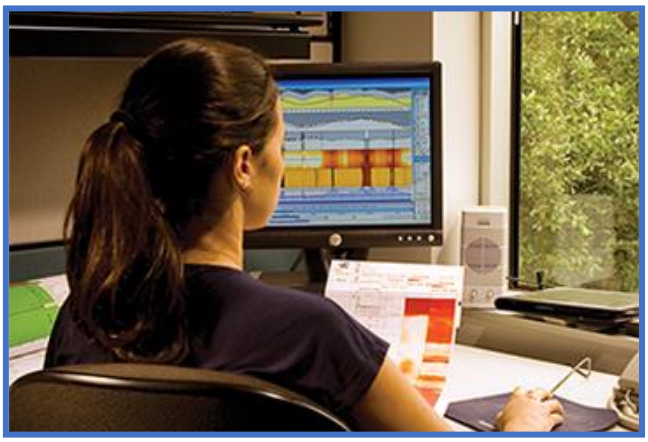
COURSE OVERVIEW DE0143
Formation Evaluation
(E-Learning Module)

Course Title
Formation Evaluation
(E-Learning Module)



Course Reference
DE0143

Course Format & Compatibility
SCORM 1.2. Compatible with IE11, MS-Edge, Google Chrome, Windows, Linux, Unix, Android, IOS, iPadOS, macOS, iPhone, iPad & HarmonyOS (Huawei)

Course Duration
30 online contact hours
(3.0 CEUs/30 PDHs)

Course Description

This E-Learning course is designed to provide participants with a detailed and up-to-date overview of formation evaluation. It covers the reservoir modelling, gathering data, subsurface geological procedures, mudlogging and coring assembly and core bit; the well log analysis, logging while drilling and well log interpretation; the common types of logs including gamma ray log, spontaneous potential (SP) log, SP log, sonic log and etc.; the Archie's equation, formation properties from cased-hole logs; the cased hole logging measurements, drill stem testing, subsurface mapping and reading assignment formation evaluation; the isometric view of dipping plane and curved surface; the coring, core preservation, core analysis, open hole logging, formation testing, well test analysis and well logging; and the principle of well logging, electrical logs, resistivity logs, induction logs, dielectric logs and etc.

During this course, participants will learn the GR and neutron tools and early porosity; the recovery of physical rock samples and formation fluid samples with wireline tools; the open hole logging measurements, value and limitations of well log data; the nomenclature for zones in and around the borehole, sources of subsurface data and well logging history; the advantages and limitations of well logging, the basic theory of measurements and resistivity; the resistivity and measurement concept and the schematic diagram of how an induction tool works; the common tools in the logging industry and the typical properties implied or estimated from the log measurements; and the modern formation for fluid identification and other logs applications.

Course Objectives

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

- Apply and gain an in-depth knowledge on formation evaluation
- Employ reservoir modelling, gathering data, subsurface geological procedures, mudlogging and coring assembly and core bit
- Carryout well log analysis, logging while drilling and well log interpretation
- Recognize the common types of logs including gamma ray log, spontaneous potential (SP) log, SP log, sonic log and etc.
- Describe Archie's equation, formation properties from cased-hole logs
- Perform cased hole logging measurements, drill stem testing, subsurface mapping and reading assignment formation evaluation
- Illustrate isometric view of dipping plane and curved surface
- Employ coring, core preservation, core analysis, open hole logging, formation testing, well test analysis and well logging
- Apply the principle of well logging and review electrical logs, resistivity logs, induction logs, dielectric logs and etc.
- Recognize GR and neutron tools and early porosity as well as employ recovery of physical rock samples and formation fluid samples with wireline tools
- Determine open hole logging measurements as well as value and limitations of well log data
- Discuss the nomenclature for zones in and around the borehole, sources of subsurface data and well logging history
- Explain the advantages and limitations of well logging, the basic theory of measurements and basic theory on resistivity
- Illustrate resistivity and measurement concept and the schematic diagram of how an induction tool works
- Recognize the common tools in the logging industry and the typical properties implied or estimated from the log measurements
- Describe the modern formation for fluid identification and identify other logs applications

Who Should Attend

This course provides an overview of all significant aspects and considerations of formation evaluation for geologists, reservoir engineers, geophysicists, technical assistants, and support staff requiring an introduction to, or a refresher course on, formation evaluation.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- USA International Association for Continuing Education and Training (IACET)

  Haward Technology is an Authorized Training Provider by the International Association 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 1-2013 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 1-2013 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 Association 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

As per proposal

Training Methodology

This Trainee-centered course includes the following training methodologies:-

- Talking presentation Slides (ppt with audio)
- Simulation & Animation
- Exercises
- Videos
- Case Studies
- Gamification (learning through games)
- Quizzes, Pre-test & Post-test

Every section/module of the course ends up with a Quiz which must be passed by the trainee in order to move to the next section/module. A Post-test at the end of the course must be passed in order to get the online accredited certificate.

Course Contents

- Outline Formation Evaluation
- Reservoir Modelling
- Gathering Data
- Subsurface Geological Procedures
- Mudlog Example
- Mud Logging
- Cores
- Information from Cores
- Coring Assembly and Core Bit
- Whole Core
- Sidewall Sampling Gun
- Sidewall Coring Tool
- Wireline Logging
- Well Log Analysis
- Logging While Drilling
- Openhole Well Logs
- Borehole Conditions
- Well Log Interpretation
- Common Types of Logs

- Gamma Ray Log
- Spontaneous Potential (SP) Log
- SP Log
- Sonic Log
- Density Log
- Neutron Log
- Resistivity Log
- Archie's Equation
- Example Log Suite
- Logging While Drilling (LWD)
- Cased-Hole Logs
- Formation Properties from Cased-Hole Logs
- Why Log Cased Wells?
- Cased Hole Logging
- Cased Hole Logging Measurements
- Common Cased-Hole Logs
- Reading Assignment Well Logging
- Drill Stem Testing
- Drill Stem Test Pressure History
- Modular Dynamic Tester
- Subsurface Mapping
- Contour Maps
- Isometric View of Dipping Plane
- Isometric View of Curved Surface
- Reading Assignment Formation Evaluation
- Summary Formation Evaluation
- Exercises Formation Evaluation
- Exercise 1
- Exercise 2
- Exercise 3
- Exercise 4
- Formation Evaluation 2
- Formation Evaluation
- Contents

- What is formulation evaluation
- Why formation evaluation
- Coring
- Core preservation
- Core analysis
- Open hole logging
- Principle of well logging
- Electrical logs
- Spontaneous potential (SP) Log
- Resistivity Logs
- Induction Logs
- Dielectric Logs
- Nuclear Logs
- Gamma Ray Log
- Neutron Log
- Formation Density Log
- Sonic or Acoustic Logs
- Logging While Drilling
- Formation Testing
- Wireline Testing
- Drillstem Test (DST)
- Well Test Analysis
- Cased-hole Logging
- Formation Evaluation 3
- Formation Evaluation
- Well Logging
- Evaluation Sequence
- What Subsurface Information is Important?
- Formation Evaluation is Critical to Understanding the Reservoir
- Logging History.
- Electrical Logging
- Dipmeter Log
- GR and Neutron Tools (First Use of Radioactive Properties in Well Logging)
- Early Porosity Determination & Microresistivity Measurement

- Induction Log (Replace Original Electrical Log in Freshwater Muds)
- Sonic Log
- Density Log
- Recovery of Physical Rock Samples & Formation Fluid Samples with Wireline Tools
- Types of Well Logging
- Open Hole Logging
- Electrical Logs
- Sonic/Acoustic Logs
- Caliper Logs
- Dipmeter Logs
- SP Logs
- Radioactive Logs
- Open Hole Logging Measurements
- Production Logging
- Value and Limitations of Well Log Data
- Strengths
- Limitations
- Petrophysical Logging Tools – Primary
- Some Questions Addressed by Log Interpretation
- Geophysicist/Geologist
- Reservoir Engineer
- Production Engineer
- Wireline Logging Equipment
- Computerized Logging Units
- Details of Wireline Logging Rigup
- Logging Cable
- Log Presentation
- Log Presentation - The Heading
- Log Presentation - Linear Grid
- Log Presentation - Common Depth Scales
- Types of Logs to be Run
- Mud Filtrate Invasion
- Common Terminology

- Borehole
- Invaded zone
- Uninvaded zone
- Radial Fluid and Resistivity Distribution
- Rt Rx0
- Fresh Mud, Salt Water Zone
- Nomenclature for Zones in and Around the Borehole
- Sources of Subsurface Data
- Mud Log
- Sources of Data – Mud Log
- Coring – Conventional
- Sources of Data – Core
- Coring – Sidewall
- Sources of Subsurface Data
- Sources of Data – Logs
- Basic Well Logging Design
- Definition
- Well Logging History
- Log Measurements
- Practical Definition of a log
- Advantages and Limitations of Well Logging
- Basic Theory of Measurements
- Logs are Implied Measurements
- Basic Theory on Resistivity
- Typical Formation
- Resistivity and Measurement Concept
- Schematic Diagram of How an Induction Tool Works
- Resistivity Application
- Spontaneous Potential Log (SP)
- RW calculation from SP Log
- Gamma Ray Log (GR)
- Natural Gamma Ray Log (NGT)
- Density Log
- Neutron Log

- Acoustic Log
- Special Tools
- Wellbore Seismic
- Log and Seismic Tie Effort
- Synthetic Seismograms
- VSP& Seismic Section
- Velocity Survey
- Vertical Seismic Profile
- Basic Concept of VSP
- Offset VSP
- Multiple offset and walkaway VSP
- Basic Log Interpretation
- Logs Data Applications
- Common Tools in the Logging Industry
- Typical Properties Implied or Estimated from the Log Measurements
- Petrophysical Properties
- Permeability Estimation from Logs
- Fluid Types and Lithology of Major Reservoirs, and Practical Applications of Log Data
- Fluid and Lithology Identification from the Logs
- How can We Remember these Easily? About Lithology Interpretation
- How can We Remember these Easily? About Fluid Interpretation
- Are there any Anomalies? About Fluid Interpretation
- How is Log Analysis Calibrated?
- Core Data
- Formation Test
- Modern Formation for Fluid Identification
- Basic Components of the Tool
- Gas Detector System
- How of a Device Operates?
- How can We Differentiate Fluid Types?
- OFA Spectrometer
- Example-1: Gas OFA
- Example-2: Water OFA

- Example-3: Oil OFA
- Are There Any Other Logs Applications?
- The Logs Can Help Us to Determine:
- Hydrocarbon Reserves Estimate
- Lateral Continuity?
- Compaction Trend?
- Fundamentals of Rock Properties
- Presentation Overview
- What is a Reservoir Rock
- Four fundamentals components of sedimentary rocks
- Properties of Reservoir Rocks
- Porosity
- Classification of porosity
- Types of Porosity
- Factors that affect porosity
- Primary
- Secondary (diagenetic)
- Permeability
- Three types of permeability
- Fluid saturation
- Saturation Type
- Wettability
- Surface and interfacial tension
- Capillary Pressure
- Rock compressibility
- Conclusion
- Porosity Determination from Logs
- Openhole Log Evaluation
- Porosity Log Types
- 3 Main Log Types
- Density Logs
- Bulk Density
- Porosity from Density Log
- Bulk Density Log

- Neutron Log
- Porosity from Neutron Log
- Acoustic (Sonic) Log
- Common Lithology Matrix Travel Times Used
- Example
- Example Solution Sonic Log
- Factors Affecting Sonic
- Log Response
- Responses of Porosity Logs
- The Three Porosity Log
- Combinations of Logs
- GAS EFFECT
- Estimating Porosity from Well Logs
- Influence of Clay-Mineral Distribution on Effective Porosity
- Geological and Petrophysical Data Used to Define Flow Units
- Schematic Reservoir Layering Profile in a Carbonate Reservoir
- Factors Affecting the Log Response
- Depth of Investigation and Resolution of Logging Tools
- Tools Size and Measuring point for Typical Oil Based Mud Environment
- Tool Specification
- Resistivity Measurement Problems and Limitations
- Effects of Borehole Environment
- Invasion Profile
- SP Log Limitations
- GR Log Limitations
- Density Log Limitations
- Neutron Log Limitations
- Sonic Log Limitations
- Formation Test Log Limitations
- Well Evaluation Strategy
- Why Wireline Well logging
- Disadvantages of Wireline logging
- Important Issues with Running Wireline logs
- Logging while Drilling

- Why LWD?
- Disadvantages of LWD
- LWD and Wireline Comparison
- Wireline Log Example
- LWD Real time and Recorded Logs
- Selecting the Tools to run
- What tools do you run in the hole?
- Ability to Define Your Need
- Type of Information to Acquire
- Geology
- Geophysics
- Type of Information
- Petrophysics
- Reservoir
- Rock Mechanics
- Understand the Scales of Observation
- Scales of Observation
- Various Well Logging Designs
- Well Logging Design Objective
- Well Logging Design-1
- Onshore well
- Well Logging Design-1
- Well Logging Design-2
- Example-1- Logging Program
- Example-2Logging Program
- Important Aspects to Consider
- Risk
- Cost
- Environment
- Hole Size
- Well Design
- Tool Speed
- What do you have in mind?
- Exploratory Well

- Development Well
- An Example of rather complex Logging Program Decision Tree
- Another Way to Save Cost
- Project Base Approach
- Exercise with well log design
- Exercise-1
- Exercise-2
- Exercise-3
- Exercise-4
- Electrical Properties Archie's Law
- Formation Factor
- Formation Factor Equation
- Formation Factor - Example Core Data
- Formation Factor
- Saturation Equation
- Lab Evaluation of N
- R0 Appears in Both Equations
- Archie's Equation (Combined)
- Saturation Equation
- Lab Evaluation of N
- R0 Appears in Both Equations
- Archie's Equation (Combined)
- Idealized Log Set
- Drilling Disturbs Formation
- Effect of Filtrate Invasion – Rnear well □ Rt (Permeability Present)
- Example Log with Resistivity
- Laboratory Resistance
- Laboratory Resistivity
- Electrical Conductivity and Resistivity
- DC Electrical Resistivity Experiment
- Low Frequency Behavior
- DC Electrical Resistivity Experiment
- Approximate Equivalent Circuit
- Factors Affecting Resistivity of Reservoirs

- Electrical Resistivity of Rock Constituents
- Electrical Resistivity of Rocks Main Tendencies
- Electrical Resistivity of Clean Porous Rocks
- Archie 1942
- Archie's Clean Sand Equation
- Effective DC
- Electrical Resistivity of Rock Constituents
- Formation Factory vs Porosity
- Formation Evaluation (Petrophysics)
- Electrical Logs
- Self (Spontaneous) Potential (SP) log
- SP Log "Definition"
- SP Log Example
- SP Scales
- SP Log "General Uses"
- Practical Uses of SP Logs
- Theory of Measurement
- Self-Potential Log and Resistivity Logs
- Self-Potential Log
- Theory of Measurement
- Resistivity Logs
- SP LOG Example
- SP Phenomena in Hydrocarbon Wells: Electrokinetic (Streaming) Potential
- Borehole Phenomenon
- Static SP Potential
- Factors Affecting SP Log Measurements
- SP Log Example
- RW from the SP Log
- RW Calculation from SP
- Applications
- Formation Evaluation and Well Log Correlation
- Overview
- Well Log
- Basic Logs Tools and their Measurements

- Calliper Log
- Basic Logs Tools and their Measurements
- Density Log
- Basic Logs Tools and their Measurements Neutron log
- Petrophysical Interpretation
- Qualitative Assessment
- Quantitative Assessment
- Basic Steps for Quick Look Evaluation
- Qualitative Interpretation
- Estimation of Porosity
- Quantitative Interpretation Estimation of Hydrocarbon Saturation
- Quantitative Interpretation Archie's equation
- Quantitative Interpretation
- Quantitative Interpretation Calculation of Water Saturation in Oil and Gas Zones
- Qualitative Interpretation V/s Quantitative Interpretation
- Formation Evaluation Subsurface Methods
- Formation Density Log Determination of Porosity
- Porosity Evaluation from Sonic
- Typical Hydrocarbon/Water Contact on Resistivity Log
- Formation Evaluation from Well Logs
- Shaliness
- Formation Evaluation from Well Logs
- Water/Hydrocarbon Saturation Determination
- Porosity Determination
- In Gas-Filled Reservoirs
- In Oil Reservoirs
- Porosity Determination
- Gas
- Detecting a Depleted Gas Reservoir When Cross-Plot Porosity Exceeds 10-12 Porosity Units, Pressure Depletion can be Presumed
- From cores
- Pressure Decline Testing
- Determination of Permeability (K)
- Porosity vs. Permeability Plot

- Interpreted Quantitatively
- From Porosity and Swi
- From SP Logs
- Dispositional Environments and Process
- Fining Upward
- Coarsening Upward
- Blocky Log Signature
- Table 1. Mud Density Measurements Comparison
- Resistivity of NaCI Solutions