Petroleum Engineering

M.Engr. in Petroleum Engineering (https://catalog.und.edu/graduateacademicinformation/departmentalcoursesprograms/engineering/petroleumengineering/ptre-meng/)

M.S. in Petroleum Engineering (https://catalog.und.edu/graduateacademicinformation/departmentalcoursesprograms/engineering/petroleumengineering/ptre-ms/)

Ph.D. in Petroleum Engineering (https://catalog.und.edu/graduateacademicinformation/departmentalcoursesprograms/engineering/petroleumengineering/ptre-phd/)

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.