

**COURSE OVERVIEW DE0731**  
**Fluid Properties and Phase Behavior (PVT)**

**Course Title**

Fluid Properties and Phase Behavior (PVT)

**Course Reference**

DE0731

**Course Duration**

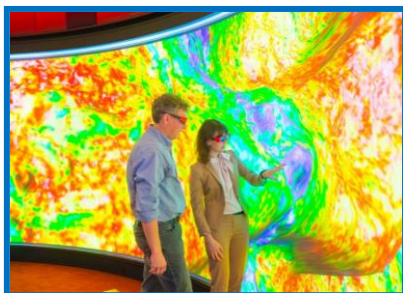
Five days/3.0 CEUs/30 PDHs



**Course Date/Venue**

Session(s)	Date	Venue
1	January 28-February 01, 2024	The Mouna Meeting Room, The H Dubai Hotel, Sheikh Zayed Rd - Trade Centre, Dubai, UAE
2	February 11-15, 2024	Kizkulesi, Crown Plaza Istanbul Asia Hotels & Convention Center, Istanbul, Turkey
3	March 03-07, 2024	Oryx Meeting Room, Doubletree By Hilton Doha-Al Sadd, Doha, Qatar

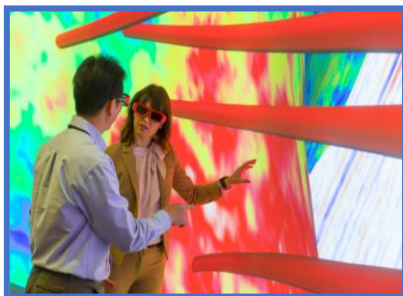
**Course Description**



***This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.***



Accurate information on phase behaviour and properties of fluids is an essential element in proper management of petroleum reservoirs. Reservoirs were often produced by depletion in which the reservoir pressure was the main variable that controlled the fluid properties. Thus understanding phase behaviour is an important step for modeling EOR and be prepared for the coming phase of development of the oil fields. Hence, experimental methods and predictive correlations with pressure as the variable were developed and successfully used for many years in industry.



The development of enhanced oil recovery techniques and growing interest in gas condensate and volatile oil reservoirs, involving wide compositional variations and complex fluid behaviour during production, necessitated the use of more advanced compositional methods and new experimental procedures. The availability of high computational capabilities greatly assisted the rapid technology development in this area and its wide use in industry.

This course is designed to present practical methods of determining required reservoir fluid properties for engineering applications by judicious review of conventional practices and introducing recent advances. Although the emphasis is on the application of PVT and phase behaviour data to engineering problems, experimental methods will also be reviewed and their limitations will be identified.

The course covers data gathering and fluid sampling that enable engineers to deliver a proper fluid characterization (from sampling to EOS characterization). This course will enable the participants to ensure optimum sampling strategy, strong laboratories follow-up capabilities and high quality EOS characterization.

### Course Objectives

This course is necessary because our fields are becoming more and more mature and when EORs expected to play an important role to maintain production plateau and in recovery. Upon the successful completion of this course, participants will be able to:-

- Apply and gain an in-depth knowledge on fluid properties and phase behavior (PVT)
- Correlate lab data to obtain PVT and analyze the principles and applications of PVT through experiments
- Distinguish traditional and black oil PVT properties and carryout fluid characterization with EOS
- Perform slim tube simulations and MMP and phase behaviour calculation
- Explain Heptane plus characterization, phase equilibria and equations of state
- Describe gas injection, interfacial tension and list applications in reservoir simulation

### Exclusive Smart Training Kit - H-STK®



Participants of this course will receive the exclusive “Haward Smart Training Kit” (H-STK®). The H-STK® consists of a comprehensive set of technical content which includes **electronic version** of the course materials, sample video clips of the instructor’s actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.

### Who Should Attend


This course provides an overview of all significant aspects and considerations of fluid properties and phase behavior (PVT) for chemists and reservoir engineers dealing with phase behaviour miscible displacement and reservoir simulation.

### Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

### Certificate Accreditations


Certificates are accredited by the following international accreditation organizations: -

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The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units (CEUs)** in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

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British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

### Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.



### Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:



**Dr. Chris Kapetan, PhD, MSc, BSc**, is a **Senior Process & Petroleum Engineer** with over **30 years** of international experience within the **onshore and offshore oil and gas industry**. His wide experience covers **Surface Production & Operation, Petroleum Production Facility, Offshore Platform Consideration, Oil & Gas Separation, Oil & Water Separation, Crude Oil Treating, Centrifugal & Reciprocating Pumps, Gas Dehydration & Processing, Reciprocating Compressors, Cased Hole Formation Evaluation, Cased Hole Logs, Production Operations, Surface Facilities, Production Management, Drilling Operations, Directional Drilling, Gas Lift Operations, Petroleum Business, Petroleum Economics, Gas Lift Valve Changing & Installation, Horizontal & Multilateral Wells, Directional Planning, Completion Design, Directional Surveying, Drilling Fluids, Matrix Acidizing, Hydraulic Fracturing, Well Completion Design & Operation, Well Stimulation & Control and Workover Planning, Completions & Workover, Rig Sizing, Hole Cleaning & Logging, Well Completion, Servicing and Work-Over Operations, Practical Reservoir Engineering, X-mas Tree & Wellhead Operations, Maintenance & Testing, Advanced Petrophysics/Interpretation of Well Composite, Construction Integrity & Completion, Coiled Tubing Technology, Corrosion Control, Wireline & Coil Tubing, Pipeline Pigging, Corrosion Monitoring, Cathodic Protection as well as Root Cause Analysis (RCA), Root Cause Failure Analysis (RCFA), Gas Conditioning & Process Technology, Production Safety and Delusion of Asphalt**. Currently, he is the **Operations Manager at GEOTECH** and an independent **Drilling Operations Consultant** of various engineering services providers to the international clients as he offers his expertise in many areas of the **drilling discipline** and is well **recognized & respected** for his process and procedural expertise as well as ongoing participation, interest and experience in continuing to promote technology to producers around the world.

Throughout his long career life, Dr. Chris has worked for many international companies and has spent several years **managing technically complex wellbore interventions** in both **drilling & servicing**. He is a **well-regarded** for his **process and procedural expertise**. Further, he was the **Operations Manager at ETP Crude Oil Pipeline Services** where he was fully responsible for optimum operations of crude oil pipeline, **workover** and **directional drilling, drilling rigs** and equipment, drilling of various geothermal deep wells and **exploration wells**. Dr. Chris was the **Drilling & Workover Manager & Superintendent for Kavala Oil** wherein he was responsible for supervision of **drilling operations** and **offshore exploration**, quality control of performance of **rigs, coiled tubing**, crude oil transportation via pipeline and abandonment of **well** as per the API requirements. He had occupied various key positions as the **Drilling Operations Consultant, Site Manager, Branch Manager, Senior Drilling & Workover Manager & Engineer** and **Drilling & Workover Engineer** in several petroleum companies responsible mainly on an **offshore sour oil field** (under water flood and gas lift) and a gas field. Further, Dr. Chris has been a **Professor of the Oil Technology College**.

Dr. Chris has **PhD in Reservoir Engineering** and a **Master's degree in Drilling & Production Engineering** from the **Petrol-Gaze Din Ploiesti University**. Further, he is a **Certified Surfaced BOP Stack Supervisor of IWCF**, a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)** and has conducted **numerous short courses, seminars and workshops** and has published several technical books on **Production Logging, Safety Drilling Rigs** and **Oil Reservoir**.

### Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures
- 20% Practical Workshops & Work Presentations
- 30% Hands-on Practical Exercises & Case Studies
- 20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

### Course Fee

Dubai	<b>US\$ 8,000</b> per Delegate + <b>VAT</b> . This rate includes H-STK <sup>®</sup> (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Istanbul	<b>US\$ 8,500</b> per Delegate + <b>VAT</b> . This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Doha	<b>US\$ 8,500</b> per Delegate. This rate includes H-STK <sup>®</sup> (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

### Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

#### **Day 1**

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	<b>PRE-TEST</b>
0830 – 0915	<b>Nomenclature – Phase Behaviour Fundamentals</b> Introduction to Phase Behaviour and H/C Fluids • Reservoir Fluid Composition • Phase Behaviour • Pure Compound • Corresponding States • Multicomponent Mixture • Classification of Reservoir Fluids • Dry Gas • Wet Gas • Gas Condensate • Volatile Oil • Black Oil • References • Exercises
0915 – 0930	Break
0930 – 1100	<b>PVT Tests &amp; Correlations – Lab PVT Experiments</b> Fluid Sampling • Well Preparation • Sample Collection • PVT Tests 38 • Dry Gas • Wet Gas • Black Oil • Gas Condensate • Volatile Oil • Empirical Correlations • Black Oil • Traditional & Black Oil PVT Properties • Oil Formation Volume Factor

1100 – 1215	<b>PVT Tests &amp; Correlations (cont'd)</b> Bubble Point Pressure • Gas in Solution • Total Formation Volume Factor • Oil Density • Oil Viscosity • Natural Gas • Volumetric Data • Using Correlations and Lab. Data to Obtain PVT
1215 – 1230	Break
1230 – 1420	<b>PVT Tests &amp; Correlations (cont'd)</b> Gas Viscosity • Formation Water • Water Content of Hydrocarbon Phase • Hydrocarbon Solubility in Water • Water Formation Volume Factor • Compressibility of Water • Water Density • Water Viscosity • References • Exercises
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day One

### Day 2

0730 – 0930	<b>Phase Equilibria</b> Criteria for Equilibrium • Chemical Potential • Fugacity • Activity • Equilibrium Ratio • Raoult's Law • Henry's Law • Empirical Correlations • References • Exercises
0930 – 0945	Break
0945 – 1100	<b>EOR Type Experiments</b>
1100 – 1215	<b>Equations of State</b> Viral EOS and its Modifications • Starling-Benedict-Webb-Rubin EOS • Cubic Equations of State • Two-Parameter EOS • Soave-Redlich-Kwong EOS • Peng-Robinson EOS • Volume Shift • Three-Parameter EOS
1215 – 1230	Break
1230 – 1420	<b>Equations of State (cont'd)</b> Schmidt-Wenzel EOS, Patel-Teja EOS • Attracting Term Temperature Dependency • Mixing Rules • Random Mixing Rules • Non-Random Mixing Rules • References • Exercises
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Two

### Day 3

0730 – 0930	<b>Phase Behaviour Calculations</b> Vapour-Liquid Equilibrium Calculations • Root Selection • Rapid Flash Calculations • Stability Analysis • Stability Limit • Critical Point Calculations • Compositional Grading
0930 – 0945	Break
0945 – 1100	<b>Phase Behaviour Calculations (cont'd)</b> Equilibrium Assumption • Non-Equilibrium Fluids • Heat of Transport • Significance • References • Exercises
1100 – 1215	<b>Heptane Plus Characterization</b>
1215 – 1230	Break

1230 – 1420	<b>Fluid Characterisation with an EOS</b> <i>Experimental Methods • Distillation • Gas Chromatography • Critical Properties • Lee-Kesler Correlations • Riazi-Daubert Correlations • Perturbation Expansion Correlations • Description of Fluid Heavy End • Single Carbon Number Function • Continuous Description • Direct Application • References • Exercises</i>
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Three

#### Day 4

0730 – 0930	<b>Slim Tube Simulations &amp; MMP Calculation</b>
0930 – 0945	Break
0945 – 1100	<b>Gas Injection</b> <i>Miscibility Concepts • Miscibility in Real Reservoir Fluids • Experimental Studies • Slim Tube • Rising Bubble Apparatus • Contact Experiments • Prediction of Miscibility Conditions • First Contact Miscibility • Vaporising Gas Drive • Condensing-Vaporising Gas Drive • References • Exercises</i>
1100 – 1215	<b>Interfacial Tension</b> <i>Measurement Methods • Prediction of Interfacial Tension • Parachor Method • Corresponding States Correlation</i>
1215 – 1230	Break
1230 – 1420	<b>Interfacial Tension (cont'd)</b> <i>Comparison of Predictive Methods • Water-Hydrocarbon Interfacial Tension • References • Exercises</i>
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Four

#### Day 5

0730 – 0930	<b>Application in Reservoir Simulation</b> <i>Grouping • Group Selection • Group Properties • Composition Retrieval • Comparison of EOS</i>
0930 – 0945	Break
0945 – 1100	<b>Application in Reservoir Simulation (cont'd)</b> <i>Phase Composition • Saturation Pressure • Density • Gas and Liquid Volumes • Robustness • Tuning of EOS</i>
1100 – 1215	<b>Application in Reservoir Simulation (cont'd)</b> <i>Fluid Characterisation • Selection of EOS • Experimental Data • Selection of Regression Variables • Limits of Tuned Parameters • Methodology</i>
1215 – 1230	Break
1230 – 1345	<b>Application in Reservoir Simulation (cont'd)</b> <i>Dynamic Validation of Model • Relative Permeability Function • Viscosity Prediction • Implementation • Evaluation of Reservoir Fluid Samples References • Exercises</i>
1345 – 1400	<b>Course Conclusion</b>
1400 – 1415	<b>POST-TEST</b>
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course



**Practical Sessions**

This practical and highly-interactive course includes real-life case studies and exercises:-



**Course Coordinator**

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