# PETROLEUM ENGINEERING (PETE)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<th>Description</th>
<th>Prerequisites</th>
<th>Lecture + Lab + Other</th>
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<tbody>
<tr>
<td>PETE F101</td>
<td>Fundamentals of Petroleum, Drilling and Production</td>
<td>3</td>
<td>Fall, Spring</td>
<td>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. Overview of Alaska unconventional hydrocarbon resources, opportunities and impact on the state economy.</td>
<td>Freshman standing in Petroleum Engineering program.</td>
<td>3 + 0 + 0</td>
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<tr>
<td>PETE F301</td>
<td>Reservoir Rock and Fluid Properties</td>
<td>4</td>
<td>Fall</td>
<td>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.</td>
<td>ES F346 (may be taken concurrently); MATH F252X; GEOS F101X or GE F261.</td>
<td>4 + 0 + 0</td>
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<tr>
<td>PETE F302</td>
<td>Well Logging</td>
<td>3</td>
<td>Spring</td>
<td>Comprehensive treatment of modern well logging methods including formation and production logging tools, and techniques and basic concepts of open hole log interpretation.</td>
<td>PETE F301, PETE F101.</td>
<td>3 + 0 + 0</td>
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<tr>
<td>PETE F303</td>
<td>Reservoir Rock and Fluid Properties Laboratory</td>
<td>1</td>
<td>Spring</td>
<td>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.</td>
<td>WRTG F111X, WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; PETE F301.</td>
<td>0 + 3 + 0</td>
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<tr>
<td>PETE F370</td>
<td>Sedimentology and Structural Geology for Petroleum Engineers</td>
<td>4</td>
<td>Fall</td>
<td>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.</td>
<td>GEOS F101X or GE F261.</td>
<td>3 + 3 + 0</td>
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<tr>
<td>PETE F407</td>
<td>Petroleum Production Engineering</td>
<td>3</td>
<td>Fall</td>
<td>Production system analysis, inflow performance analysis, gas lift design, sucker rod pumping and production decline analysis.</td>
<td>PETE F476; ES F341 and ES F346.</td>
<td>3 + 0 + 0</td>
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<tr>
<td>PETE F411</td>
<td>Drilling Fluids Laboratory</td>
<td>1</td>
<td>Spring</td>
<td>Design, composition and measurement of drilling fluid properties, evaluation of mud activities and chemical treatment of contaminated drilling fluid.</td>
<td>PETE F426 (may be taken concurrently); WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X.</td>
<td>0 + 3 + 0</td>
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<tr>
<td>PETE F421</td>
<td>Reservoir Characterization</td>
<td>3</td>
<td>Spring</td>
<td>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.</td>
<td>PETE F301; PETE F302; GEOS F370.</td>
<td>3 + 0 + 0</td>
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<tr>
<td>PETE F426</td>
<td>Drilling Engineering</td>
<td>3</td>
<td>Spring</td>
<td>Principles of drilling, drilling fluids and rheology, drilling problems, drilling hydraulics, well control techniques and casing seat selection.</td>
<td>ES F331; ES F341.</td>
<td>3 + 0 + 0</td>
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<tr>
<td>PETE F431</td>
<td>Natural Gas Engineering</td>
<td>2</td>
<td>Spring</td>
<td>Natural gas production and condensate reservoirs. Design of processing, transportation, distribution and flow measurement systems.</td>
<td>PETE F301.</td>
<td>3 + 0 + 0</td>
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<tr>
<td>PETE F456</td>
<td>Petroleum Evaluation and Economic Decisions</td>
<td>3</td>
<td>Spring</td>
<td>Economic appraisal methods for oil field developmental project evaluations including risk analysis, probability and statistics in decision making and evaluations. Case studies.</td>
<td>MATH F253X; PETE F476.</td>
<td>3 + 0 + 0</td>
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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 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  
(W)
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  
(O, W)
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 F310 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 F645  Petroleum Geology
3 Credits
Offered As Demand Warrants
Examines the origin of petroleum, the geologic controls of its distribution and accumulation and the basic tools used in exploration and exploitation, including subsurface mapping, well logging and exploration geophysics.
Prerequisites: Graduate standing.
Cross-listed with GEOS F645.
Stacked with GEOS F445.
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 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 F310 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