

# PETROLEUM AND NATURAL GAS ENGINEERING (PNG)

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## PNG 501: Flow in Porous Media

3 Credits

This course provides students with fundamental skills to formulate problems of fluid flow in porous media in the context of reservoir engineering applications. Emphasis is placed on description of petrophysical properties, characterization methods, formulation of the equations that govern flow in porous media, and analytical solutions to steady-state flow problems.

## PNG 502: Coupled Flow and Deformation in Porous Media

3 Credits

This course is a foundational course in the study of unsteady problems of flow, deformation, and transport in porous media. General topics of interest include continuum mechanics formulation of porous media, along with related mathematical solution development techniques including Green's functions, integral transforms, convolution integrals, and asymptotic expansion methods. The course further provides an overview of advanced modeling tools such as dual-continuum method and porochemoelasticity.

**Prerequisite:** P N G501

## PNG 511: Numerical Solution of the Partial Differential Equations of Flow in Porous Media

3 Credits

Differencing schemes for the partial differential equations of single-phase flow; application to flow of gas and mixing in porous media.

## PNG 512: Numerical Reservoir Simulation

3 Credits

Mathematical analysis of complex reservoir behavior and combination drives; numerical methods for the solution of behavior equations; recent developments.

## PNG 518: Design of Miscible Recovery Projects

3 Credits

Theory and design of miscible methods of oil recovery, current field applications, including hydrocarbon, CO<sub>2</sub>, micellar/polymer, alkaline, and inert gas.

## PNG 520: Thermodynamics of Hydrocarbon Fluids

3 Credits

Thermodynamic science applied to hydrocarbon mixtures and problems in petroleum and natural gas engineering. General topics include study of phase diagrams of hydrocarbon fluids and application of thermodynamic rigor to phase equilibrium problems in the petroleum and natural gas industry.

## PNG 526: Well Stimulation

3 Credits

Causes and identification of oil and gas wells with low productivity and or recovery; design and evaluation of well stimulation methods.

## PNG 530: Natural Gas Engineering

1-3 Credits/Maximum of 3

Flow in producing or storage reservoirs; gas well testing; transmission systems; storage cycle; current developments.

**Prerequisite:** P N G481

## PNG 555: Unconventional Resources Analysis

3 Credits

This course provides an in-depth analysis of the technical aspects of unconventional oil and gas reservoirs, such as geochemistry, geomechanics, storage mechanisms, and transport processes. The course is designed to contribute to the student's ability to advance the frontiers of knowledge about the characteristics and development of unconventional reservoirs. The course presents conceptual knowledge and mathematical models necessary for exploration, characterization, reserve estimation, and performance analysis of unconventional oil and gas reservoirs. This content is critical for the student given that conventional hydrocarbon resources are known not to be able to meet growing demand for energy to fuel worldwide economic growth, which has triggered the developments of unconventional resources such as Marcellus Shale.

## PNG 566: Reservoir Characterization

3 Credits

This course focuses on the quantitative characterization of oil and gas reservoirs, principally through analysis of seismic survey data, well logs, and by employing geostatistics. Emphasis is placed on the use of seismic surveys in the oil and natural gas industries, including interpretation, inversion, rock physics, and ties to well logs. One major goal of this course is to expose the student to a variety of advanced analytical tools used to quantitatively interpret seismic data. The tools we will talk about are specifically geared towards characterizing petroleum and natural gas reservoirs, but may be adapted for other purposes.

## PNG 577: Production and Completions Engineering

3 Credits

In petroleum and natural gas engineering, production and completion operations are critical components of field development operations. This course presents a high-level treatment of modern petroleum production engineering, including well deliverability from vertical and horizontal wells and diagnosis of well performance including production logging. In this course, the function of the production engineer is envisioned in the context of well design, stimulation, and artificial lift.

## PNG 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of individual lectures by faculty, students or outside speakers on energy and mineral engineering issues.

2 Petroleum and Natural Gas Engineering (PNG)

Cross-listed with: EME 590

PNG 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PNG 597: Special Topics

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PNG 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

PNG 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

PNG 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

PNG 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.