COURSE OVERVIEW DE0280-4D
Advanced Well Testing Design & Analysis

Course Title
Advanced Well Testing Design & Analysis

Course Reference
DE0280-4D

Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	September 16-19, 2024	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
2	November 18-21, 2024	Al Aziziya Hall, The Proud Hotel Al Khobar, Al Khobar, KSA

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.

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 is an advanced level seminar designed for petroleum and reservoir engineers who may be required to design and/or interpret non-routine well tests. Participants will be introduced to a systematic approach to well test analysis and will apply it using modern well test analysis software. Numerous data sets with non-ideal behavior will be reviewed and analyzed to allow participants to gain experience with real world problems. Participants will be able to apply their newly acquired skills in their job assignments immediately upon seminar completion. A well test that achieves the objectives is not accomplished by accident. A well test design is a planned activity that uses the pre-test well/reservoir information to reduce the risk of wasting test money. By coupling the well test design service with the real-time operations (RTO) service that monitors and analyzes the test data in real-time, the success of a well test is greatly enhanced. The seminar provides many examples from all over the world which are used to illustrate the various techniques. Participants will take from the seminar clear and systematic methodologies to tackle the more demanding types of well test commonly encountered.

Course Objectives

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

- Apply and gain an in-depth knowledge in well test design and analysis
- Identify properties of gas condensate wells and implement the latest techniques for extended drawdown testing
- Appreciate the importance of WTA in reservoir modeling and monitoring
- Increase confidence in carrying out post hydraulic fracture analysis
- Determine the common difficulties in analyzing WT incomplex
- Illustrate how slug test analyses are performed
- Improve understanding in non-ideal wellbore storage
- Identify injection wells and its components
- Recognize the procedures and advantages of computer aid analysis (hands on simulators)
- Gain ample lessons from relevant real cases for analysis & 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, 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 well test design and analysis for petroleum engineers, reservoir engineers and reservoir technical assistants.

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 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 **2.4 CEUs** (Continuing Education Units) or **24 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.

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:

Ms. Diana Helmy, PgDip, MSc, BSc, is a **Senior Petroleum & Geologist** with extensive years of experience within the **Oil & Gas**, **Refinery** and **Petrochemical** industries. Her expertise widely covers in the areas of **Reservoir** Engineering, **Reservoir Geophysics**, **Reservoir** Characterization & Management, **Reservoir** Surveillance & Management, **Integrated Reservoir** Analysis, **Reservoir Hydrocarbon Fluid** Classification, **Reservoir Volumetrics**, **PVT** Analysis, **Resource & Reserve Evaluation**, **Reserves Estimation & Uncertainty**, Methods for **Aggregation of Reserves & Resources**, **Horizontal & Multilateral Wells**, **Well Completion & Stimulation**, **Artificial Lift System Selection & Design**, **Well** Testing & Oil Well Performance, **Well** Test Design Analysis, **Well Test** Operations, **Well Testing & Perforation**, **Directional** Drilling, **Formation Damage** Evaluation & Preventive, **Formation Damage** Remediation, **Drilling & Formation Damage**, Simulation Program for The **International Petroleum Business**, **Well** Testing & Analysis, **Horizontal & Multilateral Wells & Reservoir** Concerns, **Oil & Gas Analytics**, **Petrophysics & Reservoir Engineering**, **Subsurface Geology & Logging** Interpretation, **Petroleum Geology**, **Geophysics**, **Seismic** Processing & Exploration, **Seismic** Interpretation, **Sedimentology**, **Stratigraphy & Biostratigraphy**, **Petroleum Economy**, **Core** Analysis, Well Logging Interpretation, **Core Lab Analysis** & **SCAL**, **Sedimentary Rocks**, **Rock** Types, Core & Ditch Cuttings Analysis, Clastic, Carbonate & Basement Rocks, **Stratigraphic Sequences**, **Petrographically** Analysis, Thin Section Analysis, Scanning Electron Microscope (**SEM**), X-ray Diffraction (**XRD**), Cross-Section Tomography (**CT**), **Conventional & Unconventional** Analysis, **Porosity & Permeability**, **Geological & Geophysical** Model, **Sedimentary** Facies, **Formation Damage** Studies & Analysis, **Rig** Awareness, 2D&3D **Seismic** Data Processing, Static & Dynamic Correction, Noise Attenuation & Multiple Elimination Techniques, Velocity Analysis & Modeling and various software such as Petrel, OMEGA, LINUX, Kingdom and Vista.

During her career life, Ms. Diana worked as a **Reservoir Geologist**, **Seismic Engineer**, **Geology Instructor**, **Geoscience Instructor & Consultant** and **Petroleum Geology Researcher** from various international companies like the **Schlumberger**, Corex Services for Petroleum Services, Petrolia Energy Supplies and Alexandria University.

Ms. Diana has a **Postgraduate Diploma** in **Geophysics**, **Master's** degree in **Petroleum Geology** and **Geophysics** and a **Bachelor's** degree in **Geology**. Further, she is a **Certified Trainer/Assessor/Internal Verifier** by the **Institute of Leadership & Management** (**ILM**) and has delivered numerous trainings, courses, workshops, seminars and conferences internationally.

Course Fee

US$ 6,750 per Delegate + **VAT**. 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	***Introduction*** *Welltest Analysis –Review of Basic Concepts ● Brief Review of Basic Concepts for Test Analysis; Type Curves: Semilog Analysis, Analytical ● Welltest Analysis -Gas Wells and Multi-Phase Flow ● Fluid Properties: Modifications for Gas Wells and Multiphase Flow*
0930 – 0945	*Break*
0945 – 1100	***Horizontal Wells*** *Interpretation for Horizontal & Vertical Permeability, Skin and Effective Flowing Length*
1100 – 1230	***Horizontal Wells (cont'd)*** *Acidized Horizontal Wells ● Effect of Layering, Formation Thickness*
1230 – 1245	*Break*
1245 – 1420	***Horizontal Wells (cont'd)*** *Constant Pressure Boundary (Gas Cap) ● Integration of Production Logging*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Gas Condensate Wells*** *Condensate-Gas Relative Permeability ● Importance of Compositional Analysis ● Liquid Drop-out Effect*
0930 – 0945	*Break*
0945 – 1100	***Gas Condensate Wells (cont'd)*** *Non-Darcy Flow in Gas Condensate Wells ● Radial Composite Behavior*
1100 – 1230	***Extended Drawdown Testing*** *Objectives of Extended Tests ● Problems of Rate Variation ● Approximate and Exact Convolution*
1230 – 1245	*Break*
1245 – 1420	***Extended Drawdown Testing (cont'd)*** *Compartmentalized Reservoir Behavior ● Extended Buildups and Recharging ● Reserve Estimation*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Importance of WTA in Reservoir Modeling & Monitoring***
0930 – 0945	*Break*
0945 – 1100	***Post Hydraulic Fracture Analysis*** *Finite Conductivity Fractures ● Bilinear and Pseudo Radial Flow Regimes ● Type Curves for Well Test Interpretation*
1100 – 1230	***Post Hydraulic Fracture Analysis (cont'd)*** *Fracture Skin ● Non-Darcy Flow in Gas Wells ● Importance of Pre Fracture Testing*
1230 – 1245	*Break*
1245 – 1420	***Difficulties in Analysing WT Incomplex***
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

0730 – 0930	***Slug Test Analysis*** *Variable Rate Methods ● Wellbore Fill Up Phenomenon ● Analytical Solution and Type Curve ● Rate Determination from Pressure Signal*
0930 – 0945	*Break*
0945 – 1100	***Slug Test Analysis (cont'd)*** *Convolution Analysis ● Testing while Perforating ● Application to Coal Bed Methane ● Closed Chamber Tests*
1100 – 1230	***Non-ideal Wellbore Storage*** *Models for Non-Ideal Wellbore Storage ● Gas or Fluid Segregation in the Wellbore ● Use of Multiple Pressure Gauges ● Temperature Changes During Build Up ● Wells Producing a Small Water Cut*
1230 – 1245	*Break*
1245 – 1345	***Injection Wells*** *Radial Composite Analytical Solution ● Interpretation Using Derivative Type Curves and Semilog Analysis ● Pressure in Inner and Outer Regions ● Gas and Steam Injection Wells ● Problems Due to Unfavorable Displacement ● Gas Storage Projects ● Thermal Fracturing*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

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

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org