COURSE OVERVIEW DE0731
Fluid Properties and Phase Behavior (PVT)

Course Title
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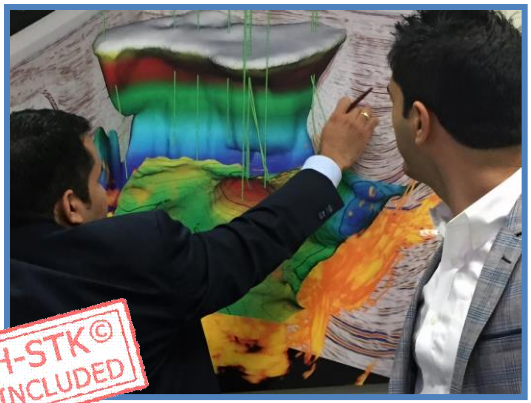


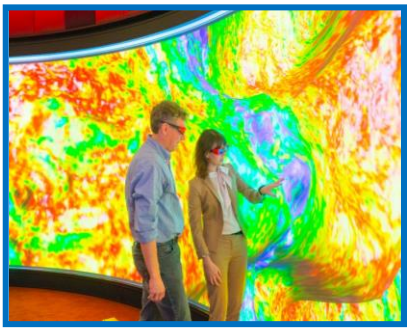
Course Date/Venue
September 01-05, 2024/Boardroom, Warwick Hotel Doha, Doha, Qatar

Course Reference
DE0731

3.0 CEUs (30 PDHs) AWARD

Course Duration
Five days/3.0 CEUs/30 PDHs

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: -

- 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.

- 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.

Course Fee

US$ 8,500 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day

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:

Mr. Konstantin Zorbalas, MSc, BSc, is a **Senior Petroleum Engineer & Well Completions Specialist** with over **25 years** of **offshore** and **onshore** experience in the **Oil** & **Gas**, **Refinery** & **Petrochemical** industries. His wide expertise includes **Workovers & Completions**, **Petroleum Risk & Decision Analysis**, **Acidizing Application** in **Sandstone** & **Carbonate**, **Well Testing Analysis**, **Stimulation Operations**, **Reserves Evaluation**, **Reservoir Fluid Properties**, **Reservoir Engineering & Simulation Studies**, **Reservoir Monitoring**, **Artificial Lift Design**, **Gas Operations**, **Workover/Remedial Operations** & **Heavy Oil Technology**, **Applied Water Technology**, **Oil & Gas Production**, **X-mas Tree** & **Wellhead Operations** & **Testing**, **Artificial Lift Systems** (**Gas Lift**, **ESP**, and **Rod Pumping**), **Well Cementing**, **Production Optimization**, **Well Completion Design**, **Sand Control**, **PLT Correlation**, **Slickline Operations**, **Acid Stimulation**, **Well testing**, **Production Logging**, **Project Evaluation** & **Economic Analysis**. Further, he is actively involved in **Project Management** with special emphasis in production technology and field optimization, performing conceptual studies, economic analysis with risk assessment and field development planning. He is currently the **Senior Petroleum Engineer & Consultant** of **National Oil Company** wherein he is involved in the mega-mature fields in the Arabian Gulf, predominantly carbonate reservoirs; designing the acid stimulation treatments with post-drilling rigless operations; utilizing CT with tractors and DTS systems; and he is responsible for gas production and preparing for reservoir engineering and simulation studies, well testing activities, field and reservoir monitoring, production logging and optimization and well completion design.

During his career life, Mr. Zorbalas worked as a **Senior Production Engineer**, **Well Completion Specialist**, **Production Manager**, **Project Manager**, **Technical Manager**, **Technical Supervisor** & **Contracts Manager**, **Production Engineer**, **Production Supervisor**, **Production Technologist**, **Technical Specialist**, **Business Development Analyst**, **Field Production Engineer** and **Field Engineer**. He worked for many **world-class oil/gas companies** such as **ZADCO**, **ADMA-OPCO**, **Oilfield International Ltd**, **Burlington Resources** (later acquired by **Conoco Phillips**), **MOBIL E&P**, **Saudi Aramco**, **Pluspetrol E&P SA**, **Wintershall**, **Taylor Energy**, **Schlumberger**, **Rowan Drilling** and **Yukos EP** where he was in-charge of the **design and technical analysis** of a gas plant with capacity **1.8 billion m3/yr gas**. His achievements include **boosting oil production 17.2% per year** since 1999 using **ESP** and **Gas Lift systems**.

Mr. Zorbalas has **Master** and **Bachelor** degrees in **Petroleum Engineering** from the **Mississippi State University**, **USA**. Further, he is an **SPE Certified Petroleum Engineer**, **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**), an active member of the Society of Petroleum Engineers (**SPE**) and has numerous scientific and technical publications and delivered innumerable training courses, seminars and workshops worldwide.

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 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: Sunday 01st of September 2024

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0915	***Nomenclature – Phase Behaviour Fundamentals*** *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	***PVT Tests & Correlations – Lab PVT Experiments*** *Fluid Sampling • Well Preparartion • 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	***PVT Tests & Correlations (cont'd)*** *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	***PVT Tests & Correlations (cont'd)*** *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	***Recap***
1430	*Lunch & End of Day One*

Day 2: **Monday 02th of September 2024**

0730 – 0930	***Phase Equilibria*** *Criteria for Equilibrium • Chemical Potential • Fugacity • Activity • Equilibrium Ratio • Raoult's Law • Henry's Law • Empirical Correlations • References • Exercises*
0930 – 0945	*Break*
0945 – 1100	***EOR Type Experiments***
1100 – 1215	***Equations of State*** *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	***Equations of State (cont'd)*** *Scmidt-Wenzel EOS, Patel-Teja EOS • Attracting Term Temperature Dependency • Mixing Rules • Random Mixing Rules • Non-Random Mixing Rules • References • Exercises*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3: **Tuesday 03th of September 2024**

0730 – 0930	***Phase Behaviour Calculations*** *Vapour-Liquid Equilibrium Calculations • Root Selection • Rapid Flash Calculations • Stability Analysis • Stability Limit • Critical Point Calculations • Compositional Grading*
0930 – 0945	*Break*
0945 – 1100	***Phase Behaviour Calculations (cont'd)*** *Equilibrium Assumption • Non-Equilibrium Fluids • Heat of Transport • Significance • References • Exercises*
1100 – 1215	***Heptane Plus Characterization***
1215 – 1230	*Break*
1230 – 1420	***Fluid Characterisation with an EOS*** *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*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4: **Wednesday 04th of September 2024**

0730 – 0930	***Slim Tube Simulations & MMP Calculation***
0930 – 0945	*Break*
0945 – 1100	***Gas Injection*** *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*

1100 – 1215	***Interfacial Tension*** *Measurement Methods • Prediction of Interfacial Tension • Parachor Method • Corresponding States Correlation*
1215 – 1230	*Break*
1230 – 1420	***Interfacial Tension (cont'd)*** *Comparison of Predictive Methods • Water-Hydrocarbon Interfacial Tension • References • Exercises*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5: ***Thursday 05th of September 2024***

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