N573: Enhanced Oil Recovery: Techniques, Practices and Simulation

Instructor(s): Yucel Akkutlu

Format and Duration

Classroom - 4 Days
Virtual - 8 Sessions

Summary

This course provides clear, concise and practical information on reservoir engineering and reflects advances in enhanced oil recovery. The course will help participants understand, simulate and practice the major enhanced oil recovery techniques. Case studies are used to demonstrate a variety of evaluation and predictive techniques using experiment, alanalytical and numerical methods.

Business Impact: Application of the learnings of this course will empower participants to build the fundamental knowledge necessary in developing specialty teams in the company focusing on the application of EOR methods to the company's oil fields.

Learning Outcomes

Participants will learn to:

1. Describe the popular EOR methods.
2. Identify how to screen a reservoir for EOR.
3. Arrange tests to characterize the reservoir prior to injection operations.
4. Develop a field-scale EOR project using the existing production wells.
5. Manage the injection and production operations and surveillance.
6. Address the environmental concerns during the EOR operations.

Training Method

This is a classroom or virtual classroom course comprising a mixture of lectures, discussions, case studies, and practical exercises.

Who Should Attend

The course is designed for petroleum engineers and other subsurface proffesionals with reservoir engineering practice.

Course Content

Topic 1

Applied Reservoir Engineering Relevant to EOR

- Oil and gas recovery mechanisms
- Under-saturated oil reservoirs
- Saturated oil reservoirs
- Single-phase fluid flow in reservoirs
- Pressure transient testing
- Decline curve analysis

- Reservoir flow modeling and simulation

Case Studies

- Project 1: Field performance evaluation and forecast using Monte-Carlo simulation
- Project 2: Numerical solution of a one-dimensional single-phase reservoir flow problem

Review of Enhanced Oil Recovery Techniques

- Gas, chemical, microbial, and thermal recovery techniques
- EOR Screening Criteria

Introduction to Oil and Gas DisplacementTheory

- Microscopic displacement efficiency.Iinterfacial and surface tension forces; wettability; capillary pressure; relative permeability characteristics and measurement
- Immiscible displacement processes. Fractional flow equation and frontal advance theory; frontal advance vs. bypass models
- Macroscopic displacement efficiency. Formation heterogeneities and anisotropy; mobility ratio; injection and production well patterns
- Miscible displacement processes. First-contact and multiple-contact (dynamic) miscibility; ternary-diagrams; condensing and vaporizing gas drive processes; miscible fluids and dispersive mixing; viscous fingering: initiation, growth, and modeling
- Emulsions in enhanced oil recovery

Topic 2

Waterflooding Practice
Improved Waterflooding Techniques

- Chemical Injection Methods
  - Surfactant
  - Polymer & mobility-control
  - Alkaline
- Microbial EOR Methods

Case Studies

- Project 3: Waterflooding field study
- Project 4: Polymer or surfactant flooding case study

Topic 3

Miscible Gas Injection Methods

- CO2
- Hydrocarbon (lean gas and enriched gas)
- Inert (nitrogen) gas and air

Thermal Methods, I

- Cyclic steam stimulation
- Steamflooding

Case Study

- Project 5: Five-spot CO2 flooding case study

Topic 4

Thermal Methods, II

- In-situ combustion
- Forward, reverse, wet, and oxygen-enriched
- Diabatic and adiabatic in-situ combustion models
- Role of catalytic agents on in-situ combustion front propagation

Short-distance Oil Displacement (SDOD) Methods

- Steam-assistedgravity drainage, SAGD
- Solvent vapor extraction, VAPEX
- Toe-to-heel air injection, THAI

Case Studies

- Project 6: Five-spot Steamflooding simulation
- Project 7: Ignition/extinction limits of in-situ combustion