



PB INSTITUTE OF RESEARCH AND TECHNOLOGY

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Nairobi - Kenya

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Compositional Reservoir Simulation & Phase Behaviour Training

Duration: 5 days

On-Site

01 Who Should Attend

- Reservoir engineers
- Petroleum engineers
- Production engineers
- Reservoir simulation engineers
- PVT and fluid characterization specialists
- Petroleum geoscientists
- EOR specialists
- Compositional modelling professionals
- Gas-condensate and volatile-oil specialists
- Reservoir management professionals
- Field development engineers
- Well and production optimization professionals
- Oil & gas technical managers
- Petroleum engineering consultants



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02 About the Course

The **GEM Compositional Modelling & Phase Behaviour with WinProp Training Course** provides participants with advanced knowledge and practical skills in compositional reservoir simulation, fluid characterization, and phase-behaviour modelling using **WinProp** and **GEM**. The course focuses on building reliable fluid models and applying compositional simulation techniques to complex reservoir and production scenarios.

Participants will learn how to characterize reservoir fluids, develop and tune equations of state (EOS), perform phase-behaviour calculations, construct PVT models, and prepare compositional fluid descriptions for simulation. The training also explores how compositional models can be applied to gas injection, miscible processes, volatile oil and gas-condensate reservoirs, enhanced oil recovery, and other challenging reservoir conditions. Through practical exercises and case studies, participants will develop the ability to build, validate, and apply compositional models, interpret phase-behaviour results, troubleshoot modelling challenges, and improve the reliability of reservoir simulation studies.

03 Workshop Objectives

- Understand the fundamentals of compositional reservoir simulation
- Build compositional models using CMG GEM and WinProp
- Apply equations of state (EoS) for phase behavior modeling
- Integrate PVT data into compositional workflows
- Simulate gas and condensate reservoir performance
- Model miscible and immiscible displacement processes
- Calibrate models with laboratory and field data
- Analyze condensate banking and retrograde condensation



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04 Module Topics

Module 1: Introduction to Compositional Modeling

- Principles of compositional simulation
- Applications in gas and condensate reservoirs
- Differences from black oil models
- Overview of GEM and WinProp capabilities
- Case study examples

Module 2: Fundamentals of Fluid Phase Behaviour

- Properties of reservoir fluids
- Phase envelopes and critical points
- Retrograde condensation and its impact
- Retrograde condensation and its impact
- Visualizing phase diagrams

Module 3: Introduction to Equations of State (EoS)

- Peng-Robinson and Soave-Redlich-Kwong EoS
- EoS tuning and calibration principles
- Role of binary interaction coefficients
- Common challenges in EoS application
- Role of binary interaction coefficients

Module 4: PVT Data Analysis and Integration

- Laboratory PVT experiment workflows
- Constant composition expansion tests
- Differential liberation tests
- Swelling and slim-tube tests
- Importing PVT data into WinProp



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Module 5: ModulBuilding Fluid Models in WinProp

- Creating compositional fluid models
- Inputting component data and fractions
- Generating phase envelopes
- Tuning EoS with experimental data
- Exporting models to GEM

Module 6: GEM Simulation Fundamentals

- Setting up GEM projects
- Grid design and initialization
- Assigning compositional properties
- Linking GEM with WinProp models
- Running base case simulations

Module 7: Gas Reservoir Simulation Workflows

- Modeling dry and wet gas reservoirs
- Condensate gas reservoir challenges
- Simulation of depletion performance
- Impact of pressure maintenance strategies
- Case studies in gas simulation

Module 8: Condensate Banking and Retrograde Condensation

- Mechanisms of condensate banking
- Impact on reservoir deliverability
- Modeling retrograde condensation in GEM
- Mitigation strategies in simulation
- Practical exercises

Module 9: Miscible and Immiscible Gas Injection



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- Fundamentals of miscibility
- Slim-tube and MMP experiments
- Modeling gas injection projects
- Effectiveness of miscible flooding
- Simulation of immiscible displacement

Module 10: Volatile Oil Reservoir Simulation

- Properties of volatile oil systems
- Differences from black oil and gas condensate reservoirs
- Simulation strategies in GEM
- Predicting production performance
- Case examples in volatile oil reservoirs

Module 11: History Matching in Compositional Models

- Principles of history matching for compositional reservoirs
- Adjusting fluid properties and EoS parameters
- Using production data in calibration
- Iterative workflows in GEM
- Case studies of history matching

Module 12: Forecasting Production with GEM

- Building forecast scenarios
- Short-term and long-term forecasting
- Uncertainty in compositional forecasts
- Short-term and long-term forecasting
- Practical forecasting examples

Module 13: Visualization and Reporting



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- ▶ Adjusting fluid properties and EoS parameters
- ▶ Generating plots and maps
- ▶ Reporting simulation results
- ▶ Communicating findings to stakeholders
- ▶ Preparing technical documentation

Module 14: Future of Compositional Simulation

- ▶ Advances in compositional modeling techniques
- ▶ AI and machine learning in PVT prediction
- ▶ Cloud-based simulation workflows
- ▶ Integration with real-time field data
- ▶ Integration with real-time field data