH E 5843**, Adv. Chemical Engineering Thermodynamics	**3**
	CH E 5971, Seminar in Chem. Engineering Research	**1**	**CH E 5971**, Seminar in Chem. Engineering Research	**1**
	CH E 5980, Research for Master's Thesis	**3**	**CH E 5980**, Research for Master's Thesis	**3**
	CH E 6723, Advanced Kinetics & Reaction Engineering	**3**		
	TOTAL CREDIT HOURS	**10**	**TOTAL CREDIT HOURS**	**7**

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.

§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 preapproved as having significant chemistry content. This elective may be chosen from but is not limited to the following: CHEM 3523, 3653, 4333; CH E 5163, 5243, 5273, 5453, 5673.

‡Technical Writing is a corequisite for CH E 3432.

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

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

COURSES IN CHEMICAL, BIOLOGICAL & MATERIALS ENGINEERING (CH E)

2002 Introduction to Chemical Engineering Computing. Prerequisite: 2033 or concurrent, Mathematics 1823 or concurrent. Introduction to engineering computing and programming using prevalent engineering computing software; program design and development; computer application exercises in engineering. (F)

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

2153 Electrical and Mechanical Engineering Concepts and Applications. Prerequisite: Physics 2524; Mathematics 2433. Review of electrical circuits and statics and dynamics; application to engineering systems, including motors, power systems, electrical safety, and design of flanges, spans, vessels and other mechanical systems. (Sp)

2313 Structure and Properties of Materials. Prerequisite: Chemistry 1415, Physics 2524. The behavior of materials under various conditions and environments is correlated to atomic and molecular structure and bonding. (Sp)

3113 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)

†G3123 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)

†G3333 Separation Processes. Prerequisite: 3123, 3473, 3723. Coverage of the fundamentals and modeling techniques of various separation processes found in the chemical process industries. Discussion of various computational approaches for binary and multicomponent separations; factors affecting efficiency, capacity and energy requirements. (Sp)

†G3432 Unit Operations Laboratory. Prerequisite: 3123, 3333 or concurrent enrollment in 3333, 3473; corequisite: English 3153. Experimental examination of processes involving fluid flow, heat and mass transfer, kinetics and process control. Process parameters and physical properties are measured. **Laboratory** (Sp)

†G3473 Chemical Engineering Thermodynamics. Prerequisite: 2033. Application of the first and second laws of thermodynamics to the analysis of phase change, solution behavior and chemical equilibria and reaction. (F)

†G3723 Numerical Methods for Engineering Computation (Crosslisted with Aerospace and Mechanical Engineering, Computer Science, and Petroleum Engineering 3723). Prerequisites: 2002 or Aerospace and Mechanical Engineering 2401 or Computer Science 1313 or Computer Science 1323 or Engineering 1001 or Engineering 2003 and Mathematics 3113. 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. This course may not be taken for graduate credit within the College of Engineering. (F, Sp)

G4153 Process Dynamics and Control. Prerequisite: 4473. Formulation of first-order models for storage tanks, chemical reactors and heated, stirred tanks; transient and 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)

G4253 Chemical Engineering Design I. Prerequisite: 3333, 4473. Processes and process equipment design; technical design of units combined into plants. (F)

G4262 Chemical Engineering Design Laboratory. Prerequisite: 3333, 3432, 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)

G4273 Advanced Process Design. Prerequisite: 4253, 4262. Process and process equipment design, complete design of process plants including complete flow sheets, estimated plant costs, costs of process development, economics of investment. (Sp) [V]

G4473 Kinetics. Prerequisite: 3473, 3723, Mathematics 3113. Fundamentals of rates, homogeneous isothermal reactions, non-isothermal reactions, reactors and design, heterogeneous reactions, fixed and fluidized bed reactors, experimental data reduction, non-ideal flow reaction systems. (Sp)

G5163 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.)

G5183 Graduate Transport Phenomena. Prerequisite: 3123. Fundamentals of the theory of transport process; heat, mass, momentum transfer combined with chemical reactions, derivation of different equations to describe processes and process units, analytical and numerical solutions of systems of describing equations. (F)

G5243 Biochemical Engineering. Prerequisite: 3123 or permission. Current bioprocesses for reaction and separation with emphasis on fundamental principles of chemical engineering, biochemistry and microbiology. (Alt. Sp)

G5453 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)

G5673 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 adsorption for pollution control. (Irreg.)

G5843 Advanced Chemical Engineering Thermodynamics. Prerequisite: 3473 or permission. Advanced thermodynamics as applied to engineering problems and design. (F)

G5971 Seminar in Chemical Engineering Research. May be repeated; maximum credit four hours for the master's degree, 10 hours for the doctoral degree. Speakers from academia and industry elaborate on methods and results from research in their areas of expertise to provide the student with an appreciation of the problems of current interest in chemical engineering. (F, Sp)

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

G6723 Advanced Kinetics and Reaction Engineering. Prerequisite: 4473 or graduate standing. Understanding and analysis of complex kinetics and reactor systems: free radical and cracking reactions, polymerization, biokinetics and catalytic kinetics with mass heat transfer limitations. Advanced reactor systems such as a catalytic fixed bed reactors in one- and two-dimensions, equilibrium limited reaction systems, fluidized and trickle bed reactors, etc. are considered. (F)

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 thermochemistry. **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. Prerequisite: 1415 or 1425. Two-semester sequence (3053 and 3153) covering the fundamental concepts of organic structure and reactions of the principal functional groups. Reaction mechanisms. (F, Sp, Su)

3152 Organic Chemistry Laboratory. Prerequisite: 3013 or 3053. Selected experiments designed to illustrate the fundamental techniques used in organic research, to develop familiarity with the properties of organic compounds and to demonstrate the application of the scientific approach to laboratory work. (F, Sp, Su)

3153 Organic Chemistry. Prerequisite: 3053 with a grade of "C" or better. Two-semester sequence (3053 and 3153) covering the fundamental concepts of organic structure and reactions of the principal functional groups. Reaction mechanisms. (F, Sp, Su)

†G3421 Physical Chemistry Laboratory. Prerequisite: 3423 or concurrent enrollment. Physiochemical measurements and calculations. (F, Sp, Su)

†G3423 Physical Chemistry I. Prerequisite: 1415 or 1425; Mathematics 2423 or concurrent enrollment. States of matter, chemical thermodynamics, equilibria, etc. (F, Sp, Su)

†G3523 Physical Chemistry II. Prerequisite: 3423 with a grade of "C" or above. Continuation of 3423. Kinetics, electrochemistry, atomic and molecular states of matter, etc. (F, Sp)

†G3653 Introduction to Biochemistry. Prerequisite: 3013 or 3053. Chemistry of proteins, carbohydrates, lipids, and nucleic acids; enzyme kinetics; biochemical energetics; intermediary metabolism; regulatory processes. (F)

G4333 Advanced Inorganic Chemistry—Periodic System. Prerequisite: 3013 or 3053. A survey of all elements and important compounds based on atomic structure and position in the Periodic System; effect of atomic size, ionic size and charge on the properties of elements. Inorganic nomenclature. (F)

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 in a large group setting where all students meet and cover details on all engineering disciplines. Additional topics would be continuums of majors, success in the College of Engineering, success at the University of Oklahoma, study abroad programs, advising issues, graduate school opportunities, career planning, and information related to technical/honor societies and participation. A second hour a week is a required small group session 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 area. (F)

1420 Freshman Engineering Orientation II. Prerequisite: declared major in engineering. All entering freshmen with a declared engineering major are required to enroll in this spring continuation course. One hour of this seminar a week is in a large group setting where all students meet and cover details on all engineering disciplines. Additional topics would be continuums of majors, success in the College of Engineering, success at the University of Oklahoma, study abroad programs, advising issues, graduate school opportunities, career planning, and information related to technical/honor societies and participation. A second hour a week is a required small group session 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 area. (Sp)

2003 Engineering Practice I. Prerequisite: 1410, 1420, and English 1213. Introduction to basic principles of successful engineering enterprise. (F, Sp)

COURSES IN ENGLISH (ENGL)

3153 Technical Writing. Prerequisite: 1213 and Engineering or hard science majors only. For students of the pure and applied sciences. 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 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]

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 multivariate functions; multiple integrals; line and surface integrals. (F, Sp, Su)

†G3113 Introduction to Ordinary Differential Equations. Prerequisite: 2423 or concurrent enrollment. 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)