

OIL AND GAS WELL TESTING AND ENHANCED OIL RECOVERY

(L-T-P: 3-0-0)

Objectives:

After going through this course the students will be able to:

- (i) Evaluate the skin factor and permeability data to determine the production rate of the well with the help of the build up/ draw down tests;
- (ii) Evaluate the potential of a reservoir for oil and gas production based on the oil and gas well testing data interpretation;
- (iii) Select the suitable method of Enhanced Oil Recovery for a given set of reservoir parameters.

This will be useful for students who want to pursue their career in Petroleum industry in future.

Syllabus:

Module -I: Reservoir Rock and Fluid Properties:

Unit 1: Rock Properties. Porosity, Permeability, Wettability, Fluid Saturation, Formation Compressibility, Total and Effective Isothermal Compressibility, Hydrostatic and Overburden Pressure and Capillary Pressure.

Unit 2: Fluid Properties: Gas Properties. Pseudocritical Properties, Pseudoreduced Properties, Gas Deviation Factor, Gas Formation Volume Factor, Gas Viscosity, Gas Isothermal Compressibility, Gas Properties from Gas Composition.

Unit 3: Oil Properties. Specific Gravity of Oil, Bubble Point Pressure, Oil Viscosity, Oil Formation Volume Factor, Oil Density Determination, Dissolved Gas/Oil Ratio.

Unit 4: Water Properties. Solubility of Gas in Water, Water Formation Volume Factor.

Module- II: Fluid Flow in Porous Medium:

Unit 1: Darcy's Law, Absolute, Effective and Relative Permeability, Single and Multiphase flow, Linear and Radial Systems.

Unit 2: The Ideal Reservoir Model. Solution to Diffusivity Equation. Radius of Investigation. Principle of Superposition. Horner's Approximation.

Module-III: Pressure Buildup Tests:

Unit1: The Ideal and Actual Buildup Tests. Qualitative Behavior of Field Tests. Effects and Durations of Afterflow. Determination of Permeability. Wellbore Damage and Stimulation. Pressure Level in Surrounding Formation.

Unit-2: Reservoir Limit Tests. Modifications for Multiphase Flow

Module- IV: Flow Tests and Other Well Testing Methods.

Unit-1: Pressure Drawdown Tests. Multirate Tests.

Unit-2: Gas Well Testing. Basic Theory of Gas Flow in Reservoirs. Flow After Flow Tests. Isochronal Tests. Modified Isochronal Tests. Use of Pseudopressure in Gas Well Testing.

Unit-3: Analysis of Well Testing Using Type Curves. Fundamentals of Type Curves. Ramey's Type Curves, McKinley's Type Curves. Gringarten et al.'s Type Curves for Fractured Wells.

Unit-4: Other Well Testing Methods. Interference Testing. Pulse Testing. Drillstem Tests. Wireline Formation Tests.

Module-V: Enhanced Oil Recovery and Improved Oil Recovery.

Unit-1: Improved Oil Recovery and Enhanced Recovery Processes. Need and Future for EOR. Classifications of EOR.

Unit-2: Displacement Efficiency. Miscible and Immiscible Displacements. Generalization of Fractional Flow Theory and Fractional Flow Equations. Areal and Volumetric Sweep Efficiency. Mobility and Mobility Ratio.

Unit-3: Polymer Flooding: Polymer and their Properties. Calculating Polymer Flood Injectivity. Designing of a Polymer Flood.

Unit-4: Surfactant Flooding. Alkali Flooding. Alkali-Surfactant-Polymer Flooding: Micellar-Polymer Flooding. Surfactants, Alkali and Micelles. The Micellar-Polymer Flooding Design.

Pre-requisite: Thermodynamics, Fluid Mechanics.

Books:

1. Well Test Analysis: John Lee; SPE Textbook Series, Society of Petroleum Engineers, Richardson, Texas, USA.
2. Enhanced Oil Recovery: Larry W. Lake; Prentice Hall, Englewood Cliffs, New Jersey, USA.
3. The Reservoir Engineering Aspects of Waterflooding: Forrest F. Craig Jr. SPE Textbook Series, Society of Petroleum Engineers, Richardson, Texas, USA.
4. Waterflooding: G. Paul Willhite; SPE Textbook Series, Society of Petroleum Engineers, Richardson, Texas, USA.
5. Enhanced oil recovery: Don W. Green and G. Paul Willhite; SPE Textbook Series, Society of Petroleum Engineers, Richardson, Texas, USA.

Process. Surfactants-Brine-Oil Phase Behavior. Non-Ideal Effects. Surfactant Retention.
Designing of a Micellar-Polymer Flood.

Thermal Methods: Hot Water Flooding. Steam Soak. Steam Flooding. In-situ Combustion.

Microbial Enhanced Oil Recovery. Microbes used in EOR. MEOR Mechanism and Process