

# REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN PETROLEUM ENGINEERING

(Accredited by the Accreditation Board for Engineering and Technology)

## COLLEGE OF EARTH AND ENERGY

THE UNIVERSITY OF OKLAHOMA

### 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**

**0907C**

Bachelor of Science in  
Petroleum Engineering

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

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

Year	FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
<b>FRESHMAN</b>	<b>ENGL 1113</b> , Prin. of English Composition (Core I)	3	<b>ENGL 1213</b> , Prin. of English Composition (Core I), <b>or</b>	3
	<b>CHEM 1315</b> , General Chemistry (Core II)	5	<b>EXPO 1213</b> , Expository Writing	3
	<b>MATH 1823</b> , Calculus & Analytic Geometry I (Core I)	3	<b>CHEM 1415</b> , General Chemistry	5
	<b>HIST 1483</b> , U.S., 1492-1865, or	3	<b>MATH 2423</b> , Calculus & Analytic Geometry II (Core I)	3
	<b>1493</b> , U.S., 1865-Present (Core IV)	3	<b>PHYS 2514</b> , General Physics for Engineering & Science Majors (Core II)	4
<b>ENGR 1410</b> , Freshman Engineering Orientation I	0	<b>ENGR 1420</b> , Freshman Engineering Orientation II	0	
			<b>P E 2012</b> , Intro. to Petroleum Engineering Systems	2
	<b>TOTAL CREDIT HOURS</b>	<b>14</b>	<b>TOTAL CREDIT HOURS</b>	<b>17</b>
<b>SOPHOMORE</b>	<b>MATH 2433</b> , Calculus & Analytic Geometry III	3	<b>#ECON 1113</b> , Principles of Economics–Macro (Core III)	3
	<b>PHYS 2524</b> , General Physics for Engineering & Science Majors	4	<b>MATH 2443</b> , Calculus & Analytic Geometry IV	3
	<b>GEOL 1114</b> , Physical Geology	4	<b>AME 2213</b> , Thermodynamics	3
	<b>CEES 2113</b> , Statics and Dynamics	3	<b>CEES 2153</b> , Mechanics of Materials	3
	<b>ENGR 2003</b> , Engineering Practice I	3	<b>P E 3213</b> , Reservoir Rock Properties	3
			<b>P E 3221</b> , Rock Properties Lab	1
	<b>TOTAL CREDIT HOURS</b>	<b>17</b>	<b>TOTAL CREDIT HOURS</b>	<b>16</b>
<b>SUMMER</b>			<b>P E 3222</b> , Petroleum Engineering Practice II (Internship)	2
			<b>TOTAL CREDIT HOURS</b>	<b>2</b>
<b>JUNIOR</b>	<b>MATH 3113</b> , Intro. to Ordinary Differential Equations	3	<b>GEOL 3003</b> , Structural Geology & Stratigraphy–Petr. Engr.	3
	<b>P E 3022</b> , Technical Communications	2	<b>P E 3413</b> , Subsurface Production Engineering	3
	<b>P E 3123</b> , Petroleum Reservoir Fluids	3	<b>P E 3513</b> , Reservoir Engineering Fundamentals	3
	<b>P E 3223</b> , Fluid Mechanics	3	<b>*P E 3723</b> , Numerical Methods for Petroleum Engineering Computing	3
	<b>P E 3313</b> , Drilling and Completions I	3	<b>P E 3813</b> , Formation Evaluation with Well Logs	3
	<b>TOTAL CREDIT HOURS</b>	<b>14</b>	<b>TOTAL CREDIT HOURS</b>	<b>15</b>
<b>SENIOR</b>	<b>GPHY 3423</b> , Introductory Petroleum Geology & Geophysics	3	<b>P E 4331</b> , Drilling and Production Engineering Lab	1
	<b>P SC 1113</b> , American Federal Government (Core III)	3	<b>P E 4423</b> , Surface Production Engineering	3
	<b>P E 4521</b> , Reservoir Fluid Mechanics Lab	1	<b>P E 4553</b> , Integrated Reservoir Management (Capstone)	3
	<b>P E 4713</b> , Petroleum Project Evaluation	3	<b>§P E</b> Approved P E Elective	3
	<b>§P E</b> Approved P E Elective	3	†Approved Elective: Artistic Forms (Core IV)	3
†Approved Elective: Western Civ. & Culture (Core IV)	3	†Approved Elective: Non-Western Culture (Core IV)	3	
	<b>TOTAL CREDIT HOURS</b>	<b>16</b>	<b>TOTAL CREDIT HOURS</b>	<b>16</b>

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 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.

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.

§ Electives to be selected from list available in the PGE Office, SEC T301. P E 4033, 4323, 4533, and 4543.

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

**COURSES IN AEROSPACE AND MECHANICAL ENGINEERING (AME)**

**2213 Thermodynamics.** Prerequisite: Mathematics 2433 and Physics 2524, or concurrent enrollment (in both). First and second law of thermodynamics are developed and applied to the solutions of problems from a variety of engineering fields. Extensive use is made of differential calculus to interrelate thermodynamics functions. (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)

**COURSES IN CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCE (CEES)**

**2113 Statics and Dynamics.** Prerequisites: Physics 2514 and Mathematics 2433 or concurrent enrollment in Mathematics 2433. Vector representations 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)

**2153 Mechanics of Materials.** Prerequisites: 2113. Basic principles of mechanics, including the definition of stress and strain, transformations and principal values for the stress and strain tensors, kinematic relations, review of conservation equations and the development and application of constitutive laws for idealized materials. Elementary elastostatics utilizing Hooke'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 mechanics problems, including thermal stresses and strains, beam flexure, shear and deflections, pressure vessels and buckling of columns. (Sp)

**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) [III-SS]

**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 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) [II-LAB]

**3003 Structural Geology and Stratigraphy for Petroleum Engineers.** Prerequisite: 1114, Physics 2524 or concurrent enrollment. Treatment of structural and stratigraphic geology with an emphasis on aspects of importance to petroleum engineering. Includes an investigation of mechanical principles relating to the earth's crust, descriptive study of nomenclature, causes of tectonic deformation, sedimentary processes and environments, and stratigraphic principles. **Laboratory** (F)

**COURSES IN GEOPHYSICS (GPHY)**

**3423 Introductory Petroleum Geology and Geophysics.** Prerequisite: Geology 1114, Mathematics 2423, Physics 2514, and Geology 3003. Fundamentals of the utilization of geological and geophysical data in the exploration for and development of petroleum reserves. Fundamental principles, geological and geophysical data acquisition, processing and interpretation. (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) [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)

**COURSES IN PETROLEUM ENGINEERING (P E)**

**2012 Introduction to Petroleum Engineering Systems.** Corequisite: 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. (Sp)

**3022 Technical Communications.** Prerequisite: English 1213. Skill to be developed: communicating effectively and efficiently; summarizing and distilling; reading for understanding; planning and writing business letters, memoranda, emails, resumes, technical reports; active listening; preparing and delivering oral technical presentations and interviewing skill. (F)

**3123 Petroleum Reservoir Fluids.** Prerequisite: Engineering 2213 or Aerospace and Mechanical 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)

**3222 Petroleum Engineering Practice II (Internship).** Prerequisite: junior standing. Career-related work experience of at least eight weeks in the petroleum industry. The internship may also involve research with faculty members. This internship usually takes place in the summer between the sophomore and junior or the junior and senior years in the students' curricula. Students must obtain prior approval of proposed internship from instructor. Written report and presentation required. (Su)

**3223 Fluid Mechanics.** Prerequisite: Aerospace and Mechanical Engineering 2213 and Mathematics 2433; corequisite: Aerospace and Mechanical Engineering 2113 or Civil Engineering and Environmental Science 2113, and Mathematics 3113. Coverage of the fundamental of fluid statics and dynamics. Formulation of the equations of fluid flow such as Navier Stokes, Euler, Bernoulli, etc. and their application. Formulation of the momentum and energy equations. Examples of ideal and viscous fluid flow in open and closed conduits. (F)

**3313 Drilling and Completions I.** Prerequisite: 3213, 3223 or concurrent enrollment, 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)

**3723 Numerical Methods for Engineering Computation (Crosslisted with Aerospace and Mechanical Engineering, Chemical Engineering, Computer Science 3723).** Prerequisite: Aerospace and Mechanical Engineering 2401 or Chemical Engineering 2002 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 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. This course may not be taken for graduate credit within the College of Engineering. (F, Sp)

**3813 Formation Evaluation with Well Logs.** Prerequisite: 3213, 3221, Geology 1114; corequisite: Geology 3003. 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)

**4331 Drilling and Production Engineering Laboratory.** Prerequisite: 3022, 3413; 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: 3413. 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: 3022, 3513. 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)

**4553 Integrated Reservoir Management.** Prerequisite: Petroleum Engineering major and senior standing. 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: Petroleum Engineering major and senior standing. 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)