



N614: Fundamentals of Reservoir Engineering

Tutor(s): Saad Ibrahim

5 Days

Competence Level:
Basic Application



Classroom Course

Summary

This five-day course is designed to introduce technical professionals to the fundamental aspects of reservoir engineering. Theoretical concepts coupled with numerous practical case histories are presented to assist reservoir and exploitation engineers in their primary functions - the determination of oil and gas reserves and the maximization of hydrocarbon recovery under primary, secondary, and tertiary schemes. Field development of unconventional gas reservoirs including shale gas, tight gas and coalbed methane (CBM) will also be covered. The application of horizontal wells and a number of new technologies will also be reviewed. The sessions will include a number of relevant class problems and examples.

Learning Outcomes

Participants will learn to:

1. Basic understanding of petroleum geology; trapping mechanism and rock types
2. Review of rock and fluid characteristics and impact on reservoir performance
3. The importance of the various reservoir drives and impact on reservoir performance and the expected ultimate recovery³
4. Reserves definitions/classification and the industry standard techniques to estimate oil and gas reserves, including the deterministic and probabilistic methods.
5. Production optimization by understanding the fundamentals of flow in porous media and the use of Nodal analysis
6. The use of well test analysis tool as one of the most effective reservoir management tools to characterize the reservoirs and how to analyze various test types to optimize production and estimate reserves.
7. How to minimize water production problems and control fluid coning.
8. Provide good understanding of enhanced oil recovery methods with emphasis on waterflooding including how to design, monitor performance, and estimate the expected ultimate oil recovery
9. Explain the difference between conventional and unconventional reservoirs, such as coalbed methane, shale gas/oil and tight sands. Illustrate the specialized techniques to evaluate the commerciality and performance of such reservoirs.
10. Review the applications and performance of horizontal wells. Also illustrate the various design options of multi-stage fracturing of horizontal wells and performance evaluation using both analytical and numerical techniques.

Duration and Training Method

Five classroom days providing 4 CEU (Continuing Education Credits) or 40 PDH (Professional Development Hours)

Who Should Attend

This course is aimed at reservoir, petroleum and exploitation engineers/technologists, geophysicists, and geologists who are involved in the field development and exploitation.



Course Content

Course Agenda

Day One

1. Petroleum Geology
 - a. Origin of the solar system and depositional environments
 - b. Geologic cycle/time and types of reservoir rocks
 - c. Main elements of petroleum reservoirs hydrocarbon migration & traps
 - d. Geologic maps
2. Rock Properties
 - a. Porosity types, permeability relative, absolute, effective
 - b. Rock wettability and capillary pressure (class problem)
3. Fluid Properties
 - a. Hydrocarbon classifications
 - b. Fluid behaviors; oil and gas physical properties (class problem)
 - c. Fluid sampling and PVT analysis

Day Two

4. Reservoir Drive Mechanisms
 - a. Primary, secondary, and tertiary recovery schemes
 - b. Performance characteristics of different reservoir drive mechanisms
5. Reserves Determination
 - a. Volumetric, material balance, and probabilistic methods (class problem)
 - b. Decline analysis (class example)
 - c. Empirical (Russian method) and statistical method

Day Three

6. Flow in Porous Media
 - a. Darcy equation and boundary conditions
 - b. Inflow performance relationship (IPR), and well allowable
7. Well Testing
 - a. Test objectives (well, reservoir) and types of tests
 - b. Buildup analysis (skin factor, reservoir press., boundaries) (class problem)
 - c. Reservoir limit and gas well testing

Day Four

8. Water Coning and Water Influx
 - a. Time to break-through and critical rate determination
 - b. Estimate of water influx (steady-state and unsteady-state methods)
9. Secondary and Tertiary Recovery Schemes
 - a. Review and screening of EOR schemes
 - b. Scheme planning and design
 - c. Performance and recovery factor prediction
 - d. Tools used to monitor performance of waterflood projects



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Day Five

10. Unconventional Oil and Gas

- a. Gas content in CBM/Shale Gas and reservoir characteristics
- b. Rate Transient Analysis (RTA); including flowing material balance, advanced type curves (Fetkovich, Blasingame, rate-normalized)
- c. Production mechanism and reserves determination

11. Horizontal Well Applications

- a. Applications/benefits of horizontal wells
- b. How to minimize geologic, drilling, and completion risks
- c. Well productivity and reserves estimate methods (case study)
- d. Multi-stage Frac of Hz Wells (MFHW); design and optimization
- e. Challenges in estimating reserves (new techniques)

12. Closing remarks and question period