PETROLEUM/NATURAL GAS ENGINEERING (PNGE)

PNGE 139 - Foundations of Academic Discovery
Foundations of Academic Discovery serves as the entry point to the Rock Integrated Studies Program. With its strong faculty-student interaction, the course promotes intellectual inquiry, critical and creative thinking, and computer skills needed for academic success. Through varied content, the course introduces students to academic discourse and information literacy while exploring topics such as diversity and inclusion and global awareness. This course will set students along the path to becoming engaged with issues and scholarship important to a 21st century education while they learn about themselves and their place in the world.

Credits: 3
Term(s) Typically Offered: Offered as Needed
Enrollment limited to students with a semester level of Freshman 1 or Freshman 2.
Enrollment limited to students with the ROCK STUDIES 2 STUDENT or ROCK STUDIES STUDENT attributes.

PNGE 190 - Experimental
A unique and specifically focused course within the general purview of a department which intends to offer it on a "one time only" basis and not as a permanent part of the department's curriculum.

Credits: 1-3
Term(s) Typically Offered: Offered as Needed

PNGE 195 - Workshop
A workshop is a program which is usually of short duration, narrow in scope, often non-traditional in content and format, and on a timely topic.

Credits: 1-6
Term(s) Typically Offered: Offered as Needed

PNGE 198 - Selected Topics
A Selected Topics course is a normal, departmental offering which is directly related to the discipline, but because of its specialized nature, may not be able to be offered on a yearly basis by the department.

Credits: 1-3
Term(s) Typically Offered: Offered as Needed

PNGE 201 - Introduction to Petroleum and Natural Gas Engineering
This course provides an overview of different aspects of petroleum and natural gas engineering from generation to exploration of petroleum reservoirs to drilling and production from these resources.

Credits: 1
Term(s) Typically Offered: Offered Fall Terms

PNGE 290 - Experimental
A unique and specifically focused course within the general purview of a department which intends to offer it on a "one time only" basis and not as a permanent part of the department's curriculum.

Credits: 1-3
Term(s) Typically Offered: Offered as Needed

PNGE 295 - Workshop
A workshop is a program which is usually of short duration, narrow in scope, often non-traditional in content and format, and on a timely topic.

Credits: 1-6
Term(s) Typically Offered: Offered as Needed

PNGE 298 - Selected Topics
A Selected Topics course is a normal, departmental offering which is directly related to the discipline, but because of its specialized nature, may not be able to be offered on a yearly basis by the department.

Credits: 1-3
Term(s) Typically Offered: Offered as Needed

PNGE 312 - Reservoir Engineering I
This course introduces the fundamental properties of reservoir rocks and their interactions with fluids in porous media. Topics include porosity, permeability, capillary pressure, wettability, relative permeability, and the interpretation of core data and well logs for formation evaluation. Emphasis is placed on understanding how rock and fluid properties control hydrocarbon storage and flow behavior in petroleum reservoirs.

Prerequisites: CHEM 107[D] and CHEM 111[D] and PNGE 201[D]
[D] Requires minimum grade of D.
Credits: 3
Term(s) Typically Offered: Offered Spring Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 313 - Reservoir Engineering I lab
This laboratory course provides hands-on experience with the measurement and analysis of reservoir rock properties. Students conduct experiments to determine porosity, permeability, fluid saturations, capillary pressure behavior, and wettability. Core handling, sample preparation, and data quality assessment are emphasized. The course reinforces concepts from the lecture through practical use of laboratory equipment, data interpretation, and application to formation evaluation.

Prerequisites: CHEM 107[D] and CHEM 111[D] and PNGE 201[D] and PNGE 312[*D] (may be taken concurrently).
[D] Requires minimum grade of D.
Credits: 1
Term(s) Typically Offered: Offered Spring Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 315 - Reservoir Fluids
This course examines the thermodynamic behavior of naturally occurring hydrocarbon mixtures and the characterization of petroleum reservoir fluids. Topics include phase behavior, PVT analysis, and the evaluation and correlation of fluid properties using laboratory measurements, empirical correlations, and equations of state. Emphasis is placed on understanding how fluid behavior influences reservoir performance and engineering calculations.

Prerequisites: PNGE 312[D] and CHEM 108[D]
[D] Requires minimum grade of D.
Credits: 2
Term(s) Typically Offered: Offered Spring Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 325 - Reservoir Engineering II
This course provides an in depth review of reservoir characteristics and behavior. Topics covered will include fluid flow through porous materials, evaluation of oil and gas resources and the reserves under a variety of production methods, and prediction of reservoir performance to achieve maximum conservation.

Prerequisites: (EGEO 327[D] or EVGE 327[D]) and PNGE 315[D]
[D] Requires minimum grade of D.
Credits: 3
Term(s) Typically Offered: Offered Spring Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 330 - Unconventional Reservoir Engineering
This course addresses topics that are specific to exploration of unconventional reservoirs - identification and characterization, economics, efficient completion technologies and development strategies. Tight gas and shale gas reservoirs and coal bed methane engineering are addressed.

Prerequisite: PNGE 325[D]
[D] Requires minimum grade of D.
Credits: 3
Term(s) Typically Offered: Offered Spring Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 390 - Experimental
A unique and specifically focused course within the general purview of a department which intends to offer it on a "one time only" basis and not as a permanent part of the department's curriculum.

Credits: 1-3
Term(s) Typically Offered: Offered as Needed
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 395 - Workshop
A workshop is a program which is usually of short duration, narrow in scope, often non-traditional in content and format, and on a timely topic.

Credits: 1-6
Term(s) Typically Offered: Offered as Needed
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 398 - Selected Topics
A Selected Topics course is a normal, departmental offering which is directly related to the discipline, but because of its specialized nature, may not be able to be offered on a yearly basis by the department.

Credits: 1-3
Term(s) Typically Offered: Offered as Needed
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 410 - Drilling Engineering with Lab
This course provides an in depth review of drilling engineering practices. Topics covered will include functions and design considerations for the rotating system, hoisting system and circulating system; drilling fluids calculations and selections; hydraulic programs; drilling optimization; casing string design; cementing programs; and pressure control; laboratory evaluation of mud weight control filtration, chemical contaminants and rheological models.

Prerequisites: ENGR 301 (may be taken concurrently)[D] and PNGE 312[D]
[D] Requires minimum grade of D.
Credits: 4
Term(s) Typically Offered: Offered Fall Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 420 - Production Engineering
This course provides an in depth review of petroleum production engineering practices. Topics covered will include well completion, performance of productive formations, drill stem tests, completion of wells, flowing wells, gas lift methods and equipment, pumping installation design, well stimulation, emulsion, treating, gathering and storage of oil and gas, field automation.

Prerequisites: PNGE 410 (may be taken concurrently)[D] and PNGE 325[D]
[D] Requires minimum grade of D.
Credits: 3
Term(s) Typically Offered: Offered Spring Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 430 - Reservoir Simulation
Mathematical models governing fluid flow in reservoirs; relevant numerical methods; numerical reservoir simulations; treatment of wells; history matching; simulation project performed using a commercial simulator.

Prerequisites: ENGR 130[D] and (MATH 309[D] or MATH 232[D])
[D] Requires minimum grade of D.
Credits: 3
Term(s) Typically Offered: Offered Fall Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 432 - Formation Evaluation
This course provides an in depth review of techniques for formation evaluation. Topics covered will include various well logging methods and related calculations with exercises in interpretation of data from actual well logs.

Prerequisite: PNGE 312[D]
[D] Requires minimum grade of D.
Credits: 3
Term(s) Typically Offered: Offered Fall Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 435 - Pressure Transient Analysis
This course provides an in depth review of the well test analysis methods. Topics covered will include pressure transient tests and interpretation methods, unsteady-state fluid flow through porous rock, analysis of the drawdown and buildup tests, wellbore storage, application of pressure derivative in pressure transient data analysis, testing of hydraulically fractured wells, type curve method, testing of horizontal wells, unified method of analysis, well test design.

Prerequisite: PNGE 420[D]
[D] Requires minimum grade of D.
Credits: 3
Term(s) Typically Offered: Offered Spring Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 440 - Hydraulic Fracturing
This course starts with a general overview of different types of unconventional reservoirs and their geological and petrophysical properties. Second part of the course emphasizes hydraulic fracturing design and data collection for proper fracture design. Economic analysis of hydraulic fracturing will be covered as well as more advanced topics such as completion design optimization.

Prerequisite: PNGE 325[D]
[D] Requires minimum grade of D.
Credits: 3
Term(s) Typically Offered: Offered Fall Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 441 - Oil and Natural Gas Resource Valuation and Economics
This course provides an in depth review of the techiques for oil and gas property evaluation. Topics covered will include reserve estimation, decline analysis, petroleum property evaluation, interest calculations, cost estimation, and tax evaluation, investment decision analysis and computer applications in property evaluation.

Prerequisites: PNGE 325[D] and PNGE 432[*D] (may be taken concurrently).
[D] Requires minimum grade of D.
Credits: 3
Term(s) Typically Offered: Offered Fall Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 443 - Enhanced Oil Recovery
This course teaches an integrated version of the basics of waterflooding and enhanced oil recovery (EOR), illustrating the connection of each process to a few fundamental principles. It reviews the specifics of thermal and solvent EOR by relating basic principles to the results of cases from the field.

Prerequisite: PNGE 325[D]
[D] Requires minimum grade of D.
Credits: 3
Enrollment limited to students with a semester level of Senior 1 or Senior 2.
Enrollment is limited to students with a program in Petro & Natl Gas Engineering.
Enrollment limited to students in the College of Engineering & Science college.

PNGE 445 - Natural Gas Engineering with Lab
This course provides an in depth review of natural gas evaluation and production engineering practices. Topics covered will include natural gas properties, compression, transmission, processing and application of reservoir engineering principles to predict the performance and design of gas, gas-condensate and storage reservoirs. Includes a laboratory devoted to gas measurements.

Prerequisite: PNGE 325[D]
[D] Requires minimum grade of D.
Credits: 3
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 450 - Internship
Supervised placement and research in selected public and private agencies.

Credits: 3-9
Term(s) Typically Offered: Offered as Needed
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 459 - Petroleum and Natural Gas Design/Capstone I
This course provides a proposal preparation for PNGE 460 which includes defining a comprehensive problem in design involving systems in oil and gas production, field processing, transportation, and storage.

Prerequisites: PNGE 325[D] and PNGE 410[D] and PNGE 420[*D] and PNGE 432[*D] (may be taken concurrently).
[D] Requires minimum grade of D.
Credits: 1
Term(s) Typically Offered: Offered Fall Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 460 - Petroleum and Natural Gas Engineering Design/Capstone II
This course provides comprehensive problems in design involving systems in oil and gas production, field processing, transportation and storage.

Prerequisite: PNGE 459[D]
[D] Requires minimum grade of D.
Credits: 2
Term(s) Typically Offered: Offered Spring Terms
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 470 - Petroleum and Natural Gas Engineering Undergraduate Research
Research and design problems of limited scope approved on an individual basis intended to promote independent inquiry.

Credits: 1-3
Term(s) Typically Offered: Offered as Needed
Enrollment limited to students with a semester level of Junior 1, Junior 2, Senior 1 or Senior 2.
Enrollment limited to students with the SPECIAL APPROVAL attribute.

PNGE 490 - Independent Study
Investigation of the theoretical or experimental area following a plan or proposal initiated by the student and approved by the major advisor. Independent Study courses give students the opportunity to pursue research and/or studies that are not part of the university's traditional course offerings. Students work one on one or in small groups with faculty guidance and are typically required to submit a final paper or project as determined by the supervising professor.

Credits: 1-3
Term(s) Typically Offered: Offered as Needed
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 495 - Workshop
A workshop is a program which is usually of short duration, narrow in scope, often non-traditional in content and format, and on a timely topic.

Credits: 1-6
Term(s) Typically Offered: Offered as Needed
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

PNGE 498 - Selected Topics
A Selected Topics course is a normal, departmental offering which is directly related to the discipline, but because of its specialized nature, may not be able to be offered on a yearly basis by the department.

Credits: 1-3
Term(s) Typically Offered: Offered as Needed
Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.