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## N934: PVT: Concepts, Methods, and Applications

Instructor(s): Bahman Tohidi

### Format and Duration

Classroom - 3 Days

Virtual - 5 Sessions

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### Summary

The course covers reservoir fluid composition, phase behaviour and reservoir fluids classification; PVT tests and correlations/modelling; the evaluation and application of PVT reports; Equation of State tuning, PVT analysis by compositional methods using a compositional behaviour model; applications in reservoir simulation. There will be a discussion of potential causes of errors and several case studies.

**Business impact:** Participants on this course will add value to their businesses through **resource estimation, reservoir simulation, and data-driven decision-making.**

### Learning Outcomes

Participants will learn to:

1. Assess the fundamentals of reservoir fluid composition, phase behaviour, correlations, and classification.
2. Construct PVT testing requirements.
3. Appraise PVT analysis by compositional methods.
4. Prepare the results of PVT analysis for use in reservoir modelling and reservoir engineering studies.
5. Characterise sources of error and evaluate case studies.

### Training Method

A classroom course comprising lectures, case studies, exercises, and discussion.

### Who Should Attend

The course is designed for Petroleum and Production Engineers as well as Geoscientists who need to understand what types of fluid are available and how the results can be used.

### Course Content

The course aims to address a number of key topics in this area, but there is some flexibility in the formal itinerary depending on the groups preferences. The key topics that are covered include:

1. Fundamentals - reservoir fluid composition; basic concepts of phase behaviour; classification of reservoir fluids.
2. PVT tests and correlations - compositional analysis by gas chromatography and distillation; conventional PVT tests.
3. PVT report - its evaluation, quality control, data processing and application of test results.
4. Applications in reservoir simulation - pseudo components and grouping; optimum fluid characterisation; tuning equation of state data; generating black oil tables for reservoir simulation.
5. Causes of errors in PVT modelling, case studies.

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6. Specialised topics and current research topics.

### Day 1: PVT in Hydrocarbon Reservoirs

- Pressure-temperature diagram for pure compounds
- Critical point; ideal and real gases; corresponding state; acentric factor
- Phase behaviour of binary and multicomponent systems; phase envelope
- Classifications of hydrocarbon reservoirs
- Retrograde condensation, cricondenbar and cricondentherm
- Effect of composition on phase envelope
- Behaviour of dry/wet gas, volatile/black oil at reservoir and separator conditions
- PVT tests for dry/wet gas, black/volatile oil and gas condensate
- Determining molecular weight of liquid hydrocarbons
- Constant Composition Expansion (CCE) test; Differential Liberation (DL) test; Separator test; Constant Volume Depletion (CVD) test

### Day 2: Fundamentals of Phase Equilibria and Fluid Characterisation

- Equation of state (EoS) - including Van der Waals EoS, SRK EoS, PR EoS
- Mixing rules
- Binary Interaction Parameters
- Algorithm for computer calculations
- Distillation
- Gas chromatography
- Single carbon number (SCN)
- Semi-continuous fluid description
- Calculating physical properties of SCN

### Day 3: Using Data in EoS Tuning and Reservoir Simulation

- Application to reservoir simulation
- PVT reports
- Grouping
- Group Selection, Group Properties
- Tuning of EoS
- Generating black oil tables for exporting to reservoir simulators