THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Petroleum Reservoir Engineering

CBE 5210

Credit Hours:
3.00

Course Levels:
Undergraduate (1000-5000 level)
Graduate (5000-8000 level)

Course Components:
Lecture

Course Description:
Determination of reserves; material balance methods; aquifer models; fractional flow and frontal advance; displacement, pattern, and vertical sweep efficiencies in waterfloods; enhanced oil recovery processes; design of optimal recovery processes. Systematic theoretical and laboratory study of physical properties of petroleum reservoir rocks.

Prerequisites and Co-requisites:
Prereq: Junior standing or above in Engineering or Earth Sciences; or graduate standing

Course Goals / Objectives:
- Derive and use the gas material balance coupled with forecasting.
- Derive and use the oil material balance coupled with forecasting
- Derive and describe immiscible frontal advance theory and applications
- Design a 5-spot waterflood pattern and make production and injection forecasts.
- Recognize mechanisms and understand appropriate application situations and advantages of common assisted and enhanced recovery methods.
- Analyze the performance of unconventional reservoirs
- Explain the physical meaning and evaluate the impact of rock and fluid properties in reservoir engineering and production problems.

Course Topics:

- Reservoir classification; Reservoir drive mechanisms and recovery factors.
- PVT properties of oil and gas; adjustments for separator conditions.
- Volumetric estimate of hydrocarbons-in-place.
- Gas material balance, gas recovery factor and gas production forecasting.
- General material balance equation; Havlena-Odeh linear material balance equation and examples.
- Darcy’s law; Two-phase flow, relative permeability, mobility ratio.
- Natural water influx; steady state models, van Everdingen-Hurst unsteady state model; history matching; Carter-Tracy model.
- Wettability, capillarity, interfacial tension; Immiscible displacement; vertical and diffuse flow Fractional flow; Buckley-Leverett 1D displacement.
- Oil recovery by Buckley-Leverett-Welge method; Segregated flow and oil recovery: Dietz model.
- Waterflooding – Intro, patterns recovery efficiency; 5-spot areal sweep efficiency; Well injectivity. for various patterns
- Quantifying permeability variation; Vertical sweep efficiency: Dykstra-Parsons model.
- 5-spot waterflood design and forecast using Buckley-Leverett model; waterflood example.
- Introduction and principles of EOR: CO2 flooding, alkali-surfactant-polymer flooding; steam injection.
- Introduction to unconventional reservoirs; Performance analysis of unconventional reservoirs.
- Reserves estimation.
- Pore space properties of rocks, porosity, permeability, Surface tension, interfacial tension, wettability, capillary pressure, and fluid saturations; rock-fluid interactions.
- Properties of pure substances; two, three, and multi-component mixtures. Phase diagrams; and Phase behavior of tight oil and shale gas; classification and identification of reservoirs by fluid type.

Designation:

Elective