Haward Technology Middle East

COURSE OVERVIEW DE0284
Well Test Design and Analysis

Course Title
Well Test Design and Analysis

Course Reference
DE0284

Course Date/Venue
Session 1: February 09-13, 2025/ Meeting Plus 8, City Centre Rotana Doha Hotel, Doha, Qatar
Session 2: August 10-14, 2025/ Meeting Plus 8, City Centre Rotana Doha Hotel, Doha, Qatar

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

Well testing is a dynamic process. At its simplest, a test discovers if a formation can flow and permits sampling of the produced fluid. Analysis can yield further information like the extent of formation damage near the borehole, reservoir permeability and heterogeneity, and initial productivity index. For this, engineers induce pressure transients by changing the rate that formation fluids enter the borehole and recording the resulting downhole pressure versus time.

Transient tests can also reveal the reservoir's areal extent and vertical layering. Primary concerns in testing exploration wells are obtaining representative samples and estimating reservoir producibility. Fluid samples are needed to determine various physical parameters required for well test analysis, such as compressibility and viscosity, and for pressure-volume-temperature (PVT) analysis that unlocks how the hydrocarbon phases coexist at different pressures and temperatures.

The analysis and interpretation of well tests have evolved remarkably since the technique became established. Today, a unified methodology has developed to obtain the maximum information from any transient. Analysis, however, reaches deeper than just the near-wellbore region.

Today, it contributes so much to characterizing the reservoir that engineers increasingly refer to well testing as reservoir testing. Analysis can indicate the likely producing mechanism of the formation-for example, how much production comes from fractures, how much from intergranular porosity- and it can determine the producing zone's permeability-thickness product, kh. It can see to the limits of the reservoir indicating the probable shape {but not orientation} of the reservoir boundaries and can show whether the primary recovery mechanism is from water or gas-cap support. This information becomes crucial in the appraisal and production stages of field development when engineers combine testing interpretation results with seismic and geologic data to refine their understanding of the reservoir.

Designing well tests involves many of the same steps the interpreter uses. This is because once a test has been proposed, both the pressure data and the data's interpretation can be simulated to show that the test as designed meets it's goals – design simulation requires estimates of formation and fluid parameters from nearby wells or the well in question. By predicting the likely shape of the log-log Δp and derivative curves, the engineer can demonstrate the feasibility of detecting and characterizing the anticipated reservoir features. For example, design simulation ensures that wellbore storage does not smother the feature being sought and guarantees a test that is long enough to view suspected reservoir boundaries. Another important feature of simulation is determining the accuracy and precision required of the pressure gauges. The design phase not only maps out the mechanics of a test, but also ensures that once underway objectives are met.

This course is designed to provide participants with a detailed and up-to-date overview of well test design and analysis. It covers the basic concepts, gas wells and multi-phase flow of well test analysis; the fluid properties and modifications for gas wells and multiphase flow; the horizontal and vertical permeability, skin and effective flowing length; the acidized horizontal wells; the effect of layering, formation thickness, constant pressure boundary (gas cap) and integration of production logging; the condensate-gas relative permeability and the importance of compositional analysis; the liquid drop-out effect, non-darcy flow in gas condensate wells and radial composite behavior; the drawdown and buildup test in oil and gas wells; the extended drawdown testing, compartmentalized reservoir behavior, extended buildups and recharging; the reserve estimation and flow regimes identification using the log-log diagnostic plot; and the characteristic pressure behavior for common bounded reservoir geometries.

During this interactive course, participants will learn the well test data affected by various wellbore and near-wellbore phenomena; the design of well test to meet desired objectives; estimating average drainage area pressure; analyzing well tests in hydraulically fractured wells, horizontal wells and naturally fractured reservoirs; the post hydraulic fracture analysis, finite conductivity fractures and bilinear and pseudo radial flow regimes; the type of curves for well test interpretation; the fracture skin and non-darcy flow in gas wells; the importance of pre-fracture testing and difficulties in analyzing WT incomplex; and the slug test analysis, non-ideal wellbore storage, injection wells and relevant real cases for analysis and interpretation.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on well test design and analysis
- Analyze drawdown and buildup tests in oil and gas wells
- Identify flow regimes using the log-log diagnostic plot
- Describe characteristic pressure behavior for common bounded reservoir geometries
- Identify well test data affected by various wellbore and near-wellbore phenomena
- Design a well test to meet desired objectives and estimate average drainage area pressure
- Analyze well tests in hydraulically fractured wells, horizontal wells and naturally fractured reservoirs
- Review the basic concepts, gas wells and multi-phase flow of well test analysis
- Identify fluid properties and the modifications for gas wells and multiphase flow
- Interpret horizontal and vertical permeability, skin and effective flowing length as well as acidized horizontal wells
- Recognize the effect of layering, formation thickness, constant pressure boundary (gas cap) and integration of production logging
- Explain condensate-gas relative permeability and the importance of compositional analysis
- Describe liquid drop-out effect, non-darcy flow in gas condensate wells and radial composite behavior
- Carryout extended drawdown testing, compartmentalized reservoir behavior, extended building and recharging and reserve estimation
- Illustrate post hydraulic fracture analysis, finite conductivity fractures and bilinear and pseudo radial flow regimes
- Identify the various type of curves for well test interpretation as well as fracture skin and non-darcy flow in gas wells
- Discuss the importance of pre-fracture testing as well as difficulties in analyzing WT incomplex
- Carryout slug test analysis, non-ideal wellbore storage, injection wells and the relevant real cases for analysis and interpretation

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 conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides a basic overview of all significant aspects and considerations of well test design and analysis for reservoir engineers, petroleum engineers and reservoir technical assistants.

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.

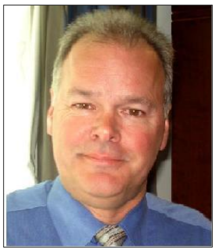
  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation 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 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. Brendon Billings, MSc, BSc, is a **Senior Petroleum Engineer** and **Well Service Consultant** with over **30 years** of international experience in **Drilling**/**Reservoir**/**Petroleum Engineering** and **Well Service Operations**. He is a **recognized authority** in "**Hands On**" **Service** and **Drilling Operations**, Electrical Submersible Pumps Application, **ESP** Assembly & Disassembly Techniques, **ESP** Modeling & Design, **ESP** Construction & Operational Monitoring, **ESP** Troubleshooting & Maintenance, **Well Completions** (**Riggless Operations**), **Product Optimization**, **Wellhead Operations**, **Wellbore Interventions**, **High Volume Lift Project Management**, **Reservoir Optimization**, **Well Testing**, **Wire/Slickilne Equipment** and **Operations**, **Coil Tubing**, **Water Flooding**, **Electric Submersible Pumps** (**ESPs**), **Gas Lifts & Steam Assist Gravity Drain** (**SAGD**) **Applications**, **Facility Inspection**, **Root Cause Failure Management** and **Power Factor Management.** Currently, he is the **President** of a large specialized engineering services provider to the **North-American Sedimentary Basin Production** and other international clients. Moreover, he occupies a **consultant position** and remains to offer his expertise in many areas of the **drilling discipline** and is well **recognized & respected** for his process, procedural expertise, modus operandi as well as ongoing participation, interest and experience in continuing to promote technology to producers around the world.

Throughout his long career life, Mr. Billings 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, procedural expertise** and **modus operandi**. Further, he was the **Projects Manager** at **Sherrit Petreola** where he was fully responsible for all **Reservoir Development** activities. He has spent **more** than **2000 days** total on **Rig Floors** for **Drilling** (**onshore/offshore**) and **Well Servicing Operations** jobs. Mr. Billings was the Senior **Applications Expert** for **Schlumberger Canada** (**REDA Services**) where he was greatly involved in high volume lift and reservoir optimization projects including specialty endeavours like **SAGD and Gas Lift**. He lead special projects for alternative technology applications and was referred to as the '**technical specialist**' for severe services on ESP applications and had provided in-house & client instruction for ESP application schooling. Previously, he was the **Artificial Lift Services Developer** for **Weatherford**, a leading provider of oilfield services equipment for drilling, evaluation, completion, production and intervention areas. Herein, he was tasked to introduce new ESP technology and lead a project team for ESP facility development & design. Much earlier in his career, he has held positions such as **Operations Supervisor**, **Rig Consultant**, **Project Manager**, **Regional Manager**, **Engineering Representative**, **International Engineering Support Technician**, **Facility Services Manager** and **Power Plant Engineer**.

Mr. Billings has **Master** and **Bachelor** degrees in **Petroleum Engineering** and **Power Engineering**. He is a **licensed Professional Engineer**, a **Certified Instructor/Trainer** and a well respected member of the **Society of Petroleum Engineers** (**SPE**). Further, he has conducted **numerous industry short courses** and **SPE workshops**.

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.

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

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

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	***PRE-TEST***
0830 - 0930	***Welltest Analysis –Review of Basic Concepts***
0930 - 0945	*Break*
0945 – 1030	***Welltest Analysis -Gas Wells & Multi-Phase Flow***
1030 – 1100	***Fluid Properties: Modifications for Gas Wells & Multiphase Flow***
1100 – 1130	***Interpretation for Horizontal & Vertical Permeability, Skin & Effective Flowing Length***
1130 - 1230	***Acidized Horizontal Wells***
1230 - 1245	*Break*
1245 – 1345	***Effect of Layering, Formation Thickness***
1345 - 1420	***Constant Pressure Boundary (Gas Cap)***
1420 - 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 - 0830	***Integration of Production Logging***
0830 – 0930	***Condensate-Gas Relative Permeability***
0930 – 0945	*Break*
0945 – 1030	***Importance of Compositional Analysis***
1030 – 1145	***Liquid Drop-out Effect***
1145 - 1230	***Non-Darcy Flow in Gas Condensate Wells***

1230 - 1245	Break
1245 – 1330	**Radial Composite Behavior**
1330 - 1420	**Analyze Drawdown & Buildup Tests in Oil & Gas Wells?**
1420 - 1430	**Recap**
1430	Lunch & End of Day Two

Day 3

0730 - 0830	**Extended Drawdown Testing**
0830 – 0930	**Compartmentalized Reservoir Behavior**
0930 – 0945	Break
0945 – 1030	**Extended Buildups & Recharging**
1030 – 1145	**Reserve Estimation**
1145 - 1230	**Flow Regimes Identifying Using the Log-Log Diagnostic Plot?**
1230 - 1245	Break
1245 – 1330	**Characteristic Pressure Behavior for Common Bounded Reservoir Geometries?**
1330 - 1420	**Well Test Data Affected by Various Wellbore & Near-Wellbore Phenomena?**
1420 - 1430	**Recap**
1430	Lunch & End of Day Three

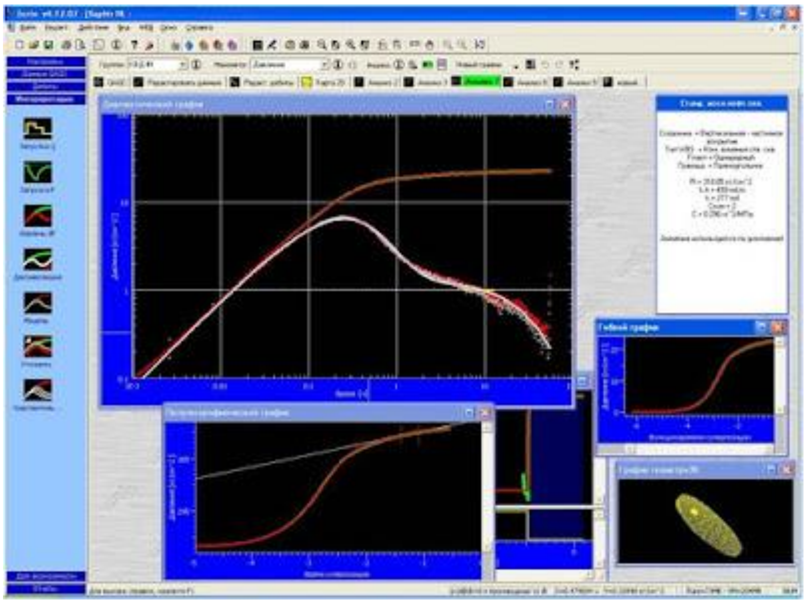
Day 4

0730 - 0830	**Design a Well Test to Meet Desired Objectives**
0830 – 0930	**Estimate Average Drainage Area Pressure?**
0930 – 0945	Break
0945 – 1030	**Analyze Well Tests in Hydraulically Fractured Wells, Horizontal Wells & Naturally Fractured Reservoirs**
1030 – 1100	**Post Hydraulic Fracture Analysis**
1100 - 1120	**Interference Test Procedure & Analysis**
1120 - 1230	**Finite Conductivity Fractures**
1230 - 1245	Break
1245 – 1330	**Bilinear & Pseudo Radial Flow Regimes**
1330 - 1420	**Type Curves for Well Test Interpretation**
1420 - 1430	**Recap**
1430	Lunch & End of Day Four

Day 5

0730 - 0830	**Fracture Skin & Non-Darcy Flow in Gas Wells**
0830 – 0930	**Importance of Pre-Fracture Testing**
0930 – 0945	Break
0945 – 1030	**Difficulties in Analyzing WT Incomplex**
1030 – 1120	**Slug Test Analysis**
1120 - 1200	**Non-ideal Wellbore Storage**
1200 – 1230	**Injection Wells**
1230 – 1245	Break
1245 – 1345	**Relevant Real Cases for Analysis & Interpretation**
1345 – 1400	**Course Conclusion**
1400 – 1415	**POST-TEST**
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course

Simulator (Hands-on Practical Sessions)
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the "ECRIN/PAN" software.



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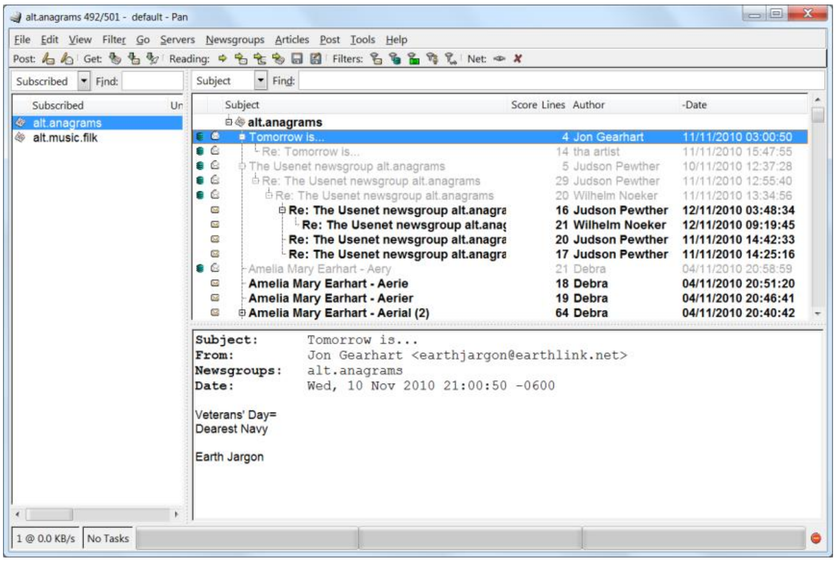

PAN

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