Applied Reservoir Engineering - RE - Instructor-led + eLearning

COURSE

About the Course

This workshop will be delivered virtually through PetroAcademy. Each PetroAcademy offering integrates multiple learning activities, such as reading assignments, self-paced e-Learning, virtual instructor-led sessions, discussion forums, group exercises, case studies, quizzes, field trips, and experiential activities.

Activities include 32 hours of instructor-led, virtual training sessions, plus approximately 88 hours of self-paced work.

See detailed course schedule

See demo online learning module

The Applied Reservoir Engineering Blended Program represents the core of the PetroSkills reservoir engineering program and the foundation for all future studies in the subject. Numerous engineering practices are covered, ranging from fluid and rock properties to simulation and field development planning. Reservoir engineering is presented in the context of a modern, multi-disciplinary team effort using supporting computer technology.

Target Audience

Engineers or geoscientists performing reservoir engineering tasks for their asset team

You Will Learn

THIS IS RESERVOIR ENGINEERING

- Principal Tasks and Tools of a Reservoir Engineer, and how this course is organized to cover these topics

RESERVOIR ROCK PROPERTIES

- Different types of rocks
- Primary rock properties from a reservoir engineering point of view
- How rock properties are measured
- How rock property values are interpolated/extrapolated throughout the reservoir

RESERVOIR ROCK PROPERTIES FUNDAMENTALS

- Describe the concept of fluid contacts
- Describe how saturations change when crossing contacts
- Describe wettability
- Describe interfacial tension
- Describe how residual oil saturation is controlled by the interplay of different forces
- Define capillary pressure
- Explain how capillary pressure is a combination of several related phenomena
- Describe how capillary pressure can be used to explain macroscopic reservoir phenomena
- Show how collecting capillary pressure data can actually save money
- Discuss the various choices available for measuring relative permeability and capillary pressure in the laboratory
- Show how reservoir engineers model relative permeability and capillary pressure
- Describe how reservoir engineers define saturations
- Apply concepts discussed in the module to build relative permeability and capillary data datasets

RESERVOIR FLUID

- Describe how fluids change in response to changes in pressure and temperature
- Define the engineering properties of reservoir fluids
- Describe the make-up of reservoir fluids
- Describe how fluids are sampled
- Describe how fluid properties are measured in the laboratory

RESERVOIR FLUID FUNDAMENTALS

You will learn how to calculate fluid properties needed for:

- Volumetrics
- Material Balance
- Fluid Flow using Darcy's Law
- Pressure Transient Analysis
- Rate Transient Analysis
- Fluid Displacement
- Many other types of analysis

RESERVOIR FLOW PROPERTIES

- Explain the origin of Darcy's law and how it evolved
- State the difference between gravity and the pressure gradients, and how they play a role in determining the rate of which fluid could flow in the porous medium
- Identify the differences between the equations of Linear versus radial flow when calculating the flow
- Explain how do heterogeneities affect the flow in porous medium, and how Darcy's law can be applied to homogenize to calculate effective permeability
- Differentiate between oil and gas flow

- Apply Darcy's law to gas and oil
- Calculate the amount of fluid that is flowing when you have single cell phase vs single phase oil
- Describe the Importance of non-Darcy effect on well performance
- Apply Darcy's law when calculating the rate of the of oil and gas well
- Identify the differences between layers in parallel and layers in series
- Discuss the effective permeability of both layers in parallel and layers in series
- State limitations of Darcy's law
- Assess the differences between gas and oil reservoirs
- Describe the effect of non-Darcy flow

RESERVOIR FLOW PROPERTIES FUNDAMENTALS

- Apply Darcy's law for radial flows
- Differentiate between oil and gas flows
- Solve simple problems for radial flow across porous medium
- Define and calculate productivity index
- Predict the inflow performance relationship for oil and gas wells
- Calculate the flow rate under different flow regimes
- Understand why productivity index changes for transient flow
- Calculate the flow rates for both oil wells and gas wells
- Understand the difference between boundary pressure and average pressure
- Understand the application of both pseudo-real pressure and pressure squared methods for gas wells in calculating the rates
- Evaluate the end of transient and the beginning of pseudo-steady state flows for circular as well as non-circular reservoirs
- Understand the importance of vertically fractured and horizontal wells
- Calculate the rates and productivity indices for vertically fractured and horizontal wells using the concept of effective well bore radius
- Understand different flow regimes encountered by vertically fractured and horizontal wells
- Evaluate efficacy of horizontal wells and compare the performance to vertically fractured wells
- Calculate the effective permeability for parallel layers and layers in series
- Evaluate the difference under linear and radial flows
- Calculate the value of skin factor using damaged zone permeability
- Evaluate the performance of a well in the presence of skin factor
- Evaluate the performance of the well with limited amount of production data
- Understand the conditions under which non-Darcy flow is important
- Evaluate the performance of gas wells in the presence of non-Darcy flow using both pressure squared and pseudo-pressure equations
- Understand the concept multi-rate test and why it is important
- Evaluate the oil well performance when the well is producing below bubble point
- Analyze and solve basic and advanced level problems

RESERVOIR MATERIAL BALANCE

- Describe the purpose of the material balance technique to estimate the initial hydrocarbons in place

- Differentiate between volumetric analysis and material balance technique
- State the basic principle of material balance analysis
- Describe the principles behind material balance equation
- Identify the data that is needed to apply the material balance equation and the uncertainties associated with collecting such data
- Identify the purpose of the modified black oil model in material balance equation
- State the assumptions involved in applying the material balance equation
- Identify the limitations of material balance technique
- Develop the material balance equations from the first principle
- Identify and explain the different mechanisms influencing the production of hydrocarbons and how they are incorporated in the material balance equation
- Understand the necessary equations to be used depending on the type of reservoir from which hydrocarbons produce
- Develop appropriate equations for dry gas, wet gas, condensate, volatile oil and black oil reservoirs
- Describe modifications of material balance equations to estimate the initial oil and gas in place
- Explain the Havlena and Odeh method and the appropriate way to linearize the material balance equations
- Express the importance of water influx and how to detect the presence of aquifer based on production data
- Recognize the uncertainties associated with predicting the water influx as a function of time

RESERVOIR MATERIAL BALANCE FUNDAMENTALS

- Calculate volumetric estimates
- Adjust volumetric estimates for transition zones and calculate recovery factors
- Perform material balance analysis
- Leverage straight-line expressions of material balance equations to analyze both oil and gas reservoirs

DECLINE CURVE ANALYSIS AND EMPIRICAL APPROACHES

- Perform Basic Statistics
- Calculate Decline Curve Analysis
- Estimate Recovery Factors

DECLINE CURVE ANALYSIS AND EMPIRICAL APPROACHES FUNDAMENTALS

- This module describes the application statistical methods to solve reservoir engineering challenges. The emphasis will be on decline curve analysis and curve fitting measured data such as relative permeability.

RESERVES AND RESOURCES

- The importance of integration with other disciplines
- Calculations using the volumetric formulas for gas and oil
- The importance of dividing into flow units for dynamic reserves in reservoir simulation
- Reserves management: what it is and how to do it

- The Reservoir Engineer's input to reserves and resources (R & R)
- How a Geoscientist and Reservoir Engineer work together on reserves
- The risk and uncertainty that drive reserves
- Other non-technical factors that influence R & R
- The standardized process between reserve estimates
- The ethical basis underlying R & R estimations

PRESSURE TRANSIENT ANALYSIS

- Pressure transient analysis concepts, terminology, equations and objectives
- Pressure transient analysis in buildup and drawdown tests
- Time period analysis - challenges and objectives
- Semi-log and log-log analysis

RATE TRANSIENT ANALYSIS

- Describe the relationship between 'rate transient analysis' and 'pressure transient analysis'
- Describe the situations under which rate transient analysis would be preferred to pressure transient analysis

RESERVOIR FLUID DISPLACEMENT

- Fluid displacement as immiscible, linear, and vertical (overcoming gravity)
- Dispersed and segregated flow
- Aquifers models
- Coning in oil/water systems, including when it is most likely to occur, and how to prevent it

RESERVOIR FLUID DISPLACEMENT FUNDAMENTALS

- Model aquifers using analytical expressions
- Calculate mobility ratios, heterogeneity indices and sweep efficiencies
- Calculate the movement of flood fronts through the reservoir
- Plot saturation vs. distance plots
- Calculate how concentrations change spatially

ENHANCED OIL RECOVERY

- Discusses the modification of rock and fluid properties in tertiary recovery
- Describes (at a high level) the range of secondary and tertiary recovery techniques currently available (and relates them back to rock & fluid properties)

IMPROVED OIL RECOVERY

Waterflood types:

- Patterns vs. peripheral
- Above vs. below bubble point pressure

- Above vs. below fracture pressure
- High vs. low reserves to producing ratios
- Normal vs. enhanced
- Onshore vs. offshore

Waterflood operations:

- Modeling the reservoir
- Monitoring injectors
- Monitoring patterns
- Water quality

RESERVOIR SIMULATION

- Describe the physical basis, use and limitations of reservoir simulation models
- Describe the kind of data required to perform a simulation study
- Describe the issues and requirements for making rate and recoverable predictions for both unconventional reservoirs (UC) and heavy-oil reservoirs (HO) with simulation tools (UC)

RESERVOIR SURVEILLANCE

- Explain that collecting data has value and cost
- Describe the different kinds of errors that appear during a measurement event
- Describe the kinds of measurements which can be used to monitor producing wells, injecting wells, and the relationships between wells
- Outline the use of data integration methods
- Describe the difference between 'data-driven' and 'model-driven' reservoir surveillance

RESERVOIR SURVEILLANCE FUNDAMENTALS

- Calculate the value of a particular type of data to your asset
- Calculate how the value of a particular type of data varies with the frequency of collection and the quality of the measurement
- Use the analysis of measurement data to identify reservoir and well problems
- Apply data integration methods, such as montages
- Integrate surveillance data with forecasting methods

RESERVOIR MANAGEMENT

- Retain flexibility in reservoir management without giving up key principles for depletion
- Build flow units critical to reservoir management of an asset
- Describe how the value of an asset is defined
- Explain the roles of risk and uncertainty in that valuation
- Evaluate vertical equilibrium and no-crossflow, and how to get the most out of each through integrated technologies from multiple disciplines

RESERVOIR MANAGEMENT FUNDAMENTALS

- Manage reservoir uncertainties throughout phases of field maturity
- Identify the geologic and reservoir parameters that make an opportunity, and the capture techniques to the particularities of that opportunity
- Conduct analysis to determine the most appropriate injectant, including EOR techniques (if any) for a particular reservoir situation
- Apply types of wells to the appropriate geology
- Adjust and adapt the reservoir management plan for each new phase of field life

Course Content

BLENDED LEARNING WORKSHOP STRUCTURE

This program is comprised of the following activities:

ILT = Virtual Instructor-led Training

OL = Online Learning Activity/Reading

Week	Activity	Hours (Est.)	Subject	Virtual ILT Option 1 Perth, AUS timezone (GMT+8)	Virtual ILT Option 2 Perth, US timezone (GMT-5)
Week 1	**ILT**	1.0	Orientation Webcast (pre-recorded)		
	OL	1.0	This is Reservoir Engineering		
	OL	3.0	Reservoir Rock Properties		
Week 2	**ILT**	1.0	Reservoir Rock Properties Fundamentals	Tuesday, Sept 17, 09:00	Tuesday, Sept 17, 08:00
	OL	6.0	Reservoir Rock Properties Fundamentals		
	ILT	2.0	Reservoir Rock Properties	Thursday, Sept 19, 09:00	Thursday, Sept 19, 08:00

			Fundamentals		
Week 3	**OL**	9.0	Reservoir Fluid		
Week 4	**ILT**	1.5	Reservoir Fluid Fundamentals - Session 1	Tuesday, Oct 1, 09:00	Tuesday, Oct 1, 08:00
	OL	7.0	Reservoir Fluid Fundamentals		
	ILT	1.5	Reservoir Fluid Fundamentals - Session 2	Thursday, Oct 3, 09:00	Thursday, Oct 3, 08:00
Week 5	**OL**	3.0	Reservoir Flow Properties		
Week 6	**ILT**	1.5	Reservoir Flow Properties Fundamentals - Session 1	Tuesday, Oct 15, 09:00	Tuesday, Oct 15, 08:00
	OL	6.0	Reservoir Flow Properties Fundamentals		
	ILT	1.5	Reservoir Flow Properties Fundamentals - Session 2	Thursday, Oct 17, 09:00	Thursday, Oct 17, 08:00
Week 7	**OL**	4.0	Reservoir Material Balance		
Week 8	**ILT**	1.5	Reservoir Material Balance Fundamentals - Session 1	Tuesday, Oct 29, 09:00	Tuesday, Oct 29, 08:00
	OL	6.0	Reservoir Material Balance Fundamentals		
	ILT	1.5	Reservoir Material Balance Fundamentals - Session 2	Thursday, Oct 31, 09:00	Thursday, Oct 31, 08:00

Week 9	**OL**	4.0	Decline Curve Analysis and Empirical Approaches		
Week 10	**ILT**	1.5	Decline Curve Analysis and Empirical Approaches Fundamentals - Session 1	Tuesday, Nov 12, 09:00	Tuesday, Nov 12, 08:00
	OL	8.0	Decline Curve Analysis and Empirical Approaches Fundamentals		
	ILT	1.5	Decline Curve Analysis and Empirical Approaches Fundamentals - Session 2	Thursday, Nov 14, 09:00	Thursday, Nov 14, 08:00
Week 11	**OL**	4.0	Reserves and Resources		
	OL	4.0	Pressure Transient Analysis		
Week 12	**OL**	4.0	Rate Transient Analysis		
	OL	4.0	Reservoir Fluid Displacement		
Week 13	**ILT**	.75	Reservoir Fluid Displacement Fundamentals - Session 1	Tuesday, Dec 3, 09:00	Tuesday, Dec 3, 08:00
	OL	7.0	Reservoir Fluid Displacement Fundamentals		
	ILT	.75	Reservoir Fluid Displacement	Thursday, Dec 5, 09:00	Thursday, Dec 5, 08:00

			Fundamentals - Session 2		
Week 14	**OL**	4.0	Enhanced Oil Recovery		
Week 15	**OL**	4.0	Reservoir Simulation		
	OL	4.0	Reservoir Surveillance		
Week 16	**OL**	4.0	Improved Oil Recovery Fundamentals		
	ILT	2.0	Improved Oil Recovery Fundamentals	Thursday, Dec 19, 09:00	Thursday, Dec 19, 08:00
Week 17	**ILT**	1.5	Reservoir Surveillance Fundamentals - Session 1	Tuesday, Jan 7, 09:00	Tuesday, Jan 7, 08:00
	OL	6.0	Reservoir Surveillance Fundamentals		
	ILT	1.5	Reservoir Surveillance Fundamentals - Session 2	Thursday, Jan 9, 09:00	Thursday, Jan 9, 08:00
Week 18	**OL**	4.0	Reservoir Management		
Week 19	**ILT**	1.5	Reservoir Management Fundamentals - Session 1	Tuesday, Jan 14, 09:00	Tuesday, Jan 14, 08:00
	OL	5.0	Reservoir Management Fundamentals		
	ILT	1.5	Reservoir Management Fundamentals - Session 2	Thursday, Jan 16, 09:00	Thursday, Jan 16, 08:00

Product Details

Categories: Upstream

Disciplines: Reservoir Engineering

Levels: Foundation

Product Type: Course

Formats Available: Virtual On-Demand

Instructors: Mohan Kelkar Richard Henry

Virtual Format

9 Sep '24 17 Jan '25 - | Course | Virtual $6,985.00

On-Demand Format

| Course | On-Demand (Available Immediately) $6,985.00
