

# **BS in Petroleum Engineering**

## **Course Description**

**PENG 101    Physical Geology    (3:0:0)**

### **3 Semester Credit Hours**

Origin of the Earth and its shells. Composition of the Earth's crust and oceans, and their Geological characteristics. Primary and secondary structures. Internal Geological processes. Plate Tectonics and the relation of Geological events to it. External Geological processes. Stratigraphic columns, details of the Geological Time Scale and case studies of Geological ages and their palaeogeographic distribution. Climate. Important biological aspects.

**PENG 202    Intro. to Petroleum Engineering    (1:0:0)**

### **1 Semester Credit Hour**

The course provides an overview and history of the petroleum industry and petroleum engineering, including nature of oil and gas reservoirs, petroleum exploration and drilling, formation evaluation, well completions and production, surface facilities, reservoir mechanics, and improved oil recovery. It introduces the importance of ethical, societal, and environmental considerations and current events on activities in the petroleum industry. It also introduces students to professional society and university resources that aid career development.

**PENG 231    Mechanics of Materials    (3:0:0)**

### **3 Semester Credit Hours**

**Pre-requisite(s): MATH 114**

This course covers external and internal forces in structures and/or machines, including conditions of equilibrium, systems of force, moments of inertia and friction. It also covers an introduction to Petroleum Rock Mechanics: Elasticity and Rock strength, Rock properties from logs, Stresses around wellbore and borehole failure criteria, Hydraulic Fracturing.

**PENG 321    Reservoir Rock and Fluid Prop. Lab    (0:3:0)**

### **1 Semester Credit Hour**

**Co-requisite(s): PENG 351**

This course deals with the measurement of fundamental properties of reservoir rocks and fluids. Rock properties include porosity, irreducible water saturation, residual oil saturation, absolute permeability, capillary pressure, and relative permeability. Fluid properties include oil distillation, oil composition of one of oil fractions, oil density at room conditions and at high pressure and temperature conditions, oil viscosity

# **BS in Petroleum Engineering**

## **Course Description**

at high pressure and temperature, surface and interfacial tensions, flash liberation process, estimation of bubble-point pressure at reservoir temperature, and oil-formation-volume factor and solution gas/oil ratio at pressures below the bubble-point pressure.

### **PENG 322 Drilling Fluids Laboratory (0:3:0)**

**1 Semester Credit Hour**

**Co-requisite: PENG 361**

This course deals with lab measurements of cement and mud properties. Mud preparation, mud rheology, filtration, wall building and resistivity, mud weight control, drilling fluid contamination test, oil well cementing experiment. **(Writing Intensive Course)**

### **PENG 351 Reservoir Rock and Fluid Properties (3:0:0)**

**3 Semester Credit Hours**

**Pre-requisite(s): CHEM 215**

Fundamental properties of reservoir rocks, namely porosity, compressibility, permeability, electric conductivity, fluid saturation, surface forces and capillary pressure, effective and relative permeability, and their applications in volumetric and flow calculations in petroleum reservoirs. Fundamental properties of reservoir fluids, namely oil, natural gas, and formation water. The course covers hydrocarbon phase behavior, equations of state, formation volume factors, gas solubility, types of vaporization, K values, and gas separation.

### **PENG 361 Drilling Engineering I (2:0:0)**

**2 Semester Credit Hours**

**Pre-requisite(s): PENG 231 / Co-requisite: CIEN 251**

This course introduces basic drilling techniques and drilling fluid properties. Topics include rock characteristics, drilling fluids, mud weight calculations, components of rotary drilling rig, drilling hydraulics, drilling bits, factors affecting rate of penetration, cementing operations.

### **PENG 371 Petroleum Reservoir Engineering (3:0:0)**

**2 Semester Credit Hours**

**Pre-requisite(s): PENG 351**

# **BS in Petroleum Engineering**

## **Course Description**

This course deals with material balance (MB) techniques to estimate reserves. Topics include generalized MB equations, fluid drive mechanisms, selection of PVT data, water influx, flow through porous media, displacement of oil, fractional flow, and oil recovery by internal drive.

### **PENG 381 Well Logging (3:0:0)**

#### **3 Semester Credit Hours**

#### **Pre-requisite(s): PENG 101 and PENG 351**

Logging is an essential operation to determine the key formation parameters, such as porosity, permeability, reservoir thickness, water saturation. All types of well logging techniques such as Logging while Drilling, Cased Hole Logging, and Production Logging are included. Logs are also run to gain information about well casing and cementing.

### **PENG 382 Petroleum Production Engineering (Well Performance) (4:0:0)**

#### **4 Semester Credit Hours**

#### **Pre-requisite(s): CIEN 251 and MENG 211**

This course covers basic well performance calculations necessary for the design and analysis of naturally flowing and artificially lifted wells. Topics include Inflow Performance Relationship (IPR), Tubing Performance Relationship (TPR), Flowline Performance Relationship (FPR), Choke Performance Relationship (CPR), Gas-Lift, Electric Submersible Pumps (ESP), and production forecasting.

### **PENG 403 Petroleum Property Evaluation (3:0:0)**

#### **3 Semester Credit Hours**

#### **Pre-requisite(s): PENG 371, PENG 382, and IENG 321**

Applications of reservoir engineering techniques, reserve calculations, decline curve analysis, rate of return calculations to project design and evaluation.

### **PENG 422 Fluid Flow in Porous Media Lab (0:3:0)**

#### **1 Semester Credit Hour**

#### **Co-requisite(s): PENG 485**

This course deals with the design aspects of oil displacement by another fluid in rock samples. It builds on the experiences of students obtained in lab measurements of individual reservoir rock and fluid properties in PENG 321 to create an integrated lab measurement of all properties needed to analyze oil displacement

# **BS in Petroleum Engineering**

## **Course Description**

by a displacing fluid. The displacing fluid can be chosen to study the relative permeability and displacement efficiency of water flooding, gas flooding, or any enhanced oil recovery fluids (acidic water, microbial water, polymer solution, or steam) using cores, fractured cores (sand packs and glass beads may be considered as alternatives) in one-dimensional geometry or packed layers in two-dimensional geometry.

### **PENG 442      Transportation and Storage of Petroleum      (3:0:0)**

#### **3 Semester Credit Hours**

#### **Pre-requisite(s): CIEN 251 and PENG 382**

This is an elective and a senior level course on production engineering. The course deals with analysis and design of surface piping and storage facilities of crude oil and natural gas. Topics include fluid flow and pressure losses in pipes, pipeline design, selection and sizing liquid pumps and gas compressors, corrosion in pipes, other transportation methods, and storage of petroleum and its products.

### **PENG 443      Separation and Treatment of Petroleum Fluids      (3:0:0)**

#### **3 Semester Credit Hours**

#### **Pre-requisite(s): PENG 382**

This is an elective and a senior level course on production engineering. The course covers nature of fluids produced from oil and gas reservoirs, phase behavior of water/hydrocarbon systems, quantitative prediction of water content in light hydrocarbon systems, oil water separations, oil-water emulsions, treatment of oil field waters, oil and gas separations, flash calculations, separator sizing and design, heater-treater design, oil skimmers selection and design.

### **PENG 462      Drilling Engineering II      (2:0:0)**

#### **2 Semester Credit Hours**

#### **Pre-requisite(s): PENG 361**

This course deals with additional topics in drilling engineering, namely casing design and landing, directional and horizontal drilling, drilling problems and fishing operations, well control problems and solutions.

### **PENG 472      Applied Reservoir Geology      (3:0:0)**

#### **3 Semester Credit Hours**

#### **Pre-requisite(s): PENG 101 / Co-requisite(s): PENG 381**

# **BS in Petroleum Engineering**

## **Course Description**

Oil distribution in the world and in the UAE: geology of reservoirs, which includes the formation of reservoir rocks, cap rocks, source rocks and the environments of depositions: petrophysical parameters of reservoir fluids: oil field waters, crude oil and natural gas; reservoir conditions: pressure, temperature and their effects on oil maturation, migration and accumulation: oil generation. Oil migration: types of oil traps: methods of exploration.

### **PENG 473     Reservoir Simulation     (3:0:0)**

#### **3 Semester Credit Hours**

**Pre-requisite(s): PENG 371 and MATH 203**

This course covers fundamental concepts of reservoir simulation to model single-phase flow in petroleum reservoirs. Topics include reservoir engineering concepts, mathematical concepts, derivation of reservoir flow equations, finite difference approximations, and their solutions, and applications to predict reservoir performance.

### **PENG 474     Applied Reservoir Simulation     (3:0:0)**

#### **3 Semester Credit Hours**

**Pre-requisite(s): PENG 473**

This course covers advanced topics in reservoir simulation. These include reservoir fluid flow equations in multiphase, multidimensional flow, up-scaling of rock properties, pseudo functions, vertical equilibrium, analysis of data for consistency, history matching, and applications to field cases.

### **PENG 482     Natural Gas Engineering     (3:0:0)**

#### **3 Semester Credit Hours**

**Pre-requisite(s): PENG 371 and PENG 382**

This course introduces the properties of natural gas, covers flow of gas in reservoir, wellbore and surface pipelines. Based on such knowledge, students are able to run nodal analysis for gas production system design. This course also covers gas compression and gas operation issues.

### **PENG 483     Well Testing     (3:0:0)**

#### **3 Semester Credit Hours - Pre-requisite(s): PENG 371 and MATH 214**

This course covers reservoir characterization by pressure test analysis. Topics include fluid flow equations in porous media under transient and pseudo-steady state flow conditions, pressure buildup and pressure

# **BS in Petroleum Engineering**

## **Course Description**

drawdown tests, average reservoir pressure, type curve matching, well testing of heterogeneous reservoirs, pressure derivatives analysis technique, multiple well testing, and test design and instrumentation.

### **PENG 484 Stimulation and Intervention in Petroleum Production Operations (3:0:0)**

#### **3 Semester Credit Hours**

#### **Pre-requisite(s): PENG 382**

Topics include well completions, perforations, wellbore damage sources and detection, hydraulic fracturing, fracturing fluids, acid/rock interactions, and acid treatment of oil wells, design and evaluation of treatments, evaluation by nodal system analysis.

### **PENG 485 Water Flooding (3:0:0)**

#### **3 Semester Credit Hours**

#### **Pre-requisite(s): PENG 371**

This is a senior level course on reservoir engineering series courses. The course covers the reservoir engineering aspects of water flooding. Topics include introduction to reservoir forces and concepts of surface and interfacial tension, wettability, capillary pressure, relative permeability; trapping and mobilization of residual oil; fluid distribution and frontal displacement theory, concept of mobility ratio, flood patterns and areal sweep efficiency considerations, pattern injection rates and pressures; characterization of reservoir heterogeneity; vertical and volumetric sweep efficiency, waterflood performance prediction models; waterflood pilot test; designing, monitoring and evaluating a waterflooding operation; water for water flooding, its sources and treatment.

### **PENG 486 Enhanced Oil Recovery (3:0:0)**

#### **3 Semester Credit Hours**

#### **Pre-requisite(s): PENG 485**

This course covers chemical and thermal method of EOR. Specific topics include interfacial tension, entrapment and mobilization of oil in porous media, residual oil, miscibility, adsorption at solid/liquid interfaces, surfactants and micro-emulsions, miscible gas flooding, polymer flooding, thermal methods, and the effect of reservoir heterogeneity.

### **PENG 491 Senior Design Project I (0:9:0)**

#### **3 Semester Credit Hours**

#### **Pre-requisite(s): Senior Standing**

# **BS in Petroleum Engineering**

## **Course Description**

A significant design effort in one area of petroleum operations. Design is based on fundamental understanding of petroleum and reservoir engineering concept and a critical review of literature of current state of knowledge for the subject under consideration. Projects may involve analysis and computer program development and/or usage combined with experimental work. Topics for projects may be developed with industry cooperation.

**PENG 492 Senior Design Project II (0:9:0)**

**3 Semester Credit Hours**

**Pre-requisite(s): PENG 491**

Continuation of phase (1).

**PENG 493 Special Topics in Petroleum Engineering (3:0:0) 3 Semester Credit Hours - Pre-requisite(s): Department Consent**

A specific topic in Petroleum Engineering that is not covered in other program courses is presented in a course format.