PETE - PETROLEUM ENGINEERING (PETE)

PETE 201 Introduction to Petroleum Engineering

Credit 1. 1 Lecture Hour. Overview and history of the petroleum industry and petroleum engineering; nature of oil and gas reservoirs, exploration and drilling, formation evaluation, well completions and production, surface facilities, reservoir mechanics, improved oil recovery; impact of ethical, societal, environmental considerations; career development resources, including professional society. **Prerequisite:** Approval of department head.

PETE 219 Foundations of Petroleum Data Analytics

Credits 2. 1 Lecture Hour. 3 Lab Hours. . Introduction to petroleum data analytics and computations; use of pre-built computational functions and packages for purposes of interpolation, gradient approximation, calculation of area under the curve, vector and matrix manipulation, and solving ordinary differential equations relevant to petroleum engineering; use of pre-built statistical functions and packages to solve petroleum engineering problems; exploratory data analysis and data preprocessing on large petroleum engineering and geophysical datasets; big-data visualization to generate insights and discover relationships; regression, classification, and clustering relevant to petroleum engineering; neural networks for regression and classification on petroleum engineering data; basic evaluation of data-driven models and basic computations using equations specific to petroleum engineering. **Prerequisite:** Grade of C or better in ENGR 102; concurrent enrollment in PETE 301.

PETE 225 Introduction to Drilling Systems

Credits 3. 2 Lecture Hours. 3 Lab Hours. Introduction to petroleum drilling systems, including fundamental petroleum engineering concepts, quantities and unit systems, drilling rig components, drilling fluids, pressure loss calculations, casing, well cementing, and directional drilling. **Prerequisites:** Grade of C or better in MATH 152, PHYS 206, and ENGR 216/PHYS 216 or PHYS 216/ENGR 216; grade of C or better in CHEM 107 and CHEM 117, or concurrent enrollment.

PETE 285 Directed Studies

Credits 1 to 4. 1 to 4 Other Hours. Special problems in various areas of petroleum engineering assigned to individual students or to groups. **Prerequisites:** Approval of department head.

PETE 289 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of petroleum engineering. May be repeated for credit. **Prerequisite:** Approval of instructor.

PETE 291 Research

Credits 1 to 4. 1 to 4 Other Hours. Research conducted under the direction of a faculty member in petroleum engineering. May be taken two times for credit. Registration in multiple sections of this course is possible within a given semester. **Prerequisites:** Freshman or sophomore classification and approval of instructor.

PETE 300 Summer Practice

Credits 0. Required. No Credit. Industry practice to familiarize the petroleum engineering student with practices and equipment of the petroleum industry. Approval of advisor required.

PETE 301 Petroleum Engineering Numerical Methods

Credits 3. 2 Lecture Hours. 3 Lab Hours. Use of numerical methods in a variety of petroleum engineering problems; numerical differentiation and integration; root finding; numerical solution of differential equations; curve fitting and interpolation; computer applications; introduction to the principles of numerical simulation methods. **Prerequisite:** Grade of C or better in MATH 308; concurrent enrollment in PETE 219; junior or senior classification, petroleum engineering majors only; or approval of instructor.

PETE 310 Reservoir Fluids

Credits 3. 2 Lecture Hours. 3 Lab Hours. Thermodynamic behavior of naturally occurring hydrocarbon mixtures; evaluation and correlation of physical properties of petroleum reservoir fluids including laboratory and empirical methods. **Prerequisite:** Grade of C or better in CHEM 107, CHEM 117, MATH 308, PETE 311 and PETE 315.

PETE 311 Reservoir Petrophysics

Credits 3. 2 Lecture Hours. 3 Lab Hours. Systematic theoretical and laboratory study of physical properties of petroleum reservoir rocks; lithology, porosity, elastic properties, strength, acoustic properties, electrical properties, relative and effective permeability, fluid saturations, capillary characteristics and rock-fluid interactions such as adsorption and absorption. **Prerequisite:** Grade of C or better in MATH 251, PHYS 207, and ENGR 217/PHYS 217 or PHYS 217/ENGR 217; grade of C or better in CHEM 107, CHEM 117, and GEOL 104, or concurrent enrollment.

PETE 314 Transport Processes in Petroleum Production

Credits 3. 3 Lecture Hours. Basics and applications of fluid mechanics including statics, mass, energy, momentum balances, laminar and turbulent flow, Reynolds number, Moody diagram, non-Newtonian fluid flow, multi-phase flow, flow in porous media, non-Darcy flow; heat transfer, heat conduction, convection and heat exchangers; emphasis on analogies and similarities within mass, energy and momentum transport. **Prerequisite:** Grade of C or better in PETE 315, junior or senior classification, petroleum engineering majors only; or approval of instructor.

PETE 315 Petroleum Engineering Thermodynamics

Credits 3. 3 Lecture Hours. Laws of thermodynamics; volumetric properties of pure fluids; heat effects; applications to flow processes; phase behavior and equations of state. **Prerequisites:** Grade of C or better in MATH 251 and MEEN 221.

PETE 321 Formation Evaluation

Credits 4. 3 Lecture Hours. 3 Lab Hours. Well-log interpretation for formation evaluation of hydrocarbon-bearing reservoirs; basic rock physics principles; theory of tool operation; analysis of open hole logs and core measurements to estimate hydrocarbon reserves and petrophysical properties of the formation such as porosity, net pay thickness, water/hydrocarbon saturation, permeability and saturation-dependent capillary pressure; formation evaluation of clay-free and shaly-sand formations as well as basic introduction to formation evaluation of organic-shale formations. **Prerequisites:** Grade of C or better in PETE 301, PETE 310, PETE 311, and GEOL 404, junior or senior classification, petroleum engineering majors only; or approval of instructor.

PETE 323 Fundamentals of Reservoir Engineering

Credits 3. 3 Lecture Hours. Determination of reserves; material balance methods; aquifer models; fractional flow and frontal advance; displacement, pattern and vertical sweep efficiencies in waterfloods; enhanced oil recovery processes; design of optimal recovery processes; introduction and performance analysis of unconventional reservoirs. **Prerequisites:** Grade of C or better in PETE 301, PETE 310, PETE 311, and GEOL 404, junior or senior classification, petroleum engineering majors only; or approval of instructor.

PETE 324 Well Testing

Credits 3. 3 Lecture Hours. Analysis of well performance under varied reservoir conditions including evaluation of unsteady, pseudo-steady and steady state flow; well testing methods used to determine well and reservoir parameters; applications to conventional and unconventional wells producing gas and/or liquids; fundamentals of preparing and operating well test equipment to monitor, measure and gather samples for evaluating well performance. **Prerequisites:** Grade of C or better in PETE 301, PETE 310, PETE 311, and GEOL 404, junior or senior classification, petroleum engineering majors only; or approval of instructor.

PETE 325 Petroleum Production Systems

Credits 3. 2 Lecture Hours. 3 Lab Hours. Petroleum operation and oil field equipment including onshore and offshore production systems; wellbore inflow and outflow and backpressure analysis; downhole completion and sand control equipment; artificial lift equipment and design; stimulation, workover/completion nomenclature; flow assurance; produced fluids, fluid separation and metering, safety systems, pressure boosting and monitoring. **Prerequisites:** Grade of C or better in PETE 301, PETE 310, and PETE 314, junior or senior classification, petroleum engineering majors only; or approval of instructor.

PETE 335 Technical Presentations I

Credit 1. 1 Lecture Hour. Preparation of a written technical paper proposal on a subject related to petroleum technology and an oral presentation of the proposal in a formal technical conference format. **Prerequisites:** Grade of C or better in COMM 203, COMM 205, COMM 243, or ENGL 210; junior or senior classification.

PETE 336 Petroleum Technical Presentation I

Credit 1. 3 Lab Hours. Preparation of a written technical paper on a subject related to petroleum technology. **Prerequisites:** Grade of C or better in ENGL 210; junior or senior classification, petroleum engineering majors only or approval of department head; Qatar campus.

PETE 337 Junior Student Paper Contest

Credits 0. No Credit. Presentation of a technical proposal on a subject related to petroleum technology judged by petroleum professionals at the junior level departmental student paper contest. Must be taken on a satisfactory/unsatisfactory basis. **Prerequisite:** Grade of C or better in PETE 336 or concurrent enrollment, or grade of C or better in PETE 335.

PETE 353 Petroleum Project Evaluation

Credits 3. 3 Lecture Hours. Economic analysis and investment decision methods in petroleum and mineral extraction industries; depletion, petroleum taxation regulations, and projects of the type found in the industry; mineral project evaluation case studies. **Prerequisites:** Grade of C or better in PETE 301 and PETE 310, or concurrent enrollment.

PETE 355 Drilling Engineering

Credits 3. 3 Lecture Hours. Design and evaluation of well drilling systems; identification and solution of drilling problems; wellbore hydraulics, well control, casing design; well cementing directional drilling, offshore drilling. **Prerequisites:** Grade of C or better in CVEN 305, PETE 225, and PETE 314; grade of C or better in PETE 321 and PETE 325, or concurrent enrollment.

PETE 401 Reservoir Simulation

Credits 2. 1 Lecture Hour. 3 Lab Hours. Solution of production and reservoir engineering problems using state-of-the-art commercial reservoir simulation software, using data commonly available in industry; emphasis on reservoir description, reservoir model design and calibration, production forecasting and optimization, economic analysis and decision making under uncertainty. **Prerequisites:** Grade of C or better in PETE 310, PETE 321, PETE 323, PETE 324, and PETE 353.

PETE 402 Integrated Asset Development

Credits 3. 1 Lecture Hour. 6 Lab Hours. Capstone design encompassing previously acquired skills; project teams formed to solve practical petroleum engineering problems using current tools; technical content of the projects may include any combination of drilling and completion, formation evaluation, inflow/outflow design and analysis, and application of reservoir engineering principles. **Prerequisites:** Grade of C or better in PETE 355, PETE 401, PETE 404, and PETE 410.

PETE 404 Integrated Reservoir Modeling

Credits 3. 3 Lecture Hours. Geophysical, geological, petrophysical and engineering data with geostatistical methods to create reservoir descriptions for dynamic reservoir modeling (simulation); geostatistical concepts such as variogram modeling, kriging and sequential Gaussian simulation; combines several techniques to quantify uncertainty in a realistic dynamic reservoir simulation. **Prerequisite:** Grade of C or better in PETE 401, or concurrent enrollment.

PETE 406 High Performance Drilling Design and Operational Practices

Credits 3. 3 Lecture Hours. Preparation in achieving differentiating drilling performance in the most complex wells; includes training in the underlying physics of each type of performance limiter and real time and engineering practices to address the limitation; performance management workflows and change models required to effectively change the way organizations conduct work essential in achieving higher performance. **Prerequisite:** Grade of C or better in PETE 355.

PETE 408 Probabilistic Reserves Evaluation

Credits 3. 3 Lecture Hours. Oil and gas reserves definitions and reporting regulations; probabilistic reserves estimation methods; unconventional resources characterization; reserves valuation techniques. **Prerequisite:** Grade of C or better in PETE 353 or approval of instructor.

PETE 409 Enhanced Oil Recovery

Credits 3. 3 Lecture Hours. Fundamentals and theory of enhanced oil recovery; polymer flooding, surfactant flooding, miscible gas flooding and steam flooding; application of fractional flow theory; strategies and displacement performance calculations. **Prerequisites:** Grade of C or better in PETE 310 or approval of instructor.

PETE 410 Production Engineering

Credits 3. 3 Lecture Hours. Fundamental production engineering design, evaluation and optimization for oil and gas producing well; well deliverability; formation damage and skin analysis; well completion selection; technologies that improve oil and gas well performance including artificial lift and well stimulation. **Prerequisites:** Grade of C or better in PETE 321, PETE 323, PETE 324 and PETE 325.

PETE 412 Surface Production Facilities

Credits 3. 3 Lecture Hours. Overview of separation and treatment of production fluid; fundamentals of gas-liquid separation; design and performance analysis of two- and three-phase separators; oil desalting, sweetening and stabilization; water treatment; overview of gas separation, dehydration and sweetening. **Prerequisite:** Senior classification or approval of instructor; Qatar campus.

PETE 413 Natural Gas Engineering

Credits 3. 3 Lecture Hours. Flow of natural gas in reservoirs and wellbores and gathering systems; deliverability testing; production surveillance and monitoring; production forecasting; flow measurement; and compressor sizing. **Prerequisites:** Grade of C or better in PETE 323, PETE 324, and PETE 325.

PETE 416 Solving Common Production Engineering Problems

Credits 3. 3 Lecture Hours. Application of petroleum engineering tools, methods and techniques to solve real problems that petroleum engineers encounter in producing individual wells; focus primarily on problems associated with single-phase gas wells and uses Microsoft Excel to solve many of these problems. **Prerequisite:** Grade of C or better in PETE 410.

PETE 418 Deterministic Reserves Evaluation

Credits 3. 3 Lecture Hours. Oil and gas reserves definitions and reporting regulations; deterministic estimation methods; unconventional resources characterization; reserves valuation techniques. **Prerequisite:** Grade of C or better in PETE 353 or approval of instructor.

PETE 419 Petroleum Data Analytics and Machine Learning

Credits 3. 3 Lecture Hours. Working knowledge about data analytics suitable for petroleum engineers and geoscientists; emphasis on implementing data-driven methods on various types of subsurface data; assembly of data-driven workflows and application of them on various types of subsurface data generated during petroleum engineering and geoscience operations and work on case studies that integrate various domains of petroleum engineering and geoscience; emphasis on the use of supervised learning, classification and regression, unsupervised learning, transformations, clustering, and feature extraction, and neural networks using open-source Python computational platforms; facilitation of understanding the basics of machine learning, data science and data analysis and their applications to petroleum engineering and geoscience. **Prerequisite:** Grade of C or better in PETE 219 and PETE 301 or approval of instructor.

PETE 426 Unconventional Reservoir Methods and Analysis

Credits 3. 3 Lecture Hours. Unconventional reservoirs and the latest practices of reservoir characterization, horizontal drilling and completion optimization methodologies, reservoir engineering and production. **Prerequisite:** Grade of C or better in PETE 323.

PETE 435 Technical Presentations II

Credit 1. 1 Lecture Hour. Preparation of a written technical paper on a subject related to petroleum technology and an oral presentation of the paper in a formal technical conference format. **Prerequisites:** PETE 337.

PETE 436 Petroleum Technical Presentation II

Credit 1. 3 Lab Hours. Preparation of a written technical paper on a subject related to petroleum technology and an oral presentation of the paper in a formal technical conference format. **Prerequisites:** Grade of C or better in PETE 336; senior classification, petroleum engineering majors only or approval of department head; Qatar campus.

PETE 437 Senior Student Paper Contest

Credits 0. No credit. Presentation of a technical petroleum engineering topic judged by petroleum professionals at the senior level departmental student paper contest. Must be taken on a satisfactory/unsatisfactory basis. **Prerequisite:** Grade of C or better in PETE 435 or PETE 436.

PETE 453 Petroleum Entrepreneurship

Credits 3. 3 Lecture Hours. Exploration of the various aspects of entrepreneurship with a focus on petroleum asset valuation and prospect analysis in the energy sector; exposure to all aspects of the journey including business idea generation, raising early stage capital, staffing the enterprise, developing the business plan and selling the concept to investors. **Prerequisites:** Grade of C or better in PETE 353.

PETE 485 Directed Studies

Credits 1 to 5. 1 to 5 Other Hours. Special problems in various phases of petroleum engineering assigned to individual students or to groups. **Prerequisites:** Junior or senior classification and approval of department head.

PETE 489 Special Topics in...

Credits 1 to 4. 1 to 4 Other Hours. Selected topics in an identified field of petroleum engineering. May be repeated for credit. **Prerequisite:** Approval of instructor.

PETE 491 Research

Credits 1 to 4. 1 to 4 Other Hours. Research conducted under the direction of a faculty member in petroleum engineering. May be taken two times for credit. Registration in multiple sections of this course is possible within a given semester. **Prerequisites:** Junior or senior classification and approval of instructor.