Petroleum Engineering (PTRE)

Courses

PTRE 201. Introduction to Petroleum Engineering. 3 Credits.
Introducing students to the broad aspects of petroleum engineering. The student will gain an appreciation for exploration, discovery, and commercial recovery of oil and gas industry. Prerequisite: Petroleum Engineering major. Corequisite: GEOL 101 or GEOE 210; all the prerequisites must be completed with a "C" or higher. S.

PTRE 201B. Introduction to Petroleum Engineering. 3 Credits.
Introducing students to the broad aspects of petroleum engineering. The student will gain an appreciation for exploration, discovery, and commercial recovery of oil and gas industry. S/U grading. S.

PTRE 301. Reservoir Rock Properties. 3 Credits.
Systematic theoretical and practical study of physical properties of petroleum reservoir rocks; lithology, porosity, relative and effective permeability, fluid saturations, capillary characteristics, compressibility, rock stress, and fluid-rock interaction. Prerequisite: GEOE 203 or GEOL 101 and GEOL 101L; all the pre-requisites must be completed with a "C" or higher. F.

PTRE 301B. Reservoir Rock Properties. 3 Credits.
Systematic theoretical and practical study of physical properties of petroleum reservoir rocks; lithology, porosity, relative and effective permeability, fluid saturations, capillary characteristics, compressibility, rock stress, and fluid-rock interaction. S/U grading. F.

PTRE 311. Petroleum Fluid Properties. 3 Credits.
Phase behavior of naturally occurring hydrocarbon system; evaluation and correlation of physical properties of petroleum reservoir fluids under various conditions of pressure and temperature, including laboratory and empirical methods. Prerequisite: CHEM 122; all prerequisites must be completed with a "C" or higher. Corequisite: ME 341. Prerequisite or Corequisite: PTRE 301. S.

PTRE 311B. Petroleum Fluid Properties. 3 Credits.
Phase behavior of naturally occurring hydrocarbon system; evaluation and correlation of physical properties of petroleum reservoir fluids under various conditions of pressure and temperature, including laboratory and empirical methods. S/U grading. S.

PTRE 361. Petroleum Engineering Laboratory I. 1 Credit.
To introduce the students to different lab equipment in order to measure physical properties of the reservoir rock. Prerequisite or Corequisite: PTRE 301 or GEOE 301. S, even years.

PTRE 401. Well Logging. 3 Credits.
This course covers topics on methods of how to measure and interpret the physical and chemical properties of formation through the well logging tools. Prerequisite: PTRE 301; all prerequisites must be completed with a "C" or higher. F.

PTRE 401B. Well Logging. 3 Credits.
This course covers topics on methods of how to measure and interpret the physical and chemical properties of formation through the well logging tools. S/U grading. F.

PTRE 405. Petroleum Eng. Economy and Law. 3 Credits.
Presenting the principles of asset management with emphasize on applications to the upstream oil and gas activities and discussing the legal aspects of petroleum exploration and production in the US and internationally. F.

PTRE 405B. Petroleum Eng. Economy and Law. 3 Credits.
Presenting the principals of asset management with emphasize on applications to the upstream oil and gas activities and discussing the legal aspects of petroleum exploration and production in the US and internationally. S/U grading. F.

PTRE 411. Drilling Engineering. 3 Credits.
Concepts, processes, equipment, and engineering principals used to drill oil and gas wells and near-surface wells common in geotechnical, environmental, and water well applications. Prerequisite: GEOE 210 or GEOL 101, PTRE 201; all prerequisites must be completed with a "C" or higher. F.

PTRE 411B. Drilling Engineering. 3 Credits.
Concepts, processes, equipment, and engineering principals used to drill oil and gas wells and near-surface wells common in geotechnical, environmental, and water well applications. S/U grading. F.

PTRE 421. Production Engineering. 3 Credits.
Design, evaluation, and optimization of petroleum production system using nodal analysis. Analysis and design of well flow systems, artificial lift systems, and surface separation/treating facilities. Prerequisite: PTRE 431 and ME 306; all prerequisites must be completed with a "C" or higher. F.

PTRE 421B. Production Engineering. 3 Credits.
Design, evaluation, and optimization of petroleum production system using nodal analysis. Analysis and design of well flow systems, artificial lift systems, and surface separation/treating facilities. S/U grading. F.

PTRE 431. Reservoir Engineering. 3 Credits.
Discussing general concepts in reservoir engineering, material balance equation for oil, gas, and water, determining reserves under different drive mechanisms, and fluid flow in different oil and gas reservoirs. Prerequisite: PTRE 311. Prerequisite or Corequisite: ME 306; all prerequisites must be completed with a "C" or higher. F.

PTRE 431B. Reservoir Engineering. 3 Credits.
Discussing general concepts in reservoir engineering, material balance equation for oil, gas, and water, determining reserves under different drive mechanisms, and fluid flow in different oil and gas reservoirs. S/U grading. F.

PTRE 441. Petroleum Evaluation & Management. 3 Credits.
Expected value and investment decision analysis, estimation of oil and gas reserves, measures of profitability, production, decline curve analysis, and oil and gas reserves evaluations. Prerequisite: PTRE 311, PTRE 431, PTRE 411, and PTRE 421. S.

PTRE 441B. Petroleum Evaluation & Management. 3 Credits.
Expected value and investment decision analysis, estimation of oil and gas reserves, measures of profitability, production, decline curve analysis, and oil and gas reserves evaluations. S/U grading. On demand.

PTRE 445. Well Testing. 3 Credits.
Well test analysis using type curve techniques, Material balance for oil and gas reservoirs, Water influx calculations, Immiscible displacement and fractional flow calculations, Well test analysis to estimate reservoir properties, Pseudo functions, Enhanced oil recovery. Prerequisite: PTRE 431 and MATH 266 with a grade of C or higher. S.

PTRE 445B. Well Testing. 3 Credits.
Well test analysis using type curve techniques, Material balance for oil and gas reservoirs, Water influx calculations, Immiscible displacement and fractional flow calculations, Well test analysis to estimate reservoir properties, Pseudo functions, Enhanced oil recovery. S/U grading. S.

PTRE 451. Advanced Drilling Engineering. 3 Credits.
Advanced topics in drilling which are part of well construction will be covered in this course. The sequence of constructing a well will be discussed and practiced through class projects and assignments. Prerequisite: PTRE 411, all prerequisites must be completed with a "C" or higher. S.

PTRE 451B. Advanced Drilling Engineering. 3 Credits.
Advanced topics in drilling which are part of well construction will be covered in this course. The sequence of constructing a well will be discussed and practiced through class projects and assignments. S/U grading. S.

PTRE 461. Natural Gas Engineering. 3 Credits.
Estimation of gas properties; gas field development and material balance analysis; study of production and reservoir characteristics of gas and gas-condensate reservoirs; design and optimization of well bore and surface facilities for separation, processing, transportation, and metering; gas hydrates. Prerequisite: ME 306 and PTRE 311; all prerequisites must have a grade of C or higher. S.

PTRE 461B. Natural Gas Engineering. 3 Credits.
Estimation of gas properties; gas field development and material balance analysis; study of production and reservoir characteristics of gas and gas-condensate reservoirs; design and optimization of well bore and surface facilities for separation, processing, transportation, and metering; gas hydrates. S/U grading. S.

PTRE 462. Petroleum Engineering Laboratory II. 1 Credit.
To introduce the students to different lab equipment in order to measure geomechanical properties of the rock and flow behavior of the reservoir fluid. Corequisite: PTRE 421 and PTRE 465. S.

PTRE 465. Petroleum Geomechanics. 3 Credits.
A brief review of fundamental of rock mechanics. The major focus of the course will be on different applications of Geomechanics in Petroleum Eng with focus on wellbore instability. Prerequisite: PTRE 411; all prerequisites must be completed with a "C" or higher. F.

PTRE 465B. Petroleum Geomechanics. 3 Credits.
A brief review of fundamental of rock mechanics. The major focus of the course will be on different applications of Geomechanics in Petroleum Eng with focus on wellbore instability. S/U grading. F.

PTRE 471. Numerical Reservoir Simulation. 3 Credits.
Use of mathematics and computer programs to solve reservoir flow problems. This course will discuss: Fundamental reservoir calculations, multiphase flow concepts, fluid displacement, fluid flow equations and discretization concepts, as well as history matching and reservoir performance forecast. Prerequisite: PTRE 431 and MATH 266; all prerequisites must be completed with a C or higher. F.

PTRE 471B. Numerical Reservoir Simulation. 3 Credits.
Use of mathematics and computer programs to solve reservoir flow problems. This course will discuss: Fundamental reservoir calculations, multiphase flow concepts, fluid displacement, fluid flow equations and discretization concepts, as well as history matching and reservoir performance forecast. S/U grading. F.

PTRE 475. Well Completions. 3 Credits.
Introduction to well problems including causes and remediation; near wellbore formation damage mechanism, control and prevention; sand and water production mechanisms; control and management; scale deposition removal and prevention; corrosion control and prevention; principles and practices of well workover and intervention operations; an overview of production logging tools and their various applications including production log interpretation, familiarization with new technology and reservoir stimulation by fracturing with emphasis on design and estimation; stimulation to improve productivity. Prerequisite: PTRE 421 with a grade of "C" or higher. S.

PTRE 475B. Well Completions. 3 Credits.
Introduction to well problems including causes and remediation; near wellbore formation damage mechanism, control and prevention; sand and water production mechanisms; control and management; scale deposition removal and prevention; corrosion control and prevention; principles and practices of well workover and intervention operations; an overview of production logging tools and their various applications including production log interpretation, familiarization with new technology and reservoir stimulation by fracturing with emphasis on design and estimation; stimulation to improve productivity. S/U grading. S.

PTRE 484. Research Design. 3 Credits.
This course is designed to prepare students to develop the essential skills in employing verbal and nonverbal communication in a variety of settings in academic and professional environments. Fundamentals of research methods, research design and also the essential written communication skills are taught to provide a basis for students to apply and practice communication principles in several informative and persuasive presentations that are focused, well organized, substantially supported and confidently delivered throughout the semester. In this course, students will learn and practice the essential skills that are required for the successful completion of the final year engineering design Capstone course and must be undertaken prior to PTRE 485 Senior Design. In the meantime, students in this course will work on assignments that will be used and are integral part of next semester's PTRE 485 Senior Design. Prerequisite: PTRE 401 and GEOL 407; all prerequisites must be completed with a "C" or higher. F.

PTRE 485. Senior Design. 3 Credits.
This is a capstone design course in the Petroleum Engineering program. This course is a continuation of PTRE 484 taken in the preceding semester. It includes: Defining the design problem, establishing design objectives, evaluating alternatives, specifying constraints, determining a methodology, and completing a formal design problem statements. Prerequisite: PTRE 484, PTRE 405, PTRE 421, PTRE 451, PTRE 465, and PTRE 471; all prerequisites must be completed with a "C" or higher. S.

PTRE 493. Selected Topics in Petroleum Engineering. 1-4 Credits.
Detailed study of selected topics in Petroleum Engineering. Includes laboratory if applicable. Repeatable up to a maximum of 6 credits. Prerequisite: Consent of the instructor. Repeatable to 6.00 credits. On demand.

PTRE 501. Graduate Cooperative Education. 1-3 Credits.
This course is designed for graduate students to spend a period of time in industry and get field/laboratory experience. A written report, presentation and feedback from the industry advisor is necessary. Prerequisite: Advisor consent. F,S,SS.

PTRE 510. Practical Seismic Processing. 3 Credits.
This fundamental course provides students with the basic knowledge required to understand a typical 2D 3D seismic processing workflow. This covers the processing sequence, parameter selection and how to design and handle a seismic processing project. Prerequisite: Background/knowledge of Petrophysics. On demand.

PTRE 511. Advanced Petroleum Engineering Labs. 3 Credits.
This fundamental course provides students with the basic knowledge required to understand the petroleum engineering laboratory. This covers the experiments such as core flooding, PVT, and drilling rig, multiphase flow loop, rock geomechanics test, drilling simulator, pipeline leak and blockage detection, slurry loop, and field-scale drilling rig, etc. This course will apply the knowledge to the lab which students learned in the courses, such as drilling, reservoir and production engineering. Prerequisite: Background/knowledge of Petrophysics and Petroleum Fluid Properties. S, odd years.

PTRE 512. Reservoir Rock Physics. 3 Credits.
The science of Rock Physics attempts to relate the elastic parameters of the rock that are measured in the lab or in the field through static or dynamic methods to other physical properties such as the mineralogy, porosity, pore shapes, size and distribution, pore fluids and their viscosity, pore pressures, permeability, stresses, organic content and maturity and overall embedded features in the rock including fractures and fine stratum. When elastic properties of the rock are collected, theoretical models will be developed to correlate them with the rock physical properties in a spatial sense also known as Rock Physics Templates (RPT). These correlations/models become important when one side of the data is missing exclusively for larger scale hydrocarbon reservoir characterizations. Prerequisite: Background/knowledge of Petrophysics. On demand.

PTRE 513. Seismic Geomechanics. 3 Credits.
This advanced course introduces students to the modern geomechanical modeling of anisotropic, heterogeneous media. Topics include the basics of elasticity, a detailed workflow for creating both 3D and 4D mechanical earth models from the creation of horizons to the interpretation, and the methods and experiments to determine the elastic and strength properties. It also covers the importance of boundary condition for numerical solution of the stress equations and production-induced deformation. Rock physics application in geomechanics is deeply explained, and seismic wave velocity in anisotropic mediawill be discussed. Geomechanical effect in time-lapse seismic data, 3D exploration of geonechanical model, and interpretation of 4D MEM is very well established. In addition, this course contains topics of reservoir seismology, production and depletion effects on geomechanics, problems occurring during hydraulic fracturing operations due to geomechanical issues, fracture identification and characterization, and stimulation optimization. Prerequisite: Background/knowledge of Petrophysics. On demand.

PTRE 515. Fundamentals of Shale Plays. 3 Credits.
The goal of this course is to focus on unconventional reserves and how to explore them from Geology and Petroleum Engineering aspects. This will provide a better understanding of the nontraditional plays that have higher protentional for exploration and recovery, and how we can optimize efforts to increase hydrocarbon potential. Prerequisite: Background/knowledge of Petrophysics and Well Logging. On demand.

PTRE 518. Applied Methods of Data Science in Petroleum Engineering. 3 Credits.
The course is an introduction to Data Science and Machine Learning for applications in oil and gas industry. The practical and theoretical aspects of the data science and machine learning for petroleum engineers are presented and make the students ready to solve different challenges in oil and gas through these techniques. It covers the topics of introduction to data science, mathematics and statistics for data science, introduction to Python programming, data preparation for oil and gas industry, introduction to supervise machine learning, applications of supervised ML in oil and gas industry, introduction to unsupervised machine learning, application of unsupervised ML in oil and gas industry, deep learning and its applications, time series ML and final term project. Prerequisite: Instructor or advisor consent. On demand.

PTRE 521. Advanced Production Engineering. 3 Credits.
Principles of development and operation of petroleum production systems. Optimization of production systems for various reservoirs. All professional components in artificial technology for oil production operations. Calculation of different skin components. Horizontal well and multilateral well performance. Formation damage. Design and optimization of surface facility. Prerequisite: Background/knowledge of Production Engineering. F, odd years.

PTRE 522. Petroleum System Evaluation. 3 Credits.
This course will cover exploration to production from conventional and unconventional reservoirs with a significant emphasis on using commercial modeling and simulation software. It includes principles of reservoir evaluation, field development, production forecast, and economics in the development and depletion of oil and gas properties; reserves classification; analysis of investments in petroleum property; petroleum taxation regulations and operating contracts found in oil and gas industry; petroleum project evaluation case studies; introduction to probabilistic method in reserves evaluation. Prerequisite: Background/knowledge of Production Engineering. On demand.

PTRE 531. Reservoir Geomechanics. 3 Credits.
The course intends to discuss and explain how the fundamentals of rock mechanics are applied in various Petroleum related disciplines, in particular its importance in enhancing production from unconventional reservoirs using the stimulation techniques, e.g. hydraulic fracturing. This is a basic level course so does not go into the details but will provide a good basis for students to do some simple but important calculations. Prerequisite: Background/knowledge of Drilling Engineering. S, even years.

PTRE 532. Advanced Topics in Reservoir Engineering. 3 Credits.
General concepts in reservoir engineering; the general material balance equation for oil, gas, and water; methods to determine reserves under different drive mechanisms; single-phase gas reservoir; gas condensate reservoir, undersaturated oil reservoir; saturated oil reservoir; single-phase fluid flow in reservoir; fractional flow and frontal advance; the displacement of oil and gas, well patterns, area and vertical sweep efficiencies in waterflood; enhanced oil recovery processes. Prerequisite: Background/knowledge of Petrophysics and Petroleum Fluid Properties. On demand.

PTRE 541. Data Mining in Petroleum Engineering. 3 Credits.
This course will provide students with the fundamentals of data mining and machine learning methodologies and their applications in the petroleum industry. Students will become familiar with data mining system architecture, concepts and tasks such as data processing, data integration and classification techniques. Prerequisite: Background/knowledge of Multivariable Calculus. S, odd years.

PTRE 544. Advanced Topics in Reservoir Geomechanics. 3 Credits.
The course intends to discuss the advanced topics of geomechanics applied in various Petroleum related disciplines, in particular its importance in enhancing production from unconventional reservoirs using the stimulation techniques, e.g. hydraulic fracturing. This is an advanced level course. Prerequisite: Background/knowledge of Drilling Engineering. On demand.

PTRE 545. Advanced Topics in Drilling Engineering. 3 Credits.
The sequence of well construction will be discussed and practiced through class project. The advanced topics presented in this course are based on the fundamental concepts of Drilling Engineering course. Prerequisite: Background/knowledge of Petrophysics. On demand.

PTRE 555. Pressure Transient Analysis. 3 Credits.
This course will discuss the methods of executing a set of planned data acquisition activities to broaden the knowledge and understanding of hydrocarbon properties and the characteristics of underground reservoirs where hydrocarbons are trapped. The overall objective is identifying reservoir's capacity to produce hydrocarbons, such as oil, gas, and condensate. Prerequisite: Background/knowledge of Reservoir Engineering and Differential Equations. F, even years.

PTRE 561. Natural Gas Engineering. 3 Credits.
Estimation of gas properties for well test or production data analysis using accurate correlations and laboratory data. Gas field development and material balance analysis for gas reserve calculation. Study of production and reservoir characteristics of gas and gas-condensate reservoirs. Skin effects and calculation for non-Darcy flow in gas well. Design, evaluation, and optimization of gas production and transportation system using nodal analysis. Analysis and design of gas well flow systems. Design surface facilities for gas well stream separation, dehydration, and compression. Gas processing, transportation, and metering. Gas hydrate prevention and inhibition. Prerequisite: Background/knowledge of Reservoir Engineering. S, odd years.

PTRE 562. Graduate seminar. 1 Credit.
In This course, graduate students should present their biweekly progress in their research for the classroom. In addition, different topics other than the thesis/dissertation will be presented by the graduate students. Finally, several lectures will be given by guest speakers on petroleum related topics mostly. Prerequisite: Department consent. Repeatable to 3.00 credits. S/U grading. On demand.

PTRE 563. Quantitative Seismology. 3 Credits.
This advanced course introduces students to the modern seismology of anisotropic, heterogeneous media. In-depth discussion of wave propagation and seismic amplitudes analysis for anisotropic, heterogeneous media. Topics include the basics of dynamic elasticity, the influence of anisotropy on plane-wave properties and point-source radiation, seismic signatures for transversely isotropic (TI) and orthorhombic models, parameter-estimation and imaging methods for TI media, wide-azimuth reflection data, anisotropic amplitude-variation-with-offset (AVO) and azimuth (AVA) analysis, and the seismic characterization of the natural fractures. Prerequisite: Background/knowledge of Petrophysics. On demand.

PTRE 571. Petroleum Geostatistics. 3 Credits.
The reservoir data including porosity and permeability follow the spatial statistics as there is a dependency between the data depending on their distance and position with respect to each other. This course presents the fundamental of spatial statistics with several case examples in Petroleum Engineering. Prerequisite: Background/knowledge of Calculus-based Statistics. F, even years.

PTRE 572. Advanced Numerical Reservoir Simulation. 3 Credits.
A basic approach to present the principles of petroleum reservoir simulation in an easy-to-use and accessible format. It is to use mathematics, reservoir engineering, and computer skills to solve reservoir flow problems. This course will discuss the fundamental reservoir calculations, multiphase flow concepts, fluid flow equations and discretization concepts, different solutions, as well as history matching and reservoir performance forecast. Prerequisite: Background/knowledge of Reservoir Engineering. On demand.

PTRE 575. Advanced Stimulation Techniques. 3 Credits.
Introduction to well completion; an overview of well completion and their various applications; near wellbore formation damage mechanism, control and prevention; selection and design of artificial lift; sand production mechanisms; control and management; scale deposition removal and prevention; corrosion control and prevention; principles and practices of well workover and intervention operations; familiarization with new technology and reservoir stimulation by fracturing with emphasis on design and estimation; well stimulation to improve productivity. Prerequisite: Background/knowledge of Drilling Engineering. S, even years.

PTRE 579. Advanced Topics in Petrophysics. 3 Credits.
This course covers systematically theoretical and practical study of physical properties of petroleum reservoir rocks; lithology, porosity, relative and effective permeability, fluid saturations, capillary characteristics, compressibility, rock stress, and fluid-rock interaction. Prerequisite: Background/knowledge of Fundamental Geoscience Topics. On demand.

PTRE 581. Reservoir Geophysics. 3 Credits.
This fundamental course provides students with the basic knowledge required to understand a typical 2D 3D seismic processing workflow. This covers the processing sequence, parameter selection and how to design and handle a seismic processing project. Prerequisite: Background/knowledge of Petrophysics. S, even years.

PTRE 587. Advanced Well Logging. 3 Credits.
This course is designed to provide petroleum engineering and geoscience students with a working knowledge of principles and applications of well logging, types of logging tools, basics and applications of each tool, factors affecting the measurements with analysis of the log outputs. Students also learn about the properties of carbonate and clastic reservoirs and methods to evaluate properties of different types of reservoirs. Prerequisite: Background/ knowledge of Petrophysics and Petroleum Fluid Properties. On demand.

PTRE 589. Applied MDS in Petroleum Engineering. 3 Credits.
This course will cover topics from exploration to production from unconventional reservoirs with a significant emphasis on using commercial modeling and simulation software. Prerequisite: Supervisor or instructor consent. On demand.

PTRE 593. Selected Topics in Petroleum Engineering. 1-6 Credits.
Detailed study of selected topics in Petroleum Engineering. Includes laboratory if applicable. Prerequisite: Consent of instructor. Repeatable to 12.00 credits. On demand.

PTRE 595. Design Project. 3-6 Credits.
Design project is for non-thesis based Master's students. Prerequisite: Department Consent Required. Repeatable to 6.00 credits. F.

PTRE 598. Enhanced Oil Recovery. 3 Credits.
This course is the implementation of various techniques for increasing the amount of crude oil that can be extracted from an oil field. Enhanced oil recovery is also called improved oil recovery or tertiary recovery (as opposed to primary and secondary recovery). Prerequisite: Background/knowledge of Reservoir Engineering. S.

PTRE 599. Research. 1-15 Credits.
Analysis, planning, and detailed study of definite problems; individual laboratory work on some selected problems in the field of Petroleum Engineering to develop the power of independent investigation. Prerequisite: Department or advisor consent. Repeatable to 30.00 credits. F,S,SS.

PTRE 996. Continuing Enrollment. 1-12 Credits.
Continuing Enrollment. Repeatable to 12.00 credits. S/U grading. F,S,SS.

PTRE 998. Thesis. 1-9 Credits.
Development and documentation of scholarly activity demonstrating proficiency in Petroleum Engineering at the master's level. Repeatable to 9.00 credits. F,S,SS.

PTRE 999. Dissertation. 1-18 Credits.
Development and documentation of scholarly activity demonstrating proficiency in Petroleum Engineering at the doctoral level. Repeatable to 18.00 credits. F,S,SS.