Department: Petroleum Engineering **Division:** Petroleum Engineering

Level and Major: Graduate

Course Title: Oil & Gas Reservoir Engineering (II) **Number of Credits:** 3
Prerequisite: Oil & Gas Reservoir Engineering (I)

Lecturer: Mohammad Ahmadi

Course Description:

In this course, the traditional tools for reserve estimation like material balance and decline curve analysis are discussed in details. In addition, volumetric calculations and material balance applications for different types of reservoirs (dry gas, wet gas, gas condensate, light oil, undersaturated and saturated oil) are presented. The applications of material balance analysis for history matching of reservoir and performing forecasts will be discussed as well.

Course Goals and Objectives:

- Application of traditional reservoir engineering tools to evaluate the hydrocarbon in place and recovery factors

Course Topics:

- Derivation and Applications of General Material Balance Equation for Saturated Oil Reservoirs, Considering the impact of different production mechanisms
- Study of Graphical Material Balance Methods for History Matching of Reservoir including the Production Mechanisms, Hydrocarbon in place and the Aquifer Characterization
- Study and the applications of Water Influx Models describing the volume and rate of Water Influx from the Aquifers, including Steady-State, PSS and Transient Models
- Study of Superposition Methods for Water Influx Calculations with Time
- Study and Investigation of Volumetric Calculations and Material Balance Method for Gas Condensate Reservoir
- Study and the applications of Decline Curve Analysis for Ultimate Recovery Estimation in Hydrocarbon Reservoirs
- Pressure and Temperature gradient and the Normal versus Abnormal pressured reservoirs
- Volumetric Calculation of Hydrocarbon in place and determination of contact surfaces in the reservoir
- Study of Production Mechanisms in different Hydrocarbon Reservoir and their Competition, The Impact of Different Production Mechanisms on the reservoir pressure behavior, Producing GOR and Water Cuts
- Derivation of Material Balance Equation for Dry Gas Reservoirs and the modifications needed for Wet Gas Reservoir
- Derivation and Applications of Material Balance Equation for Undersaturated Oil Reservoirs and the Relative Competition of Different Production Mechanisms

The course aims to familiarize BSc students with the primary functions of a reservoir engineer including:

- Estimation of hydrocarbon volumes in place
- Calculation of Recovery factors
    - What fraction of hydrocarbons in place is recoverable?
- Production Operations Optimization
    - How fast can the reserves be depleted?

Reading Resources:

- Applied Petroleum Reservoir Engineering (2nd Edition) 2nd Edition, by B. C. Craft , M. Hawkins, Ronald E. Terry
- The Practice of Reservoir Engineering (Revised Edition), 1st Edition from L.P. Dake

Evaluation:

Final Exam: 50%
Midterm Exam: 25%
HWs: 10%
Projects: 15%