

Petroleum and Geosystems Engineering (PGE)

PGE 301 Engineering, Energy, and the Environment 3 Hours
Introduction to the field of petroleum engineering. Overview of energy supply and demand. Studies subsurface engineering and engineering problem-solving methods, with an emphasis on fossil energy exploitation and geologic CO₂ storage. Includes aspects of basic petroleum geology.

PGE 109, 209, 309, 409, 509, 609, 709, 809, 909 Topics in Petroleum and Geosystems Engineering 1-9 Hours

PGE 311 Numerical Methods and Programming 3 Hours
Introduction to computer programming and mathematical equations typically encountered in petroleum and geosystems engineering; methods to visualize data and solve engineering and mathematical equations with numerical methods; and applications of computers to general problem solving.

PGE 312 Physical and Chemical Behavior of Fluids I 3 Hours
Principles of organic chemistry; phase behavior; properties of hydrocarbon gases and liquids and oil field waters; overview of laboratory phase behavior measurements; material balance calculations.

PGE 119S, 219S, 319S, 419S, 519S, 619S, 719S, 819S, 919S Topics in Petroleum and Geosystems Engineering 1-9 Hours
Used to record credit the student earns while enrolled at another institution in a program administered by the University's Study Abroad Office. Credit is recorded as assigned by the study abroad adviser in the Department of Petroleum and Geosystems Engineering. University credit is awarded for work in an exchange program; it may be counted as coursework taken in residence. Transfer credit is awarded for work in an affiliated studies program.

PGE 421K Physical and Chemical Behavior of Fluids II 4 Hours
Applications of thermodynamics and physical chemistry to petroleum and geosystems engineering.

PGE 322K Transport Phenomena in Geosystems 3 Hours
Applications of mass, heat, and momentum balances to fluid flow problems; shell balances; non-Newtonian fluids; transport processes through permeable media.

PGE 323K Reservoir Engineering I: Primary Recovery 3 Hours
Classification of subsurface reservoirs by type and recovery mechanism; reserve estimates based on material balance; steady-state and transient fluid flow in permeable reservoir rocks as applied to subsurface engineering problems.

PGE 323L Reservoir Engineering II: Secondary and Tertiary Recovery 3 Hours
Introduction to reservoir displacement processes; water and gas injection; enhanced recovery.

PGE 323M Reservoir Engineering III: Numerical Simulation 3 Hours
Mathematical equations governing fluid flow in reservoirs; numerical methods to solve the equations; numerical reservoir simulation; treatment of wells; history matching; a simulation project performed using a commercial simulator.

PGE 424 Petrophysics 4 Hours
Properties of rocks; measurement and interpretation of petrophysical properties; application of petrophysics to subsurface engineering problems; interaction of resident fluids with rocks. Extensive written reporting.

PGE 326 Thermodynamics and Phase Behavior 3 Hours
Basics of phase behavior, classical thermodynamics in terms of material and energy balances, and applications to changes of state of petroleum fluids.

PGE 427 Properties of Petroleum Fluids 4 Hours
Principles of organic chemistry, phase behavior of multicomponent mixtures, properties of hydrocarbon gases and liquids and oil field waters, overview of laboratory phase behavior measurements, and material balance calculations.

PGE 129S, 229S, 329S, 429S, 529S, 629S, 729S, 829S, 929S Topics in Petroleum and Geosystems Engineering 1-9 Hours
This course is used to record credit the student earns while enrolled at another institution in a program administered by the University's Study Abroad Office. Credit is recorded as assigned by the study abroad adviser in the Department of Petroleum and Geosystems Engineering. University credit is awarded for work in an exchange program; it may be counted as coursework taken in residence. Transfer credit is awarded for work in an affiliated studies program.

PGE 430 Drilling and Well Completions 4 Hours
Elements of rock mechanics, drilling fluids, factors affecting rate of penetration, and well completions, including casing and tubing design.

PGE 333T Engineering Communication 3 Hours
Advanced technical communication skills, with emphasis on writing strategies for technical documents, oral presentations, and visual aids.

PGE 334 Reservoir Geomechanics 3 Hours
Basic stress and strain analysis; pore pressure and in situ stress estimation and measurement; deformation mechanisms in rock; rock fracture description and analysis; wellbore stresses and failure; wellbore stability analysis; fault stability analysis; depletion-induced reservoir deformation; and hydraulic fracturing. Emphasis on applications to petroleum engineering.

PGE 338 Geostatistics and Data Analysis 3 Hours
Explore basic frequentist and Bayesian probability and statistics, confidence and significance models, multivariate and spatial correlated features, feature engineering, spatial debiasing and estimation, stochastic simulation, uncertainty modeling, basic machine learning, and optimum decision making in the presence of uncertainty. Examine applications to spatial problems such as geology and subsurface resource development.

PGE 358 Principles of Formation Evaluation 3 Hours
Integrated petrophysical interpretation of well logs, core laboratory measurements, and geological data for static, dynamic, and geophysical appraisal of subsurface rock formations.

PGE 361 Advanced Reservoir Engineering 3 Hours
Secondary recovery methods; computer simulation of reservoir performance; applications to field problems.

PGE 362 Production Technology and Design 3 Hours
Analysis, specification, and characteristics of production systems; inflow performance; wellbore and tubing hydraulics; and artificial lift.

PGE 363 Petroleum Leasing Regulations and Practices 3 Hours
Domestic and worldwide regulations associated with petroleum leasing, including offshore areas, and environmental provisions concerning petroleum exploration and production.

PGE 364 Natural Gas Engineering 3 Hours
Production, transportation, and storage of gas; metering and gauging; performance of wells; estimation of gas reserves; prevention of waste and utilization of natural gas.

PGE 365 Resource Economics and Valuation 3 Hours

Derivation of profitability criteria for earth resource investments, project analysis in terms of the interrelation of technical and economic factors, investment analysis in the presence of uncertainty, and project planning.

PGE 368 Fundamentals of Well Logging 3 Hours

Principles, applications, and interpretation of well logs as used in exploration and evaluation of subsurface formations.

PGE 371 Energy Finance 3 Hours

Fundamentals of finance as applied to the petroleum industry, including petroleum project financing techniques, investigating sources of capital, and methods used to evaluate an oil company's financial performance.

PGE 372 Advanced Drilling and Well Completions 3 Hours

Applications of geomechanics in wellbore and near-wellbore problems encountered in drilling and completing high-pressure, high-temperature wells on land and water locations.

PGE 373L Geosystems Engineering Design and Analysis 3 Hours

Team-oriented design projects involving the application of geologic and engineering methods to the solution of subsurface problems, using field case histories. Projects are selected for each student based on his or her petroleum engineering technical area option.

PGE 175, 275, 375, 475 Special Topics in Petroleum and Geosystems Engineering 1-4 Hours

Explore recent developments in engineering.

PGE 176, 276, 376 Special Problems in Petroleum and Geosystems Engineering 1-3 Hours

Independent investigation of an advanced subject in petroleum and geosystems engineering, for superior students only.

PGE 377 Deepwater Operations 3 Hours

Overview of various technical, logistical, and managerial elements that are functionally integrated in deepwater operations, with emphasis on applications in the Gulf of Mexico.

PGE 378 Applied Reservoir Characterization 3 Hours

Reservoir modeling using software tools for statistical analysis of reservoir data; variogram analysis and modeling; spatial interpolation (kriging); tools for data integration in kriging; stochastic simulation of rock-types (lithology), pay thickness/porosity, and permeability; inputting geological models into flow simulation; uncertainty assessment.

PGE 379 Topics in Petroleum and Geosystems Engineering 3 Hours

Special courses or seminars on recent developments in engineering.

PGE 379.10 Artificial Lift 3 Hours

Life of a well, well testing, gas and plunger lift, progressive cavity pumps, electric submersible pumps, and beam lift.

PGE 379.11 Facilities Management 3 Hours

Petroleum fluid characteristics, process control, separators, metering, produced water, tanks, gas processing, gas compression, and liquid pumps.

PGE 379.12 Blowout Prevention and Control 3 Hours

Background in hydrostatics, hydrodynamics, hydraulics, geomechanics, mechanical systems, and procedures as they apply to well control.

PGE 379.13 Fundamentals of Enhanced Oil Recovery Techniques 3 Hours

Overview of the fundamental displacement concepts of chemical, miscible, and thermal enhanced oil recovery methods. Also includes the concept of phase behavior in each process.

PGE 379.14 High Performance Computational Engineering 3 Hours

An introduction to the UNIX environment in a scientific computing context, including instruction in several import UNIX applications to improve user productivity. Examine the differences between various parallelization styles of computing and develop a basic working understanding of how to utilize the application programming interfaces (APIs) in scientific applications.

PGE 379.15 E4: The Earth, Natural Resources, and Sustainability 3 Hours

Application of logic, common sense, the fundamental laws of mass and energy conservation, as well as more advanced thermodynamics to evaluate overall efficiencies of major human energy supply schemes such as fossil, nuclear, solar, wind, and biomass to define and quantify the irreversible linear processes and sustainable/unsustainable cycles.

PGE 379.16 Hydraulic Fracture Design and Evaluation 3 Hours

Overview of Formation evaluation; elasticity; in situ stress calculation and measurement; fracture initiation; basic equations of fracture mechanics; 2-and-3-dimensional fracture models; fluid rheology; proppant settling; pipe friction/surface pressure calculations; treatment pressure analysis; fracture diagnostics; fracturing from horizontal and deviated wells; and treatment design and completions.

PGE 379.17 Applied Subsurface Geology 3 Hours

Principles and techniques for subsurface geologic interpretation, including subsurface mapping; construction of cross-sections; core description and analysis; stratigraphic interpretation of well logs; and stratigraphic and facies interpretation of seismic data.

PGE 379.18 Wellbore Mechanics and Managed Pressure Drilling 3 Hours

Operational topics will draw from drilling fluids engineering; drilling system engineering; rig and wellbore hydraulics; ROP parameters and drilling optimizations; wellbore stability; fracture and pore pressure gradients; mud weight windows; in-situ and near-wellbore stress states; lost circulation; pressure control; pipe sticking; and other situations common to drilling operations.

PGE 379.19 Advanced Well Construction 3 Hours

Focus on advanced topics in drilling fluids, cementing, hydraulics, managed pressure and dual gradient drilling, advanced well control and casing design, complex well design (DW, HPHT, Arctic), and well completions.

PGE 379.20 Drilling Engineering and Operations Management 3 Hours

A broad overview of the key elements of today's drilling engineering discipline, including an understanding of rigs and rig equipment, familiarity with drilling fluids, cementing, directional drilling techniques etc., up to understanding of casing design, well control and the application of new & emerging drilling and completion technologies.

PGE 379.21 Wellbore to Reservoir Geomechanics 3 Hours

Applications from offshore to unconventional. Applications of fluid flow/geomechanics concepts at wellbore, near-wellbore and reservoir scales; vertical, inclined, and horizontal wells; drilling, completion, production and reservoir applications; sandstones, shales, carbonates

PGE 379.22 Global Carbon Monitoring Systems 3 Hours

Review technologies that help us monitor the pulse of the planet. Learn about systems that directly measure carbon dioxide and methane emissions from both natural sources like wetlands and permafrost and human-made sources like agriculture and fossil fuels. Study how modern technologies - drones, satellites, aerial systems - are revolutionizing the way we measure carbon emission from energy production and use.

PGE 379.23 Subsurface Energy Storage 3 Hours

Explore hydrogen, compressed air, and carbon storage in geological formations. Review ongoing projects and their relations to net-zero greenhouse emission targets. Discuss flow, transport, and geochemical interactions of different gases with site minerals.

PGE 379.3 Geothermal and Sustainable Energy Resources 3 Hours

Explore energy resources including geothermal, solar thermal, and biomass. Examine the foundations of these energy resources and the engineering approaches to recovering them. Build on basic knowledge in thermodynamics, flow through porous media, and chemistry.

PGE 379.4 Carbon Capture and Storage 3 Hours

Explore carbon dioxide emission into the atmosphere; carbon dioxide capture from industrial sources; and the utilization, underground storage, and monitoring of carbon dioxide.

PGE 379.5 Energy and the Environment 3 Hours

Examine current and potential energy sources and how these might impact the earth's environment. Explore the consequences of energy production in terms of the environmental impact. Discuss carbon, water, and land footprints.

PGE 379.7 Small Scale Fluid Flow 3 Hours

Examine the physics of fluid flow at the microscale in the context of pore-scale transport in subsurface systems and microfluidic models of subsurface systems. Review geological sediment deposition and how that motivates the appropriate microscopic length-scales. Explore equations of mass and momentum conservation for incompressible fluids. Develop simplifications towards the small-scale slow-flow limit to describe transport through pores and cover techniques in microfluidics and micromodels development.

PGE 379.8 Oil, Gas, and Mineral Law 3 Hours

Explore basic oil and gas law concepts, the forms generally used in oil and gas transactions and the type of regulation commonly applied to the oil and gas industry with a focus on Texas oil and gas law and regulation.

PGE 379.9 Subsurface Machine Learning 3 Hours

Explore fundamental probability and statistics; inference and prediction; and model training, testing, tuning, and validation. Examine workflows for integrating many features; workflows for anomaly detection, spatiotemporal prediction, and uncertainty integration. Communicate results within a project team to impact subsurface decision making.

PGE 679H Undergraduate Honors Thesis 6 Hours

Research performed during two consecutive semesters under the supervision of an engineering faculty member; topics are selected jointly by the student and the faculty member with approval by the director of the Engineering Honors Program. The student makes an oral presentation and writes a thesis.

PGE 380, 680 Advanced Petroleum Laboratory for Master's Degree Candidates 3,6 Hours

PGE 381 Drilling Engineering 3 Hours

Basic drilling terminology and advanced drilling engineering topics.

PGE 381K Engineering Analysis 3 Hours

Application of classical methods of mathematical analysis to problems frequently encountered in engineering applications.

PGE 381L Advanced Petrophysics 3 Hours

Measurement, interpretation, and analysis of petrophysical properties of petroleum reservoir rocks.

PGE 381M Transport Phenomena 3 Hours

PGE 382 Basic Geological Concepts for Engineers 3 Hours

Basic geological principles for students with little or no geological background.

PGE 382K Theory and Application of Reservoir Transients 3 Hours
Mathematical development and application of multiple pressure transients in well and reservoir systems.

PGE 382L Numerical Methods in Petroleum and Geosystems Engineering 3 Hours

The use of numerical methods and computers in the solution of petroleum and geosystems engineering problems.

PGE 383 Special Topics in Petroleum and Geosystems Engineering 3 Hours

Recent literature on petroleum production practice and petroleum and geosystems engineering problems.

PGE 383.10 Numerical Solution of Time-Dependent Problems 3 Hours

PGE 383.12 Near Wellbore Problems 3 Hours

PGE 383.16 Topics in Computational Methods 3 Hours

PGE 383.17 Naturally Fractured Reservoirs 3 Hours

PGE 383.2 Advanced Drilling Fluids 3 Hours

PGE 383.20 Geostatistics 3 Hours

PGE 383.24 Natural Gas Engineering 3 Hours

PGE 383.27 Rock Mechanics: Drilling, Completing, and Producing Applications 3 Hours

PGE 383.28 Macroeconomics of Petroleum 3 Hours

PGE 383.30 Fundamentals of Subsurface Environmental Engineering 3 Hours

PGE 383.32 Hydraulic Fracture Design and Evaluation 3 Hours

PGE 383.33 Advanced Drilling and Well Completion 3 Hours

PGE 383.35 Advanced Production Engineering 3 Hours

PGE 383.36 Advanced Numerical Methods 3 Hours

PGE 383.38 Chromatographic Transport and Geochemical Modeling 3 Hours

PGE 383.39 Design and Analysis of Pumping Systems 3 Hours

PGE 383.41 Energy Finance 3 Hours

PGE 383.46 International Petroleum Concessions and Agreements 3 Hours

PGE 383.5 Thermal Recovery 3 Hours

PGE 383.50 Reservoir Applications of Foam 3 Hours

PGE 383.55 Pore-Level Petrophysics 3 Hours

Geological and mathematical investigation of pore-scale basis for transport phenomena and petrophysical properties of sedimentary rocks.

PGE 383.56 Stochastic Methods for Reservoir Modeling 3 Hours

Spatial interpolation and stochastic simulation techniques for reservoir characterization.

PGE 383.57 Deepwater Operations 3 Hours

Overview of various technical, logistical, and managerial elements that are functionally integrated in deepwater operations, with emphasis on applications in the Gulf of Mexico.

PGE 383.58 Applied Reservoir Characterization 3 Hours

Reservoir modeling using software tools for statistical analysis of reservoir data; variogram analysis and modeling; spatial interpolation (kriging); tools for data integration in kriging; stochastic simulation of rock types (lithology), pay thickness/porosity, and permeability; inputting geological models into flow simulation; uncertainty assessment.

PGE 383.59 Oil and Gas Production Facilities Design 3 Hours
Applied theory relating to field processing of hydrocarbons and water, including hydrocarbon and gas separation, gas sweetening and dehydration, gas compression, fluid metering, process control, corrosion, and safety systems.

PGE 383.60 Energy and Earth Resource Economics 3 Hours
Theoretical and applied topics in natural resource economics, including project analysis, production theory, industrial organization, markets and regulation, and environmental economics.

PGE 383.61 Project Management 3 Hours
Overview of project management theory and practice in the natural resource sector, with a focus on exploration and production of energy resources.

PGE 383.62 Energy and the Environment 3 Hours
A survey course covering current and potential energy sources, what the energy supply mix will be in the future, and how this might impact the environment.

PGE 383.63 Subsurface Machine Learning 3 Hours
Explore the theory and practice of data analytics and machine learning for subsurface resource modeling. Examine fundamental probability and statistics; data preparation and feature engineering, inference (clustering, multidimensional scaling) and prediction (regression, naive Bayes, decision trees, random forest, support vector machines and artificial neural nets); and model selection, training, testing, tuning, and validation.

PGE 383.64 High Performance Computing for Engineers 3 Hours
Explore an introduction to the UNIX environment in a high-performance scientific computing context. Examine several import UNIX applications that can help users be more productive. Discuss the basic differences between various parallelization styles of computing, as well as how to utilize the application programming interfaces (APIs) in scientific applications.

PGE 383.65 Formation Evaluation of Unconventional Reservoirs 3 Hours
Explore advanced formation evaluation of unconventional reservoirs through experimental and computational/analytical methods and workflows. Discuss the rock physics of unconventional reservoirs. Examine multi-physics and multi-scale formation data (well logs, core data, and geological information) to construct hydrocarbon reservoir models amenable to production forecast and improved development of available reserves in unconventional reservoirs.

PGE 383.66 Data Analytics and Geostatistics 3 Hours
Explore subsurface data analytics and geostatistics, from fundamental probability and statistics, univariate and multivariate analysis, representative sampling, spatial characterization and modeling, and uncertainty management to decision-making in the presence of uncertainty.

PGE 383.67 Applied Subsurface Geology 3 Hours
Explore subsurface geology as a window into stratigraphy, depositional environments, depositional processes, tectonic influences, and other knowledge that can be applied to petroleum systems. Examine principles and techniques for subsurface geologic interpretation through inquiry-based, hands-on activities using petroleum-industry datasets.

PGE 383.68 Digital Rock Physics 3 Hours
Examine current modalities used in imaging porous medium structure, transport within, or its deformation. Discuss the analysis and visualization of 2D or 3D images, quantifying properties of interest (such as porosity, tortuosity, areas or permeability) as well as the associated uncertainty. Delve into a combination of advanced image analysis algorithms, scientific visualization, and computation (based on the images). Explore digital rock physics: the images, their analysis, and using them in simulation of petrophysical properties of interest.

PGE 383.69 Geothermal and Sustainable Energy Resources 3 Hours
Explore energy resources including geothermal, solar thermal, and biomass. Examine the foundations of these energy resources and the engineering approaches to recovering them. Build on basic knowledge in thermodynamics, flow through porous media, and chemistry.

PGE 383.70 Advanced Geomechanics 3 Hours
Examine the fundamentals of theoretical geomechanics and its application to problems in petroleum engineering. Explore the mechanics of porous solids and saturated porous solids, mechanical properties of real reservoir geomaterials, plane strain solutions for typical applications and numerical solutions for particular problems, and thermo-hydro-mechanical coupled processes. Apply this knowledge to understand the deformational behavior of various geomaterials found in petroleum engineering, to recognize situations in which geomechanical effects are important, and to choose the proper tools to solve geomechanical problems.

PGE 383.71 Artificial Lift 3 Hours
Explore the life of a well, well testing, gas and plunger lift, progressive cavity pumps, electric submersible pumps, and beam lift.

PGE 383.72 Carbon Capture and Storage 3 Hours
Explore carbon dioxide emission into the atmosphere; carbon dioxide capture from industrial sources; and the utilization, underground storage, and monitoring of carbon dioxide.

PGE 383.73 Finite Element Methods 3 Hours
Explore the basic concepts of the finite element method for two-point boundary value problems, elliptic and parabolic partial differential equations, and linear and nonlinear solvers. Examine the development of the method: weak formulations, approximating spaces, and construction and solution of linear systems.

PGE 383.74 Writing Technical Papers 3 Hours
Explore how to write technical papers, theses, and dissertations. Practice writing and editing technical works.

PGE 383.75 Inverse Problems in Geophysics and Petroleum Engineering 3 Hours
Explore the basics of multi-parameter linear and nonlinear inversion of noisy measurements. Discuss inversion methods including deterministic, stochastic approaches, and machine-learning approaches. Examine examples of application from the fields of subsurface geophysics and petroleum engineering.

PGE 383.76 Decision Analysis 3 Hours
Explore the principles and application of techniques for the logical illumination of complex decision problems within any context. Examine utility theory, probability as a statement of belief, risk preference, value of information and control, probability assessment, influence diagrams, risk sharing and scaling, and life and death decision making. Discuss the principles and fundamental concepts for the normative theory of decision making under uncertainty. Develop a language, set of theories, and tools to transform complex decisions into ones where the course of action is clear.

PGE 383.77 Small-Scale Fluid Flow 3 Hours

Examine the physics of fluid flow at the microscale in the context of pore-scale transport in subsurface systems and microfluidic models of subsurface systems. Review geological sediment deposition and how that motivates the appropriate microscopic length-scales. Explore equations of mass and momentum conservation for incompressible fluids. Develop simplifications towards the small-scale slow-flow limit to describe transport through pores and cover techniques in microfluidics and micromodels development.

PGE 383.78 Subsurface Energy Storage 3 Hours

Explore hydrogen, compressed air, and carbon storage in geological formations. Review ongoing projects and their relations to net-zero greenhouse emission targets. Discuss flow, transport, and geochemical interactions of different gases with site minerals.

PGE 383.79 Global Carbon Monitoring Systems 3 Hours

Review technologies that help us monitor the pulse of the planet. Learn about systems that directly measure carbon dioxide and methane emissions from both natural sources like wetlands and permafrost and human-made sources like agriculture and fossil fuels. Study how modern technologies - drones, satellites, aerial systems - are revolutionizing the way we measure carbon emission from energy production and use.

PGE 384 Advanced Thermodynamics and Phase Behavior 3 Hours

Thermodynamic study of pressure/volume/temperature/composition relationships in oil and gas mixtures.

PGE 385K Advanced Multi-Well Formation Evaluation 3 Hours

Advanced concepts in formation evaluation for the estimation of static and dynamic petrophysical properties of rocks from well logs, core data, and geological information. Multi-well data sets, seismic amplitude data, and regional geological studies are used to construct hydrocarbon reservoir models amenable to production forecast and improved development of available reserves.

PGE 385M Advanced Well-Logging and Correlation 3 Hours

Advanced well-logging for the geologist and engineer, involving working problems with suites of well logs to cover advanced mapping and logging techniques.

PGE 386K Advanced Fluid Flow in Porous Media 3 Hours

The hydrodynamic equations governing the steady state flow of homogeneous fluids in porous media and their application to petroleum and geosystems engineering problems.

PGE 387 Secondary Recovery of Petroleum 3 Hours

Recovery by gas injection and water flooding.

PGE 387K Fundamentals of Enhanced Oil Recovery I 3 Hours

Recent innovations in the recovery of petroleum by injecting fluids miscible with the oil or by application of heat to the reservoir.

PGE 387L Fundamentals of Enhanced Oil Recovery II 3 Hours

Basic concepts and principles of chemical flooding methods of enhanced oil recovery, which include polymer flooding, surfactant-polymer flooding (SP), alkaline-surfactant-polymer flooding (ASP), chemical imbibitions by wettability alteration methods and surfactant-gas (SG) methods, and also some comparisons with other EOR methods such as miscible gas flooding when appropriate and as time permits.

PGE 388 Advanced Reservoir Engineering 3 Hours

Basic concepts of reservoir engineering, with applications to the production of hydrocarbons from both gas and oil reservoirs. Examines the governing equations for flow in permeable media, as well as concepts such as streamline flow; pseudo-steady-state flow, fractional flow, and both immiscible and miscible flow. Uses black oil and compositional reservoir simulators.

PGE 389 Economic Analysis in the Petroleum Industry 3 Hours

Engineering justification for capital outlay in the petroleum industry.

PGE 290, 390, 690, 990 Advanced Laboratory for Doctoral Candidates 2,3,6,9 Hours

PGE 392K Numerical Simulation of Reservoirs 3 Hours

Development and application of reservoir simulator models to primary and secondary recovery processes in reservoir engineering.

PGE 397M Graduate Research Internship 3 Hours

PGE 197R, 297R, 397R, 497R, 597R, 697R, 797R, 897R, 997R Research in Petroleum and Geosystems Engineering 1-9 Hours

PGE 698 Thesis 6 Hours

PGE 398R Master's Report 3 Hours

Preparation of a report to fulfill the requirement for the master's degree under the report option.

PGE 399W, 699W, 999W Dissertation 3,6,9 Hours