P E-PETROLEUM ENGINEERING

P E 2011 Introduction to Petroleum Engineering 1 Credit Hour
Discuss the various sources of energy and their uses. Outline the full value chain of fossil fuels from exploration to production in light of government regulation and political influence. Recognize the impact of fossil fuel production on society. (Sp)

P E 2022 Python for Energy Applications 2 Credit Hours
Prerequisite: MATH 1914. This course provides an introduction to programming basics, problem-solving methods and algorithm development aided with Python. The course focuses on program design, debugging, testing and documentation and covers data types, control statements, functions, passing arguments, library functions, arrays, plotting, and object-oriented design. Students will also learn about various Python libraries that aid in the manipulation and analyses of large datasets. (Sp)

P E 2113 Statics and Dynamics 3 Credit Hours
Prerequisite: Physics 2514 and Mathematics 2934 or 2433 or concurrent enrollment in Mathematics 2934 or 2433. Vector representations of forces and moments; general three-dimensional theorems of statics and dynamics; centroids and moments of area and inertia. Free-body diagrams, equilibrium of a particle and of rigid bodies, principles of work and energy; principle of impulse-momentum. Motion of particles and rigid bodies of translating and rotating reference frames. Newton's laws of motion and Lagrange's equation, including application to lumped-parameter systems. Analyses of trusses, frames, and machines. (F)

P E 2153 Mechanics of Materials 3 Credit Hours
Prerequisite: PE 2113. Basic principle of mechanics, including the definition of stress, transformations and principal values for the stress and strain tensors, kinematic relation review of conservation equations and the development and application of consecutive laws for idealized materials. Elementary elastostatics utilizing Hooke's Law; consecutive relations for a linear-elastic continuum, including elastic parameters such as youngs modulus, shear and bulk moduli and poisson-s ratio. Solution of elementary one- and two-dimensional mechanics problems, including thermal stresses and strains, beam flexure, shear and deflections, pressure vessel and buckling of columns. (Sp)

P E 2213 Thermodynamics 3 Credit Hours
Prerequisite: MATH 2934 or 2433 and PHYS 2524 or concurrent enrollment in both MATH 2934 or 2433 and PHYS 2524. First and second law of thermodynamics are developed and applied to the solutions of problems from a variety of engineering fields. Extensive use is made of differential calculus to interrelate thermodynamics functions. (Sp)

P E 2281 Engineering Co-Op Program 1 Credit Hour
(Crosslisted with AME, CH E, CEES, C S, ECE, ENGR, EPHY and I E 2281) Prerequisite: student participation in the program. The Co-Op program provides student placement in jobs outside the University, but in a position related to the student's major. On completion of a semester work period, the student submits a brief written report. One hour of credit (elective) granted for each work period, with a maximum credit of six hours. (F, Sp, Su)

P E 3021 Technical Communications 1 Credit Hour
Prerequisite: English 1213/EXPO 1213. Develop skills for communication in a business/technical setting. (Sp)

P E 3022 Technical Communications 2 Credit Hours
Prerequisite: ENGL 1213. Develop skills for communication in a business/technical setting. (Sp)

P E 3123 Petroleum Reservoir Fluids 3 Credit Hours
Prerequisite: PE 2213. Gain knowledge of properties of naturally occurring fluids in the subsurface. Analyze and interpret contemporary field and laboratory fluid property measurements to construct fluid system models for reservoir performance during depletion. (F)

P E 3213 Reservoir Rock Properties 3 Credit Hours
Prerequisite: PE 2011 or concurrent enrollment, PE 2213 or concurrent enrollment, and GEOL 1114; Corequisite: PE 3221. Gain knowledge of properties of reservoir rocks under subsurface conditions, as well as the physical processes which control and alter them. Analyze and interpret contemporary rock properties measurements that address storativity, transmissibility and heterogeneity. (Sp)

P E 3220 Petroleum Engineering Internship 0 Credit Hours
Prerequisite: PE 2011. Full time Career-related work experience of at least eight weeks in the petroleum industry. The internship may also involve research with faculty members. (F, Su)

P E 3221 Rock Properties Laboratory 1 Credit Hour
Prerequisite: PE 3022 or concurrent enrollment, co-requisite PE 3213. Laboratory course aimed at exposing student teams to the design and conducting of experiments and the analysis and interpretation of reservoir properties. Students are expected to summarize experimental results in written research reports. The course will stress safety concerns appropriate for all laboratory procedures, error analyses and report writing. (Sp)

P E 3222 Petroleum Engineering Practice II (Internship) 2 Credit Hours
Prerequisite: P E 2011. Full time Career-related work experience of at least eight weeks in the petroleum industry. The internship may also involve research with faculty members. (F, Su)

P E 3223 Fluid Mechanics 3 Credit Hours
Prerequisite: PE 2113, PE 2213 or concurrent enrollment, Mathematics 2934/2443 or concurrent enrollment, Mathematics 3113 or concurrent enrollment. Coverage of the fundamental of fluid statics and dynamics. Formulation of the equations of fluid flow such as Navier Stokes, Euler, Bernoulli, etc. and their application. Examples of ideal and viscous fluid flow in open and closed conduits. (F)

P E 3313 Drilling I 3 Credit Hours
Prerequisite: PE 3213, PE 3223 or concurrent enrollment. Comprehension of contemporary drilling techniques including: rig systems, drilling cost and economics, drilling fluids, wellbore hydraulics, cementing, pore and fractured pressure gradients and drill bits. Design of balanced pressure systems, with professional and ethical responsibility considerations towards safety, while minimizing common drilling problems such as formation damage, fluid loss, lost circulation, stuck pipe, kick and well control incidents. (F)

P E 3343 Revolution in Power: the Evolution of Energy Systems from Fossil Fuels to Renewables 3 Credit Hours
(Crosslisted with HSTM 3343) Prerequisite: Junior standing, or completion of one History of Science lower-division course, or permission of instructor. This course provides an interdisciplinary perspective on energy systems in both their technical and human contexts, from fossil fuels to renewables, with particular focus on their social, culture, and environmental implications for Western society and the world. The history and evolution of the associated technologies will be discussed, with attention to non-western and indigenous perspectives on these global technological systems. (F) [IV-WC].

P E 3413 Production Engineering I 3 Credit Hours
Prerequisite: PE 3123; PE 3223 or concurrent enrollment. Comprehension of well completion concepts leading to design for optimum well performance, including nodal analysis for performance prediction. (Sp)

P E 3440 Mentored Research Experience 3 Credit Hours
0 to 3 hours. Prerequisites: ENGL 1113 or equivalent, and permission of instructor. May be repeated; maximum credit 12 hours. For the inquisitive student to apply the scholarly processes of the discipline to a research or creative project under the mentorship of a faculty member. Student and instructor should complete an Undergraduate Research & Creative Projects (URCP) Mentoring Agreement and file it with the URCP office. Not for honors credit. (F, Sp, Su)

P E 3513 Reservoir Engineering I 3 Credit Hours
Prerequisite: PE 3123, PE 3213. Combine knowledge of rock and fluid properties in enabling performance prediction and evaluation of hydrocarbon reservoirs, encouraging the understanding of the impact of evolving technology to the development of conventional and unconventional reservoirs. (Sp)

P E 3712 Petroleum Economics 2 Credit Hours
Prerequisite: Students need to have been admitted to the PE professional program to take upper division PE courses, requires Mewbourne College of Earth and Energy qualified enrollment. Application of petroleum engineering principles and economics to the evaluation of oil and gas projects. Analysis of the petroleum reserve management system and its use by the securities exchange commission and investors to value corporations. (F)

P E 3723 Numerical Methods for Engineering Computation 3 Credit Hours
Prerequisite: MATH 3113 or MATH 3413 or concurrent enrollment. Course uses software applications tailored for petroleum engineering majors, including methods for obtaining numerical solutions with digital computers, methods for solutions of algebraic and transcendental equations, simultaneous linear equations, and curve fitting techniques. Students will solve contemporary engineering problems using computational numerical methods for solutions in varied technical, societal, global, economic, and environmental applications. Any student who earns credit for P E 3723 cannot receive duplicate credit for AME 3723, C S 3723, or CH E 3723. (F)

P E 3813 Formation Evaluation with Well Logs 3 Credit Hours
Prerequisite: PE 3213. Comprehension of various methods of formation evaluation. Application of tool responses to formation evaluation in conventional and unconventional reservoirs. Using these principles to evaluate in-place hydrocarbon volume and the selection of applicable techniques as they evolve to the ever changing exploration environment. (Sp)

P E 3960 Honors Reading 1-3 Credit Hours
1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. Consists of topics designated by the instructor in keeping with the student's major program. Covers materials not usually presented in regular coursework. (F, Sp)

P E 3970 Honors Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. The projects covered will vary. Deals with concepts not usually presented in regular coursework. (Irreg.)

P E 3980 Honors Research 1-3 Credit Hours
1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. Provides an opportunity for the gifted Honors candidate to work on a special project in the student's field. (F, Sp)

P E 3990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: permission of instructor and junior standing. May be repeated once with change of content. Independent study may be arranged to study a subject not available through regular course offerings. (F, Sp, Su)

P E G4033 Oil, Gas and Environmental Law 3 Credit Hours
Prerequisite: PE 3712. Review and analysis of legal principles and leading cases related to oil and gas exploration, production and marketing in the areas of land titles, leases, operating agreements, contracts, acquisitions, gas marketing, environmental regulation, pollution, and litigation. (F)

P E 4221 Petroleum Engineering Practice III 1 Credit Hour
Prerequisite: P E 3220; Majors only. Career-related work experience of at least eight weeks in the petroleum industry. (F, Su)

P E 4323 Drilling II 3 Credit Hours
Prerequisite: PE 3313, PE 2153. Application of petroleum engineering principles, wellbore, well planning, casing design, direction control, drilling preparation, offshore operations. Team design project and presentation in casing design. Understand and evaluate environmental risk, professional and ethical responsibilities associated in drilling and production operations. Assess impact price of oil has on drilling activities, analyze and compare international drilling and completion concepts under environmental, societal contexts. (F)

P E 4331 Drilling Engineering Laboratory 1 Credit Hour
Prerequisite: P E 3313. Laboratory course aimed at exposing student teams to the design and conducting of experiments and the analysis and interpretation of drilling and production engineering. The course will stress safety concerns appropriate for all laboratory procedures, error analyses and report writing. (Sp)

P E 4423 Production Engineering II 3 Credit Hours
Prerequisite: PE 3223. Gain applied understanding of the surface production systems and associated components based on technical, professional, environmental, and safety principles. Included are flow assurance, surface facilities, separation, water and gas processing, pumps, compressors and flow meters. (F)

P E 4463 Data Analytics 3 Credit Hours
(Slashlisted with P E 5463) Prerequisite: P E 3723. Introduction to Data Mining and Machine Learning for students interested in the theory and applications of data mining/data analytics/machine learning in the petroleum industry. Will be of value to petrophysicists, geophysicists, and petroleum engineers who deal with large datasets, extracting meaning out of data. No student may earn credit for both 4463 and 5463. (Sp)

P E 4521 Reservoir Fluid Mechanics Laboratory 1 Credit Hour
Prerequisite: PE 3513. Laboratory course aimed at exposing student teams to the design and conducting of experiments and the analysis and interpretation of reservoir fluid mechanics. The course stresses safety concerns appropriate for all laboratory procedures, error analyses and report writing. (F)

P E 4532 Reservoir Engineering II 2 Credit Hours
Prerequisite: PE 3513. Comprehension of primary and secondary recovery drive mechanisms, including the effects of heterogeneity, for constructing enhanced recovery performance prediction models. (F)

P E G4533 Reservoir Engineering II 3 Credit Hours
Prerequisite: PE 3513. Comprehension of primary and secondary recovery drive mechanisms, including the effects of heterogeneity, for constructing enhanced recovery performance prediction models. (F)

P E 4552 Data Analytics 2 Credit Hours
Prerequisite: PE 3723. This course provides an introduction to Data Mining and Machine Learning for students interested in the theory and applications of data mining/data analytics/machine learning in the petroleum industry. As such it will be of immense value to petrophysicists, geophysicists and petroleum engineers who deal with large datasets and want to extract meaning out of this data. (Sp)

P E 4553 Integrated Reservoir Management 3 Credit Hours
(Slashlisted with P E 5553) Prerequisite: PE 3313, PE 3813, PE 4712 or PE 4711, PE 4423, PE 4533 or PE 4532, PE 4323 or concurrent enrollment. Comprehensive reservoir assessment experience based on knowledge and skills throughout PE curriculum. Results are delivered by teams in oral presentations, written technical and summary reports. Experience incorporates petroleum reserve management system (appropriate engineering standards) and multiple realistic constraints (current economic and political conditions). Requires work flow design tailored to specific reservoirs to resolve production performance, recovery and volumetrics. Capstone. No student may earn credit for both 4553 and 5553. (F, Sp) [V].

P E 4573 Well Test Analysis 3 Credit Hours
(Slashlisted with PE 5573) Prerequisite: PE 3513 or PE 3413. Review of petrophysics and fluid properties related to well testing. Material balance, diffusivity equation, steady-state flow, and pseudosteady-state flow. Analytical model for well tests. Wellbore storage and skin effects. Well test interpretation in conventional formations. Gas well test interpretation. Flow regimes and bounded reservoir behavior. Well test interpretation in fractured, faulted, and dual-porosity formations. Wellbore and near-wellbore phenomena. No student may earn credit for both 4573 and 5573. (Irreg.)

P E 4583 Improved Recovery Techniques 3 Credit Hours
(Slashlisted with P E 5583). Prerequisite: PE 3513. New wellbore and reservoir techniques for improved recovery, diagnostic techniques, waterflooding, and enhanced oil recovery. No student may earn credit for both 4583 and 5583. (Sp)

P E 4711 Petroleum Project Evaluation 1 Credit Hour
Prerequisite: PE 3413, PE 3513, PE 3712. Application of petroleum engineering principles and economics to the evaluation of oil and gas projects. Analysis of the petroleum reserve management system and its use by the securities exchange commission and investors to value corporations. Evaluation of risk including developing political and scientific risks to oil and gas projects. (F, Sp)

P E 4712 Petroleum Project Evaluation 2 Credit Hours
Prerequisite: PE 3413, PE 3513, PE 3712. Application of petroleum engineering principles and economics to the evaluation of oil and gas projects. Analysis of the petroleum reserve management system and its use by the securities exchange commission and investors to value corporations. Evaluation of risk including developing political and scientific risks to oil and gas projects. (F)

P E 4960 Directed Readings 1-4 Credit Hours
1 to 4 hours. Prerequisite: good standing in University; permission of instructor and dean. May be repeated; maximum credit four hours. Designed for upper-division students who need opportunity to study a specific problem in greater depth than formal course content permits. (Irreg.)

P E 4970 Special Topics/Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: Senior standing or permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)

P E 4990 Special Studies 1-4 Credit Hours
1 to 4 hours. Prerequisite: department instructor permission. May be repeated; maximum credit 4 hours. Special research on current or special problems. (F, Sp, Su)

P E 5123 Scanning Electron Microscopy of Geological Materials 3 Credit Hours
Prerequisite: Graduate standing and permission of instructor. Gain the competency to operate and apply scanning electron microscopy technology to focus on geologic materials with special attention pertinent to the petroleum industry. Acquire and critically analyze SEM data suitable for scientific publication. (F)

P E 5233 Geothermal Technologies 3 Credit Hours
(Crosslisted with G E 5233) Prerequisite: Graduate standing or instructor permission. This course provides an overview of geothermal resources, applications, systems, surface facilities, wellbore design and completion in geothermal wells, fracture design for EGS systems, drilling challenges of deep geothermal application, well construction challenges in geothermal, and new advancements in numerical and experimental investigation of geothermal. Risk and failure analysis and economic analysis of geothermal systems are incorporated. (F)

P E 5243 Introduction to Rock Mechanics 3 Credit Hours
Prerequisite: Graduate standing or instructor permission. Engineering properties of rock; rock testing techniques; in-situ methods; mathematical approach to stress-strain analysis; discontinuities in rock; applications for underground openings; rock slopes; foundations and drilling. (Sp)

P E 5343 Oil Country Tubular Goods 3 Credit Hours
Prerequisite: Graduate standing or permission of instructor. Provides an overview of tubular use in the oil industry and manufacturing process of tubulars used from upstream to downstream applications. Students will learn about the design options to meet deliverables, safety, and integrity requirements in tubular applications. Main components of a well are described and analyzed by their function and design criteria. (F)

P E 5353 Advanced Drilling 3 Credit Hours
Prerequisite: Graduate standing or instructor permission. Cost control, hole problems, planning a well, drilling; muds, drilling fluid solids removal, pressure losses, lifting capacity of drilling fluids, surge and swab pressures, pore pressure and fracture gradients, pressure control, well control equipment, blowouts, deviation in boreholes, rotary drilling bits. (F)

P E 5363 Completion and Workover 3 Credit Hours
Prerequisite: Graduate standing and majors only, or P E 3313 and P E 3413. This course provides an overview of completions and workover equipment and methods in the oil and gas industry. It is designed to complement the courses on drilling and production engineering currently offered. The students will learn about the design options to meet deliverability, safety, and integrity requirements in completions and workover operations. (F)

P E 5393 Rheology of Complex Fluids 3 Credit Hours
(Crosslisted with CH E 5393) Prerequisite: Graduate standing and CH E 5971, or permission of instructor. Develop skills necessary to understand the basic principles of rheological and viscoelastic properties of complex fluids, such as polymer melts and solutions, emulsions, suspensions, multiphase flow, etc. Covers the flow behavior of non-Newtonian fluids and viscoelastic fluids. Newtonian fluid mechanics will be reviewed to describe the standard flows for rheology. Rheometry, the technique for characterization of fluids, will be discussed. (Sp)

P E 5423 Advanced Stimulation 3 Credit Hours
Prerequisite: Graduate standing or instructor permission. Theory and application of continuum mechanics concepts to hydraulic fracturing, acidizing, acid fracturing and other stimulation processes. (Irreg.)

P E 5433 Horizontal Well Technology 3 Credit Hours
Prerequisite: Graduate standing or instructor permission. Horizontal well technology including: horizontal drilling and associated drilling problems, horizontal well completions and stimulation, horizontal well testing and logging, horizontal wells lift systems, environmental aspects of horizontal wells, economics, regulations. (Sp)

P E 5443 Formation Damage 3 Credit Hours
(Crosslisted with G E and GEOL 5443) Prerequisite: Graduate standing or permission of instructor. This course presents an overview of main mechanisms of formation damage (mechanical, chemical, thermal, and biological) occurring during subsurface applications, including but not limited to primary and enhanced hydrocarbon production, CO2 storage, and geothermal processes. Existing theories explaining the process and methods to mitigate the formation damage will be discussed. (Irreg.)

P E 5463 Data Analytics 3 Credit Hours
(Slashlisted with P E 4463) Prerequisite: Graduate standing or instructor permission. Introduction to Data Mining and Machine Learning for students interested in the theory and applications of data mining/data analytics/machine learning in the petroleum industry. Will be of value to petrophysicists, geophysicists, and petroleum engineers who deal with large datasets, extracting meaning out of data. No student may earn credit for both 4463 and 5463. (Sp)

P E 5523 Advanced Production Engineering 3 Credit Hours
Prerequisite: graduate standing or permission. Inflow performance relationship, skins of well completion & design, single/multiple phase flow in wellbore and pipes, Nodal analysis, artificial lifting methods including gas lift, rod pump and ESP, Production stimulation technologies including acidizing and hydraulic fracturing, introduction of production logging. (F)

P E 5553 Integrated Reservoir Management 3 Credit Hours
(Slashlisted with P E 4553) Prerequisite: Graduate standing, prerequisite or concurrent enrollment in P E 3313, P E 3813, P E 4423, P E 4323, P E 4712 or P E 4711, P E 4533 or P E 4532. Comprehensive reservoir assessment experience based on knowledge and skills throughout P E curriculum. Results are delivered by teams in oral presentations, written technical and summary reports. Experience incorporates petroleum reserve management system (appropriate engineering standards) and multiple realistic constraints (current economic and political conditions). Requires work flow design tailored to specific reservoirs to resolve production performance, recovery, and volumetrics. No student may earn credit for both 4553 and 5553. (F, Sp)

P E 5563 Mathematical Simulation Models 3 Credit Hours
Prerequisite: Graduate standing or instructor permission. Principles of simulating engineering systems by partial differential equation systems; considers the use of engineering principles in formulating mathematical simulation models and analytic techniques for solving the resulting mathematical models. (Sp)

P E 5573 Well Test Analysis 3 Credit Hours
(Slashlisted with P E 4573) Prerequisite: Graduate standing or instructor permission. Review of petrophysics and fluid properties related to well testing. Material balance, diffusivity equation, steady-state flow, and pseudosteady-state flow. Analytical model for well tests. Wellbore storage and skin effects. Well test interpretation in conventional formations. Gas well test interpretation. Flow regimes and bounded reservoir behavior. Well test interpretation in fractured, faulted, and dual-porosity formations. Wellbore and near-wellbore phenomena. No student may earn credit for both 4573 and 5573. (Sp)

P E 5583 Improved Recovery Techniques 3 Credit Hours
(Slashlisted with P E 4583) Prerequisite: senior standing, or graduate standing. New wellbore and reservoir techniques for improved recovery, diagnostic techniques, waterflooding, and enhanced oil recovery. No student may earn credit for both 4583 and 5583. (Sp)

P E 5603 Introduction to Natural Gas Engineering and Management 3 Credit Hours
Prerequisite: Graduate standing or instructor permission. Global natural gas supply and demand, international gas trade and infrastructure, gas policy, regulation, safety and environmental issues, natural gas resource base: conventional and unconventional, gas exploration, drilling and production, gas processing, storage and pipeline, gas trading and marketing, gas utilization, LNG, chemicals. (F)

P E 5613 Natural Gas Engineering 3 Credit Hours
Prerequisite: Graduate standing or permission of instructor. Review of properties of natural gases and condensate systems; gas flow in porous media; gas reservoir engineering; gas field development; gas condensate reservoirs; natural gas transportation and storage. (Alt. Sp)

P E 5623 Natural Gas Processing 3 Credit Hours
Prerequisite: PE 5603, graduate standing or permission of instructor. Gas conditioning; processing of gas for its liquids; design of adsorption and absorption facilities; fractionation design. (Alt. Sp)

P E 5633 Oil and Gas Laws 3 Credit Hours
Prerequisite: Graduate standing and departmental permission. The course will provide students with fundamental understanding of various oil and gas laws which control and govern different aspects of oil and gas business activities, from reservoir to ultimate customers of different products, whether they are oil and natural gas or final products, including methane, ethane, propane, LPG, NGL, etc. (Irreg.)

P E 5643 Natural Gas Finance - Valuation and Investment 3 Credit Hours
Prerequisite: Graduate standing or instructor permission. This course is the first in a two-course sequence in natural gas finance. The first course covers valuation and investment topics; and the second course covers risk management and natural gas trading topics. The valuation and investment course exposes students to basic concepts and practices of valuation and investment in the natural gas industry. Topics include accounting systems, financial statement analysis, valuation of company stocks, competitive comparisons, value of reserves in the ground, corporate restructuring, legal and tax environment for mergers, valuation of bonds and preferred stocks. The emphasis of the course will be on the application of the basis financial theories of valuation and investment on the natural gas industry. (F)

P E 5653 Natural Gas Finance - Trading and Risk Management 3 Credit Hours
Prerequisite: Graduate standing or instructor permission. This course is the second in a two-course sequence in natural gas finance. The first course covers valuation and investment topics; and the second course covers risk management and natural gas trading topics. The gas risk management course exposes students to basic concepts and practices of risk management in the natural gas industry. Topics include basic structure of the gas physical and financial markets, derivatives, hedging strategies, futures and forward price determination, option pricing theories, value at risk and market fundamental and technical analyses. The emphasis of the course will be on the application of the basis financial risk management theories to the natural gas industry. (Sp)

P E 5663 Natural Gas Utilization 3 Credit Hours
Prerequisite: Graduate standing or permission of instructor. The course covers the uses of natural gas for combustion, power, LNG, gas conversion to chemicals and fuels, and gas transportation. (Sp)

P E 5673 Liquified Natural Gas Value Chain 3 Credit Hours
Prerequisite: Graduate standing and departmental permission. The course covers the worldwide supply and demand landscape for LNG followed by all aspects of the LNG value chain, beginning with receiving feed natural gas from supply pipelines and processing it to meet required specifications for liquification to LNG and transporting it to end users. (F, Sp)

P E 5683 Natural Gas Transportation & Storage 3 Credit Hours
Prerequisite: Graduate standing and departmental permission. This course covers basic principles of hydrocarbon value chain from well-head to the end user. Primary focus relates to mid-stream operations and covers hydrocarbon transportation fundamentals (on-shore and off-shore), transportation safety, fluid characterization, pipeline design (on-shore and off-shore), rotating and reciprocating equipment design, storage facilities, flow assurance, and integrity management. (F)

P E 5693 Safety and Human Factors 3 Credit Hours
Prerequisite: Graduate standing and departmental permission. This course is designed as an introduction to the safety and human factors that are important in delivering on the energy industries' commitment to safe and environmentally-sound development of our natural resources. Engineered systems work hand in hand with leadership and organizational culture to adapt to an ever-changing environment to ensure that safe and environmentally-sustainable performance is maintained. (Su)

P E 5703 Advanced Energy Economics 3 Credit Hours
Prerequisite: Graduate standing. Covers the topics related to the economic analysis of the energy industry markets at both the domestic and international levels. Analysis of natural gas market including topics of energy scenarios, energy demand and supply analyses, determination of prices under different market structures, various energy sectors, role of energy efficiency, and policy. (F)

P E 5723 Environmental Sustainability 3 Credit Hours
Prerequisite: Graduate standing and departmental permission. Course will discuss trends moving toward low carbon energy sources and how natural gas technologies fit in the future energy market; will cover proactive environmental management opportunities including concepts in pollution prevention and industrial ecology applied to natural gas systems; and will review how to calculate material and energy balances for power systems as basis for sustainability analyses. (Sp)

P E 5733 Culmination Experience 3 Credit Hours
Prerequisite: Graduate standing and departmental permission. Culmination research project within the online Master's Degree Program in Natural Gas Engineering and Management program. Designed to prepare Engineering Managers, Business Managers, and Government Representatives to address the wide-ranging challenges in the midstream natural gas business. This research project course is structured to demonstrate the program outcomes have been achieved and sufficient awareness of topics gained. (F, Sp)

P E 5743 Advanced Project Management 3 Credit Hours
Prerequisite: Graduate standing or instructor permission. This course covers how capital-intensive projects worth billions of dollars in the oil and gas industry are executed, including the different aspects of planning from conception to closeout for successful execution. (Su)

P E 5753 Low Carbon Energy Markets 3 Credit Hours
Prerequisite: Graduate standing or departmental permission. Comprehensive review of principles, technologies, policies, and market drivers behind the shift towards low-carbon energy. Learn about technologies that make up low-carbon energy markets and explore the role of energy storage and emerging trends. Examine policies/regulations that shape industry. Develop critical thinking and problem-solving skills to analyze complex energy markets, evaluate ethical/social implications and make strategic recommendations for stakeholders. (Su)

P E 5960 Directed Readings 1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing and permission of department. May be repeated; maximum credit twelve hours. Directed readings and/or literature reviews under the direction of a faculty member. (F, Sp, Su)

P E 5970 Special Topics/Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: Graduate standing or permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)

P E 5980 Research for Master's Thesis 2-9 Credit Hours
Variable enrollment, two to nine hours; maximum credit applicable toward degree, four hours. (F, Sp, Su)

P E 5990 Special Studies 1-4 Credit Hours
1 to 4 hours. Prerequisite: graduate standing in petroleum engineering. May be repeated with change of topic; maximum credit twelve hours. Supervised individual study or specialized research in petroleum engineering. (F, Sp, Su)

P E 6273 Advanced Rock Mechanics II 3 Credit Hours
(Crosslisted with G E 6273) Prerequisite: Graduate standing and instructor permission. Advanced topics related to petroleum and geothermal reservoir rock properties, constitutive models, rock fracture, and coupled processes in rocks and rock masses. Influence of stress, fluid pressure, temperature, and chemistry on rock properties and deformation in the context of drilling, reservoir stimulation, and induced seismicity. (Irreg.)

P E 6283 Seismic Reservoir Modeling 3 Credit Hours
Prerequisite: Graduate standing or permission of instructor. This course is designed to explore the seismic response of rocks and how it is related to petrophysical parameters. This understanding is key to interpretation of seismic data in terms of subsurface rocks and fluids. (F)

P E 6293 Unconventional Reservoirs 3 Credit Hours
Prerequisite: Graduate standing or instructor permission. The objective of this course is to provide basic understanding of developing and producing from unconventional reservoirs, in particular, mudrocks/shales. (F)

P E 6573 Advanced Reservoir Engineering 3 Credit Hours
Prerequisite: graduate standing. Petrophysics, Formation Evaluation, Reservoir Fluid Properties, Flow in Porous Media, Reservoir Material Balance, Decline Curve Analysis and Reservoir Simulation. (F)

P E 6583 Enhanced Oil Recovery 3 Credit Hours
Prerequisite: graduate standing or permission. Fundamentals and principles of enhanced oil recovery; practical applications of method of characteristics to design miscible gas injection, water alternating gas flooding, and polymer flooding. (Sp)

P E 6960 Directed Readings 1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing or permission of instructor. May be repeated; maximum credit six hours. Directed readings and/or literature review under the direction of a faculty member. (Irreg.)

P E 6970 Special Topics/Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing or permission of instructor. May be repeated; maximum credit 12 hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or research and field projects. (Irreg.)

P E 6980 Research for Doctoral Dissertation 2-16 Credit Hours
2 to 16 hours. Prerequisite: Graduate standing and permission of instructor; may be repeated. Directed research culminating in the completion of the doctoral dissertation. (F, Sp, Su)

P E 6990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: Graduate standing and permission of instructor. May be repeated; maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)