

REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN PETROLEUM 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 127•
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.

Petroleum Engineering

0907A
 Bachelor of Science in
 Petroleum 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 (Core I)	3
	HIST 1483 , U.S., 1492-1865, or	3	PHYS 2514 , General Physics for Engineering & Science	4
	1493 , U.S., 1865-Present (Core IV)		Majors (Core II)	
	ENGR 1112 , Intro. to Engineering	2	ENGR 1001 , Engineering Computing	1
	TOTAL CREDIT HOURS	16	TOTAL CREDIT HOURS	16
SOPHOMORE	MATH 2433 , Calculus & Analytic Geometry III	3	ECON 1113 , Principles of Economics–Macro (Core III)	3
	PHYS 2524 , General Physics for Engineering & Science	4	MATH 2443 , Calculus & Analytic Geometry IV	3
			Majors	
	GEOL 1114 , Physical Geology	4	ENGR 2153 , Strength of Materials	3
	ENGR 2113 , Rigid Body Mechanics	3	ENGR 2213 , Thermodynamics	3
	P E 2012 , Intro. to Petroleum Engineering Systems	2	P E 3213 , Reservoir Rock Properties	3
		P E 3221 , Rock Properties Lab	1	
	TOTAL CREDIT HOURS	16	TOTAL CREDIT HOURS	16
JUNIOR	GEOL 4133 , Petroleum Geology	3	P E 3813 , Formation Evaluation with Well Logs	3
	MATH 3113 , Intro. to Ordinary Differential Equations	3	P E 3413 , Subsurface Production Engineering	3
	ENGR 3223 , Fluid Mechanics	3	P E 3513 , Reservoir Engineering Fundamentals	3
	P E 3123 , Petroleum Reservoir Fluids	3	GPHY 3423 , Petroleum Geophysics	3
	P E 3313 , Drilling and Completions I	3	ENGR 3723 , Numerical Methods for Engineering	3
	P E 3021 , Technical Communications	1	Computations	
	TOTAL CREDIT HOURS	16	TOTAL CREDIT HOURS	15
SENIOR	P SC 1113 , American Federal Government (Core III)	3	P E 4331 , Drilling and Production Engineering Lab	1
	P E 4323 , Drilling and Completions II	3	P E 4423 , Surface Production Engineering	3
	P E 4713 , Petroleum Project Evaluation	3	P E 4543 , Improved Recovery Techniques	3
	P E 4533 , Applied Reservoir Engineering	3	P E 4553 , Integrated Reservoir Management (Capstone)	3
	P E 4521 , Reservoir Fluid Mechanics Lab	1	†Approved Elective: Artistic Forms (Core IV)	3
	†Approved Elective: Western Civ. & Culture (Core IV)	3	†Approved Elective: Non-Western Culture (Core IV)	3
	TOTAL CREDIT HOURS	16	TOTAL CREDIT HOURS	16

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.

‡Economics 1113 satisfies three hours of lower-division, General Education Social Science.

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)

COURSES IN ECONOMICS (ECON)

1113 Principles of Economics—Macro. The functioning and current problems of the aggregate economy: determination and analysis of national income, employment, inflation and stabilization; money and banking, monetary and fiscal policy; and aspects of international interdependence. **Laboratory** (F, Sp, Su)

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)

2153 Strength of Materials. Prerequisite: 2113. Elementary elasticity and Hooke's law; Poisson's ratio; solution of elementary one- and two-dimensional statically indeterminate problems; stresses and strains due to temperature changes; stresses induced by direct loading, bending and shear; deflection of beams; area-moment and moment distribution; combined stresses; structural members of two materials; columns. (F, Sp)

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)

3223 Fluid Mechanics. Prerequisite: 2213, Mathematics 2433; concurrent enrollment in 2113 and Mathematics 3113. Coverage of the fundamentals of fluid statics and dynamics. Formulation of the equation of fluid flow, i.e., Navier Stokes Equations, Eulers Equations, Bernoulli Equations, etc. and their application. Examples of ideal fluid flow and viscous fluid flow, such as flow in open and closed conduits. (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 GEOLOGY (GEOL)

1114 Physical Geology for Science and Engineering Majors. Prerequisite: equivalent knowledge of high school chemistry, algebra and trigonometry. Laboratory included. Plate tectonics, the makeup of continents and mountain building. Heat flow, magnetism, gravity, rock deformation, earthquakes and the earth's interior. Surface processes including weathering, erosion, transport and deposition. Landforms, rivers, groundwater, glaciers, ocean processes, and volcanoes. Minerals and rocks. Application of geology to land-use, groundwater, mineral and fossil fuel exploration. **Laboratory** (F, Sp)

†G4133 Fundamentals of Petroleum Geology. Prerequisite: 1124, junior or senior standing. Includes history of North American oil industry; drilling, completing and producing an oil well; methods used in petroleum exploration; origin, evolution, migration and trapping of hydrocarbons; application of well-logging to subsurface studies; oil producing basins of North America and Canada. Practical problems and mapping exercises included. **Laboratory** (F)

COURSES IN GEOPHYSICS (GPHY)

3423 Petroleum Geophysics. Prerequisite: Geology 1114, Mathematics 2423, and Physics 2514. Fundamentals of the utilization of geophysical data in the exploration for and development of petroleum reserves. Fundamental principles; data acquisition, seismic processing; resolution; modeling and quantitative analysis; attributes; amplitude variation with offset (AVO); multicomponent data; structural boundaries; rock physics; predicting reservoir properties; inferring reservoir properties and architecture; fluids and pressures; time-lapse data; seismic inversion. (Sp)

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 PETROLEUM ENGINEERING (P E)

2012 Introduction to Petroleum Engineering Systems. Prerequisite: Chemistry 1415, Engineering 1112, Mathematics 2423, and Physics 2514. Overview of petroleum engineering systems including: uses of petroleum products, exploration, exploitation subjects such as drilling, production, reservoir and formation evaluation, transportation and refining; marketing; government regulation and political influence. (F)

3021 Technical Communications. Prerequisite: 2012, Engineering 1112, English 1213, and junior standing. Reading for technical understanding; planning and writing technical reports; active listening; preparing and delivering oral technical presentations. (F)

3123 Petroleum Reservoir Fluids. Prerequisite: 3213 and Engineering 2213. Properties of petroleum behavior of gases, phase behavior of liquids, qualitative and quantitative phase behavior of hydrocarbon systems, reservoir fluid characteristics. Application of these concepts to the prediction of gas and gas-condensate reservoir behavior. (F)

3213 Reservoir Rock Properties. Prerequisite: 2012, Geology 1114; corequisite: 3221. Fundamental course establishing primary petrophysical concepts, properties and their measurement. Covers rock types, distribution, composition and structure, porosity, permeability, resistivity, wettability, water saturation, elastic moduli and includes effects of pressure and temperature on rock properties. (Sp)

3221 Rock Properties Laboratory. Prerequisite: Geology 1114; corequisite: 3213. Laboratory course aimed at exposing the student to the measurement and analysis of reservoir properties such as porosity, permeability, fluid saturation, grain size, elastic moduli and pore throat sizes. The course will stress safety concerns appropriate for all laboratory procedures, error analyses and report writing. (Sp)

3313 Drilling and Completions I. Prerequisite: 3213, Engineering 3223, and Geology 1114. Drilling operations, drilling costs and economics, drilling fluids, pressure losses in circulating systems, rotary drilling bits and penetration rate, rotary drilling techniques, pore and fracture gradients. (F)

3413 Subsurface Production Engineering. Prerequisite: 3123, 3313. Tubing and packer design; hydraulic fracturing and acidizing; oil and gas well performance; vertical lift and choke performance; systems analysis; production operations. (Sp)

3513 Reservoir Engineering Fundamentals. Prerequisite: 3123, 3213, and Mathematics 3113. Fundamentals of evaluation of oil and gas reservoirs. Reservoir volumetrics; material balance; Darcy's law and equation of continuity; diffusivity equation; streamlines; well models; introduction to well testing; decline curve analysis; natural water influx. (Sp)

3813 Formation Evaluation with Well Logs. Prerequisite: 3123, 3213, and Geology 4113. Basic formation evaluation concepts, borehole environment, principles of resistivity, radiation, thermal and elastic wave measurements and measuring tools, applications to formation evaluation using commercial software package. (Sp)

4323 Drilling and Completions II. Prerequisite: 3313 and 3413. Wellbore configuration, well planning, casing design, direction control, drilling program preparation, offshore operations, cost control and AFE, post-drilling review, and economics. (F)

4331 Drilling and Production Engineering Laboratory. Prerequisite: 3021, 3413, 4323; corequisite: 4423. Properties of drilling and completion fluids; well control; oil and gas well testing; production operations; evaluation of artificial lift systems; gas measurement. (Sp)

4423 Surface Production Engineering. Prerequisite: 4323. Artificial lift design; sucker rod pumping, electric submersible pumping, plunger lift, and gas lift; design of surface production equipment; oil and gas separation; oil treating; gas dehydration; single and two-phase flow through pipes, fluid measurement; pipeline system design. (Sp)

4521 Reservoir Fluid Mechanics Laboratory. Prerequisite: 3021, 3513; corequisite: 4533. Laboratory experiences in hydrocarbon phase behavior, saturation pressure, real fluid properties, relative permeability, secondary recovery by water flooding and gas displacement, volumetric reserve estimation, statistical analyses of core data, two-dimensional flow, enhanced oil recovery using surfactants and polymers. (F)

4533 Applied Reservoir Engineering. Prerequisite: 3513, and Engineering 3723. Advanced reservoir engineering concepts required for effective production of oil and gas. Reservoir characterization; reservoir heterogeneity and anisotropy; recovery mechanisms; Leverett J-functions; upscaling; flow simulation; history matching and forecasting; uncertainty and risk. (F)

4543 Improved Recovery Techniques. Prerequisite: 3413, 4323, and 4533. New wellbore and reservoir techniques for improved recovery. Feasibility analysis; diagnostic techniques; single well operations; infill drilling; horizontal wells and multilaterals; waterflooding; enhanced oil recovery. (Sp)

4553 Integrated Reservoir Management. Prerequisite: 4323, 4533, 4713, and Geophysics 3423. Application of petroleum engineering and geoscience principles to the design of the reservoir management plan. The management environment; integrated reservoir description; performance prediction; developing the reservoir management plan; economics. (Sp)

4713 Petroleum Project Evaluation. Prerequisite: 3413, 3513, and 3813. Application of petroleum engineering principles and economics to the evaluation of oil and gas projects; evaluation principles, time value of money concepts, and investment measures; cost estimating, price and production forecasting; risk and uncertainty, project selection, and capital budgeting. (F)

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)