

PETROLEUM ENGINEERING (PETE)

College of Engineering and Mines

Department of Petroleum Engineering (<https://cem.uaf.edu/pete/>)
907-474-7734

PETE F101 Fundamentals of Petroleum, Drilling and Production

2 Credits

Offered Fall

Fundamental principles of origin, migration, accumulation and exploration of petroleum. Principles of drilling, drilling practices, and drilling fluids. Overview of production practices, surface production equipment. Influence of rock and fluid properties on the principles of petroleum recovery, petroleum transportation.

Prerequisites: Freshman standing in Petroleum Engineering program.

Lecture + Lab + Other: 2 + 0 + 0

PETE F201 Future Trends in the Oil and Gas Industry

1 Credit

Offered Fall

Overview of the rapidly changing landscape of the oil and gas industry. Introduction to technically challenged resources with special emphasis on Alaska North Slope heavy oil and methane hydrates. Coexistence with renewables and alternative energy. Diversification of the petroleum industry, and emergence of data sciences, HSE, climate issues and sustainability.

Prerequisites: Sophomore Standing.

Lecture + Lab + Other: 1 + 0 + 0

PETE F301 Reservoir Rock and Fluid Properties

4 Credits

Offered Fall

Fundamental concepts of reservoir rock and fluid properties including porosity, permeability, fluid saturations, capillary pressure, relative permeabilities, classification of petroleum reservoirs by fluid phase contents, oil, gas and water properties, fluid sampling, and PVT analysis.

Prerequisites: ES F346 (may be taken concurrently); MATH F252X; GEOS F101X or GE F261.

Lecture + Lab + Other: 4 + 0 + 0

PETE F302 Well Logging

3 Credits

Offered Spring

Comprehensive treatment of modern well logging methods including formation and production logging tools, and techniques and basic concepts of open hole log interpretation.

Prerequisites: PETE F301; PETE F101.

Lecture + Lab + Other: 3 + 0 + 0

PETE F303 Reservoir Rock and Fluid Properties Laboratory

1 Credit

Offered Spring

Measurement of properties of reservoir rock and reservoir fluids. Determination of porosity, permeability, fluid saturations, capillary pressures, specific gravity density, viscosity, surface tension, PVT properties and interpretation of PVT reports for reservoir fluid samples.

Prerequisites: WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; PETE F301.

Lecture + Lab + Other: 0 + 3 + 0

PETE F370 Sedimentology and Structural Geology for Petroleum Engineers (n)

4 Credits

Offered Fall

Origin and distribution of sedimentary rocks including depositional environments, stratigraphic relationships and structures. Emphasis on the relationship to petroleum occurrences and petroleum exploration. Laboratory exercises on mapping, structural problems and facies relationships in petroleum exploration.

Prerequisites: GEOS F101X or GE F261.

Cross-listed with GEOS F370.

Lecture + Lab + Other: 3 + 3 + 0

PETE F407 Petroleum Production Engineering

3 Credits

Offered Fall

Production system analysis, inflow performance analysis, gas lift design, sucker rod pumping and production decline analysis.

Prerequisites: PETE F476; ES F341 and ES F346.

Lecture + Lab + Other: 3 + 0 + 0

PETE F411 Drilling Fluids Laboratory

1 Credit

Offered Spring

Design, composition and measurement of drilling fluid properties, evaluation of mud activities and chemical treatment of contaminated drilling fluid.

Prerequisites: PETE F426 (may be taken concurrently); WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X.

Lecture + Lab + Other: 0 + 3 + 0

PETE F421 Reservoir Characterization

3 Credits

Offered Spring

Review of reservoir rock properties and their spatial variations; estimation of reserves; introduction to theory and application of geostatistics to reservoir characterization; presentation of fundamental geostatistical concepts including: variogram analysis, estimation variance, kriging and stochastic simulations and some data analytics concepts. Impact of geologic structure on oil recovery. Use of computer software for reservoir characterization and class project.

Prerequisites: PETE F301; PETE F302; GEOS F370.

Stacked with PETE F621.

Lecture + Lab + Other: 3 + 0 + 0

PETE F426 Drilling Engineering

3 Credits

Offered Spring

Principles of drilling, drilling fluids and rheology, drilling problems, drilling hydraulics, well control techniques and casing seat selection.

Prerequisites: ES F331; ES F341.

Lecture + Lab + Other: 3 + 0 + 0

PETE F431 Natural Gas Engineering

2 Credits

Offered Spring

Natural gas production and condensate reservoirs. Design of processing, transportation, distribution and flow measurement systems.

Prerequisites: PETE F301.

Lecture + Lab + Other: 2 + 0 + 0

PETE F456 Petroleum Evaluation and Economic Decisions

3 Credits

Offered Spring

Economic appraisal methods for oil field developmental project evaluations including risk analysis, probability and statistics in decision making and evaluations. Case studies.

Prerequisites: MATH F253X; PETE F476; STAT F300 (may be taken concurrently).

Lecture + Lab + Other: 3 + 0 + 0

PETE F458 Petroleum Engineering Internship

1 Credit

Offered As Demand Warrants

Practical experience in a supervised petroleum engineering environment.

Participation in professional petroleum operations including drilling, production, formation evaluation, reservoir engineering, petroleum property evaluation, management and economics. Written and oral presentation of technical report describing experience is required. Course may be repeated for up to 4 credits.

Prerequisites: Junior standing.

Lecture + Lab + Other: 0 + 0 + 1

PETE F466 Petroleum Recovery Methods

3 Credits

Offered Fall

Flow and physicochemical principles of oil recovery by water, chemical, thermal and miscible floods. Prediction of recovery for each of these methods.

Prerequisites: PETE F301 and PETE F476.

Lecture + Lab + Other: 3 + 0 + 0

PETE F469 Enhanced Oil Recovery and Reservoir Simulation

3 Credits

Offered Fall

This course will discuss the principles of enhanced oil recovery (EOR) methods. Enhanced recovery calculations for water flood using analytical and empirical methods will be covered. The principles and practice of reservoir simulation using numerical models will be discussed. Reservoir simulation will be used for EOR calculations.

Prerequisites: ES F301, MATH F426; PETE F476.

Lecture + Lab + Other: 3 + 0 + 0

PETE F476 Petroleum Reservoir Engineering

3 Credits

Offered Spring

Quantitative study and prediction of the behavior of oil and gas reservoirs under primary, secondary and tertiary recovery mechanisms.

Prerequisites: PETE F301; MATH F253X.

Lecture + Lab + Other: 3 + 0 + 0

PETE F478 Well Test Analysis

2 Credits

Offered Spring

Transient flow of fluids through porous media, application of solutions of the diffusivity equation to pressure buildup, drawdown, interference testing and log-log type curve analysis and effect of reservoir heterogeneities on pressure behavior.

Prerequisites: PETE F407; PETE F476; MATH F302.

Lecture + Lab + Other: 2 + 0 + 0

PETE F481 Well Completions and Stimulation Design

3 Credits

Offered Fall

Design of casing programs, cementing, open-hole and set-through completions, well stimulation; completion and workover fluids; and evaluation of sand control and workover operations.

Prerequisites: WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; ES F341; PETE F426.

Lecture + Lab + Other: 2 + 3 + 0

PETE F487A Petroleum Project Design

1 Credit

Offered Fall

Two-semester course with emphasis on design and analysis of petroleum exploration, production and reservoir engineering systems by analytical, experimental and computer methods. Identification of requirements, conceptual and detailed project design and cost analysis. Completion of an engineering project.

Prerequisites: Senior standing; PETE F407 or PETE F426; PETE F476.

Lecture + Lab + Other: 2 + 0 + 0

PETE F487B Petroleum Project Design

1 Credit

Offered Spring

Two-semester course with emphasis on design and analysis of petroleum exploration, production and reservoir engineering systems by analytical, experimental and computer methods. Identification of requirements, conceptual and detailed project design and cost analysis. Completion of an engineering project.

Prerequisites: COJO F131X or COJO F141X; WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; senior standing.

Lecture + Lab + Other: 2 + 0 + 0

PETE F489 Reservoir Simulation

2 Credits

Offered Fall

The theory and application of computer reservoir simulation in petroleum reservoir and production engineering.

Prerequisites: PETE F476; MATH F426 or ES F301.

Lecture + Lab + Other: 2 + 0 + 0

PETE F607 Advanced Production Engineering

3 Credits

Offered As Demand Warrants

Production system analysis, production optimization, downhole equipment design, surface facilities design, oil and gas processing, gas and oil treating systems, disposal well systems, project organization and field development.

Prerequisites: Graduate standing; PETE F407.

Lecture + Lab + Other: 3 + 0 + 0

PETE F608 Flow Assurance in the Petroleum Industry

3 Credits

Offered As Demand Warrants

Study of the thermodynamics of gas hydrates; paraffin waxes; asphaltenes; scale and chemistry of corrosion and erosion processes. Study of chemical and physical methods used for mitigation of solid phase formation. Experimental analysis and modeling of solid phase formation envelopes. Analysis of flow regimes resulting from the presence of solid phases in oil and gas flow lines.

Prerequisites: Permission of the instructor.

Lecture + Lab + Other: 3 + 0 + 0

PETE F610 Advanced Reservoir Engineering

3 Credits

Offered As Demand Warrants

Concepts and tools for solving petroleum reservoir engineering problems; advances in petroleum reservoir engineering. Emphasis on material balance methods and their application to estimate reserves and calculate water influx; diversity equations and solutions; gas and water coning; streamline tracking; and decline curve analysis, productivity index and well performance models for vertical, horizontal and multilateral wells.

Prerequisites: PETE F476.**Lecture + Lab + Other:** 3 + 0 + 0**PETE F621 Applied Reservoir Characterization**

3 Credits

Offered Spring

Review of reservoir rock properties and their spatial variations; estimation of reserves; introduction to theory and application of geostatistics to reservoir characterization; presentation of fundamental geostatistical concepts including: variogram analysis, estimation variance, kriging and stochastic simulations and some data analytics concepts. Impact of geologic structure on oil recovery. Use of computer software for reservoir characterization and class project.

Prerequisites: Graduate standing in Petroleum Engineering.**Stacked with** PETE F421.**Lecture + Lab + Other:** 3 + 0 + 0**PETE F630 Waterflooding**

3 Credits

Offered As Demand Warrants

A study of the fundamental concepts and procedures for the design of waterflooding processes in petroleum reservoirs.

Prerequisites: PETE F301; PETE F476.**Lecture + Lab + Other:** 3 + 0 + 0**PETE F656 Advanced Petroleum Economic Analysis**

3 Credits

Offered As Demand Warrants

Economic analysis of petroleum production leading towards increasing cost efficiency in the petroleum and related industries. Qualitative and quantitative description of production forecasts and reserve estimation; oil and gas pricing; cash flow analysis; risk and uncertainty of operation of oil and gas production (financing, debt/equity ratio, depreciation and taxation).

Prerequisites: PETE F407, PETE F456.**Lecture + Lab + Other:** 3 + 0 + 0**PETE F661 Applied Well Testing**

3 Credits

Offered As Demand Warrants

Equations for transient flow of single phase fluids through porous media, extension to sample multiphase flow, isolated and developed multi-well flow, conventional drawdown and buildup analysis, log-log type curve analysis, interference testing, fractured wells, pulse tests, and drill stem tests.

Prerequisites: PETE F476; PETE F610.**Lecture + Lab + Other:** 3 + 0 + 0**PETE F662 Enhanced Oil Recovery**

3 Credits

Offered As Demand Warrants

Secondary and tertiary oil recovery processes, including waterflooding and chemical and thermal recovery methods.

Prerequisites: PETE F476 or PETE F610.**Lecture + Lab + Other:** 3 + 0 + 0**PETE F663 Applied Reservoir Simulation**

3 Credits

Offered As Demand Warrants

Mathematical description of the reservoir, organization of reservoir simulation study, history matching and prediction for several published case studies of reservoir simulations.

Prerequisites: Reservoir Engineering course, such as PETE F476 or PETE F610.**Lecture + Lab + Other:** 3 + 0 + 0**PETE F665 Advanced Phase Behavior**

3 Credits

Offered As Demand Warrants

The development and application of phase equilibrium simulators to predict fluid properties for reservoir fluids.

Prerequisites: PETE F301.**Lecture + Lab + Other:** 3 + 0 + 0**PETE F666 Drilling Optimization**

3 Credits

Offered As Demand Warrants

Principles of drilling optimization: drilling cost analysis and control; rheological properties of drilling fluid for optimum hole cleaning; planning an optimum mud program for vertical, directional and horizontal wellbores; optimizing bit hydraulics. Use of software packages in optimized hydraulics.

Prerequisites: Graduate standing in engineering discipline.**Lecture + Lab + Other:** 3 + 0 + 0**PETE F670 Fluid Flow Through Porous Media**

3 Credits

Offered As Demand Warrants

The study of transport phenomena in porous media and application to petroleum engineering.

Prerequisites: PETE F301; PETE F476.**Lecture + Lab + Other:** 3 + 0 + 0**PETE F680 Horizontal Well Technology**

3 Credits

Offered As Demand Warrants

Review of the state of the art of horizontal well technology covering recent advances in drilling and completion of horizontal wells. Emphasis on field practices, reservoir engineering aspects including well testing and well performance estimation, application of horizontal wells to gas and water coning problems as well as enhanced oil recovery.

Prerequisites: PETE F426; PETE F476.**Lecture + Lab + Other:** 3 + 0 + 0**PETE F683 Natural Gas Processing and Engineering**

3 Credits

Offered As Demand Warrants

Natural gas reservoir engineering and gas production practices. Transient flow of real gases, gas field development, gas well testing, transportation and gas storage reservoirs.

Prerequisites: PETE F431; PETE F476.**Lecture + Lab + Other:** 3 + 0 + 0

PETE F685 Non-Newtonian Fluid Mechanics

3 Credits

Offered As Demand Warrants

Characteristics of stress in fluids, flow models of non-Newtonian fluids (Bingham plastic fluids, fluids without yield stress), couette flow analysis of non-Newtonian fluids, surge and swab pressure models for plugged and open-end pipes.

Prerequisites: ES F341; PETE F426.

Lecture + Lab + Other: 3 + 0 + 0

PETE F687 Experimental and Data Analytics Methods in Petroleum Engineering

3 Credits

Offered As Demand Warrants

Application of statistical methods to develop empirical models in petroleum engineering. Topics covered include dimensional analysis, fundamental statistical concepts, regression analysis, neural networks, time series analysis and analysis of factorial and fractional factorial designed experiments.

Prerequisites: Graduate standing.

Lecture + Lab + Other: 3 + 0 + 0

PETE F689 Multiphase Fluid Flow in Pipes

3 Credits

Offered As Demand Warrants

Multiphase flow in pipes, modeling of fluid flow of complex mixtures in pipes, empirical correlations developed in the literature, and calculation of pressure gradients and flow rates during the flow of multiphase fluids through vertical, inclined and horizontal pipes.

Prerequisites: ES F341; MATH F426 or ES F301; PETE F407.

Lecture + Lab + Other: 3 + 0 + 0

PETE F692 Seminar

1-3 Credits

Lecture + Lab + Other: 0 + 0 + 0

PETE F692P Seminar

1-3 Credits

Lecture + Lab + Other: 0 + 0 + 0

PETE F698 Non-thesis Research/Project

1-9 Credits

Lecture + Lab + Other: 0 + 0 + 0

PETE F699 Thesis

1-9 Credits

Lecture + Lab + Other: 0 + 0 + 0