REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

(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 2000 through Spring 2001

GENERAL REQUIREMENTS
Total Credit Hours . . . . . 136•
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.

Chemical Engineering
(Biotechnology Option)
0906C
Bachelor of Science in Chemical Engineering

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)	3
	CHEM 1315, General Chemistry (Core II)	5	**CHEM 1415**, General Chemistry	5
	MATH 1823, Calculus & Analytic Geometry I (Core I)	3	**MATH 2423**, Calculus & Analytic Geometry II	3
	HIST 1483, U.S., 1492-1865, **or** **1493**, U.S., 1865-Present (Core IV)	3	**PHYS 2514**, General Physics for Engineering & Science Majors (Core II)	4
	ENGR 1112, Intro. to Engineering	2	**P SC 1113**, American Federal Government (Core III))	3
	TOTAL CREDIT HOURS	**16**	**TOTAL CREDIT HOURS**	**18**
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 1001, Engineering Computing	1	**ENGR 2213**, Thermodynamics	3
	❖**CH E 2033**, Chemical Engineering Fundamentals	3	**CH E 3113**, Momentum, Heat & Mass Transfer I	3
	CHEM 3013, Organic Chemistry	3	†Approved Elective, Core III: Social Science	3
	CHEM 3012, Organic Chemistry Lab	2	†Approved Elective, Core IV: Artistic Forms	3
	TOTAL CREDIT HOURS	**16**	**TOTAL CREDIT HOURS**	**18**
JUNIOR	**CHEM 3423**, Physical Chemistry I	3	**ENGL 3153**, Technical Writing	3
	CHEM 3421, Physical Chemistry Lab	1	**CHEM 3523**, Physical Chemistry II	3
			CHEM 3521, Physical Chemistry Lab	1
	MBIO 2815, Introduction to Microbiology, **or** **MBIO 3813**, Fundamentals of Microbiology, **and** **MBIO 3812**, Fund. of Microbiology Lab	5	**ENGR 2113**, Rigid Body Mechanics	3
			CH E 3333, Separation Processes	3
			CH E 3432, Unit Operations Lab‡	2
	ENGR 3723, Numerical Methods for Engineering Computation	3		
	CH E 3123, Momentum, Heat & Mass Transfer II	3	†Approved Elective, Core IV: Western Civ. & Culture	3
	CH E 3473, Chemical Engineering Thermodynamics	3		
	TOTAL CREDIT HOURS	**18**	**TOTAL CREDIT HOURS**	**18**
SENIOR	**CHEM 3653**, Introduction to Biochemistry	3	**CHEM 3753**, Introduction to Biochemical Methods	3
	CH E 4253, Chemical Engineering Design I	3	**CH E 4153**, Process Dynamics & Control	3
	CH E 4262, Chemical Engineering Design Lab	2	**CH E 4273**, Advanced Process Design (Capstone)	3
	CH E 4473, Kinetics	3	**CH E 5243**, Biochemical Engineering	3
	ENGR 2313, Structure & Properties of Materials	3	†Approved Elective, Core IV: Non-Western Culture	3
	ENGR 2613, Electrical Science	3		
	TOTAL CREDIT HOURS	**17**	**TOTAL CREDIT HOURS**	**15**

Courses designated as Core I, II, III or IV 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. Six 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 should read the College of Engineering Scholastic Regulations which are posted on the Advising Bulletin Board across from CEC 104.

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.

‡Technical Writing is a prerequisite or concurrent enrollment 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.

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COURSES IN CHEMICAL ENGINEERING (CH E)

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)

3113 Momentum, Heat and Mass Transfer I. Prerequisite: 2033; Mathematics 2443 or concurrent enrollment in 2443, 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, Engineering 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, Engineering 2213. Application of the first and second laws of thermodynamics to the analysis of phase change, solution behavior and chemical equilibria and reaction. (F)

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. (Sp)

G4253 Chemical Engineering Design I. Prerequisite: 3123, 3333, 3473. 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. 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)

G4473 Kinetics. Prerequisite: 3473, Engineering 3723, Chemistry 3523, 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. (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.

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)

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)

3012 Organic Chemistry Laboratory. Prerequisite: concurrent enrollment in 3013 or permission of the department. (F)

3013 Organic Chemistry. Prerequisite: 1415 or 1425, concurrent enrollment in 3012 or permission of the department. Structure and reaction of both aliphatic and aromatic compounds. Reaction mechanism and modern structural theory. (F)

†G3421 Physical Chemistry Laboratory. Prerequisite: chemistry majors must concurrently enroll in 3423. Physiochemical measurements and calculations. (F, Sp, Su)

†G3423 Physical Chemistry I. Prerequisite: 1425, Physics 2524, Math 2423 or concurrent enrollment; chemistry majors must concurrently enroll in 3421. States of matter, chemical thermodynamics, equilibria, etc. (F, Sp, Su)

†G3521 Physical Chemistry Laboratory. Prerequisite: concurrent enrollment in 3523 or permission of the department. Continuation of 3421; credit not given to students seeking the degree of Bachelor of Science in Chemistry. (F, Sp, Su)

†G3523 Physical Chemistry II. Prerequisite: 3423, Math 2433 or concurrent enrollment. Continuation of 3423. Kinetics, electrochemistry, atomic and molecular states, etc. (F, Sp)

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

3753 Introduction to Biochemical Methods. Prerequisite: 3653. A survey of current and routinely used methods in biochemistry. Students attend lecture twice weekly and a three-hour lab per week. **Laboratory** (Sp)

COURSES IN ENGINEERING (ENGR)

1001 Engineering Computing. Prerequisite: Mathematics 1823 or concurrent enrollment. Introduction to computer programming and University computing facilities; program design and development; computer application exercises in engineering. (F, Sp, Su)

1112 Introduction to Engineering. Prerequisite: Mathematics 1523. Engineering fundamentals/problem solving, (principles of mechanics, energy balances, simple circuits), graphics, specifications, ethics, contracts, introduction to the engineering library. (F, Sp, Su)

2113 Rigid Body Mechanics. Prerequisite: 1112, Physics 2514 and Mathematics 2433 or concurrent enrollment in 2433. Vector representation of forces and moments; general three-dimensional theorems of statics; free bodies; two- and three-dimensional statically determinate frames; centroids and moments of inertia of areas. Absolute motion of a particle; motion of rigid bodies; rotating axes and the Coriolis component of acceleration; Newton's laws applied to translating and rotating rigid bodies; principles of work and energy and impulse and momentum in translation and rotation; moments of inertia of masses. (F, Sp, Su)

2213 Thermodynamics. Prerequisite: 1112, Mathematics 2433 and Physics 2524 or concurrent enrollment. First and second laws of thermodynamics are developed and applied to the solution of problems from a variety of engineering fields. Extensive use is made of partial differential calculus to interrelate the thermodynamic functions. (F, Sp, Su)

2313 Structure and Properties of Materials. Prerequisite: 1112, Chemistry 1315 and concurrent enrollment in Physics 2524. The behavior of materials under various conditions and environments is correlated to atomic and molecular structure and bonding. (F, Sp)

2613 Electrical Science. Prerequisite: 1112, Mathematics 2423; Physics 2524 or concurrent enrollment. Formulation and solution of circuit equations, network theorems, sinusoidal steady-state analysis, simple transients. (F, Sp, Su)

†G3723 Numerical Methods for Engineering Computation. Prerequisite: 1112, 1001 or Computer Science 1313 or 1323, and Mathematics 3113. Basic methods for obtaining numerical solutions with a digital computer. Included are methods for the solution 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. (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)

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)

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: 2443 or concurrent enrollment. Duplicates two hours of 3413. First order ordinary differential equations, linear differential equations with constant coefficients, Laplace transformations, power-series solutions of differential equations, Bessel functions. (F, Sp, Su)

COURSES IN MICROBIOLOGY (MBIO)

2815 Introduction to Microbiology. Prerequisite: one course in college chemistry. Introduction to microorganisms as biological entities. Survey of the roles of microorganisms in the ecosystem. Application of microorganisms to industrial and environmental problems. Discussion of microorganisms as causes of human disease and response of hosts to microbial invasion. This course does not count for major credit in Microbiology or Botany. **Laboratory** (F, Sp, Su)

3812 Fundamentals of Microbiology Laboratory. Prerequisite: credit or concurrent enrollment in 3813. Fundamental microbiological methods: aseptic technique, culture methods, microscopy, metabolic and physiological tests, bacterial isolation and identification, environmental microbiology. **Laboratory** (F, Sp, Su)

3813 Fundamentals of Microbiology. Prerequisite: one course in biology and concurrent enrollment in Organic Chemistry. Cell structure of Procaryotes and microbial Eucaryotes; survey of major groups of Eucaryotic and Procaryotic protists; metabolic characteristics and ecological roles; growth; symbiotic relationships; genetics. (F, Sp)

COURSES IN PHYSICS (PHYS)

2514 General Physics for Engineering and Science Majors. Prerequisite: Mathematics 1823. 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)

2524 General Physics for Engineering and Science Majors. Prerequisite: 2514 and Mathematics 2423. Not open to students with credit in 1215. Temperature, heat, thermodynamics, electricity, magnetism, optics. (F, Sp, Su)