Department of Petroleum and Natural Gas Engineering, M.S.P.N.G.E, Ph.D.

Degrees Offered

• Masters of Science, Petroleum and Natural Gas Engineering (M.S.P.N.G.E.)
• Doctor of Philosophy, Petroleum and Natural Gas Engineering (Ph.D.)

The Petroleum and Natural Gas Engineering (PNGE) graduate programs are designed for students who have already completed a basic petroleum engineering curriculum.

Degree Programs

The Department of Petroleum and Natural Gas Engineering admits students to the following degree programs: master of science in petroleum and natural gas engineering (M.S.P.N.G.E.) and petroleum and natural gas engineering major under the Statler College of Engineering and Mineral Resources’ interdisciplinary doctor of philosophy (Ph.D.). Students in these programs must comply with the rules and regulations as presented in the general requirements for graduate work in the Statler College of Engineering and Mineral Resources.

Program Objectives

The objective of the Petroleum and Natural Gas Engineering (PNGE) graduate programs is to educate and train men and women who will be capable of performing at the highest levels of the petroleum and natural gas engineering profession. The programs provide students with the advanced technical knowledge and engineering skills needed by the oil and gas industry in the state, the nation, and the world. Moreover, the programs will make students competent to perform independent research and will prepare them to be the future providers of high quality education in petroleum and natural gas engineering. Graduates have the opportunity to enter all phases of the oil and natural gas industry, government agencies, and academia in meaningful and important jobs.

Student Learning Outcomes

• Graduates will have in-depth knowledge of petroleum and natural gas engineering principles and applications to function effectively in their profession or continue their education.
• Graduates will have the ability to perform independent research to solve engineering and scientific problems encountered in their profession.

Areas of Research

• Development of the Unconventional Oil and Gas Resources
• Drilling and Well Completion
• Stimulation
• Reservoir Characterization and Formation Evaluation
• \( \text{CO}_2 \) Sequestration and Enhanced Oil Recovery
• Reservoir Modeling and Simulation
• Application of Artificial Intelligence and Data Analytics

FACULTY

CHAIR

• Samuel Ameri - M.S.Pet.E., P.E. (West Virginia University)
  Formation Evaluation

PROFESSORS

• Kashy Aminian - Ph.D. (University of Michigan)
  Natural Gas Engineering, Unconventional Reservoirs
• Shahab Mohaghegh - Ph.D. (Pennsylvania State University)
  Intelligent Systems, Shale Analytics

ASSOCIATE PROFESSOR

• H. Ilkin Bilgesu - Ph.D., P.E. (Pennsylvania State University)
  Drilling and Production Engineering
Admissions

MASTERS ADMISSION

A candidate for the M.S.P.N.G.E. program must meet the following requirements:

• B.S. degree in engineering from an ABET-accredited, or an internationally-recognized engineering program or equivalent with a grade point average (GPA) equal to, or greater than, 3.0 (on a 4.0 scale)
• International applicants must submit proof of English language proficiency.
• At least three recommendation letters (one letter must be from the applicant’s academic advisor or equivalent.)

DOCTORAL ADMISSION

Doctoral candidates must comply with the rules and regulations as outlined in the general requirements for graduate work in engineering and the specific requirements stated in the departmental guidelines.

A candidate for the degree of Doctor of Philosophy (Ph.D.) must meet the following requirements:

• B.S. or M.S. degree in petroleum engineering from an ABET-accredited, or an internationally-recognized petroleum engineering program or equivalent with a grade point average (GPA) equal to, or greater than, 3.0 and 3.2, respectively
• A score of at least seventy-fifth percentile for Graduate Record Examination (GRE) quantitative analysis
• International applicants must submit proof of English language proficiency.
• At least three recommendation letters (one letter must be from the applicant’s previous thesis advisor or an academic equivalent.)

MSPNGE Major Code: 3075
PhD Major Code: 3076

For specific information on the following program, please see the links to the right:

• Petroleum and Natural Gas Engineering, M.S.P.N.G.E.

For specific information on the following program, please see the links to the right:

• Petroleum and Natural Gas Engineering, Ph.D.

COURSES

PNGE 501. Petroleum Engineering Problems. 1-3 Hours.
PR: Senior standing. Investigation of a special problem in petroleum engineering.

PNGE 532. Introduction to Reservoir Simulation. 3 Hours.
PR or CONC: PNGE 434 or Consent. Partial differential equations for fluid flow in porous media and the use of finite difference equations in solving reservoir flow problems for various boundary conditions. Study of individual well pressures and fundamentals of history matching.
PNGE 533. Secondary Recovery of Oil by Water Flooding. 3 Hours.
PR: PNGE 333. Theory of immiscible fluid displacement mechanism, evaluation and economics of water flood projects, and oil field flooding techniques. (3 hr. lec.).

PNGE 591. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

PNGE 601. Fluid Flow in Porous Media. 3 Hours.
PR: PNGE 434 and MATH 261 or consent. Theoretical and practical aspects of the physical principles of hydrodynamics in porous media. (3 hr. lec.).

PNGE 632. Reservoir Simulation and Modeling. 3 Hours.
PR: PNGE 532 or consent. Application of finite-difference equations to multi-phase fluid flow in porous media in two or three dimensions with gravity and capillary pressure effects. Simulation of waterflood performance and enhanced recovery techniques.

PNGE 633. Advanced Secondary Recovery. 3 Hours.
PR: PNGE 533. Secondary recovery of oil by gas flooding, miscible fluid injection, in-situ combustion, and heat injection. (3 hr. lec.).

PNGE 634. Pressure Transient Analysis. 3 Hours.
PR: PNGE 434 or consent. Methods of analysis of pressure transient data obtained from well testing for the purpose of determining in-situ reservoir conditions including porosity, lateral extent, average reservoir pressure, and formation permeability.

PNGE 691. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

PNGE 693. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

PNGE 695. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

PNGE 697. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).

PNGE 701. Environmental Issues in Petroleum Engineering. 3 Hours.
PR: Graduate standing. Environmental impacts of petroleum exploration and production, methods to minimize or eliminate potential environmental impacts, treatment and disposal of the drilling and production wastes, and remediation methods for petroleum contaminated sites.

PNGE 710. Advanced Drilling Engineering. 3 Hours.
PR: PNGE 310. Drilling optimization, methods for estimating formation pore and fracture pressures, air drilling, application of directional drilling and deviation control, horizontal drilling, and coiled tubing applications.

PNGE 711. Advanced Productions Engineering. 3 Hours.
PR: PNGE 420. Advanced well completion methods, problem well analysis, well remediation and workover planning, multi-phase flow in pipes, system approach for oil and gas wells, application of NODAL analysis, and surface and subsurface production equipment.

PNGE 734. Advanced Reservoir Engineering. 3 Hours.
PR: PNGE 434. Modeling and simulation of heterogeneous reservoirs, predicting the performance of the heterogeneous reservoirs during primary, secondary, and enhanced recovery production.

PNGE 735. Advanced Formation Evaluation. 3 Hours.
PR: PNGE 450. Advanced methods for interpreting well logs, shaly sand analysis, and production logging methods.

PNGE 770. Advanced Natural Gas Engineering. 3 Hours.
PR: PNGE 470. Application of reservoir modeling, history matching, and type curves techniques to analyze and predict the performance of conventional and unconventional gas reservoirs.

PNGE 790. Teaching Practicum. 1-3 Hours.
PR: Consent. Supervised practice in college teaching of petroleum and natural gas engineering. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It will also present a mechanism for students not on assistantships to gain teaching experience. (Grading may be S/U.).

PNGE 791. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

PNGE 792. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

PNGE 793. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

PNGE 795. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.
PNGE 796. Graduate Seminar. 1-3 Hours.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

PNGE 797. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).