COURSE OVERVIEW DE0894
Rock Physics and Petrophysics for Seismic Interpretation (E-Learning Module)

Course Title
Rock Physics and Petrophysics for Seismic Interpretation
(E-Learning Module)

Course Reference
DE0894

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 is designed to provide participants with a detailed and up-to-date overview of rock physics and petrophysics for seismic interpretation. It covers the petro-elastics, rock-physics, synthesis, hypothesis and study of seismic velocities; the impact of reservoir properties on velocity, influence of porosity, lithology and the effect of effective pressure; the basics for pore pressure prediction from seismic data, Eaton’s method, confining pressure, well prediction and effect of fluids and temperature; and the basics for pore pressure prediction from seismic data, Eaton’s method, confining pressure, well prediction and effect of fluids and temperature.

During this interactive course, participants will learn the modelling fluid impact on elastic parameters, ground media and wave propagation; the viscoelastivity/quality factor, velocity & dispersion, synthesis and the main influent factors; the reservoir seismic characterization, petrophysics for seismic interpretation and fluid replacement modelling; the tips for using Gassmann’s equation, patchy saturation, seismic interpretation and data acquisition methods; the petrophysical measurements, neutron logging, sonic logging, saturation and integration yields best results; and the seismic petrophysics workflow and seismic lithology.

Course Objectives

After completing the course, the employee will:-

- Apply systematic techniques on rock physics and petrophysics for seismic interpretation
- Understand rock physics vs petrophysics, anisotropy, elastic properties, heterogenous media
- Understand modulus-porosity relationship, critical porosity, Gassmann's equation
- Understand velocity-porosity relation for shales, shaly sand & carbonates, VP & Vs, rock compressibility, elastic impedance, Reflection coefficient, AVO
- Understand pore pressure and effective stress, Biot theory, poroelasticity, fracture gradient, stress modeling, stress sensitivity of shales & sands
- Understand shale anisotropy, fractured reservoir, rock physics models for fractures, seismic characterization of fractured reservoir
- Understand borehole stability, reservoir Geomechanics and 4D seismic monitoring
- Apply rock physics and petrophysics for seismic interpretation as well as seismic reservoir characterization
- Discuss petro-elastics, rock-physics, synthesis, hypothesis and study of seismic velocities
- Explain the impact of reservoir properties on velocity, influence of porosity, lithology and the effect of effective pressure
- Discuss the basics for pore pressure prediction from seismic data, Eaton’s method, confining pressure, well prediction and effect of fluids and temperature
- Illustrate the modelling fluid impact on elastic parameters, ground media and wave propagation
- Identify the viscoelastivity/quality factor, velocity & dispersion, synthesis and the main influent factors
- Carryout reservoir seismic characterization, petrophysics for seismic interpretation and fluid replacement modelling
- Apply the tips for using Gassmann’s equation, patchy saturation, seismic interpretation and data acquisition methods
- Carryout petrophysical measurements, neutron logging, sonic logging, saturation and integration yields best results
- Illustrate seismic petrophysics workflow and seismic lithology

Who Should Attend

This course covers systematic techniques and methodologies on rock physics and petrophysics for seismic interpretation for geoscientists, petrophysicists, and engineers wishing to understand rock physics and learn how to work together in integrated teams to build geomechanical models.

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.

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 Fee

As per proposal

Course Contents

- Rock Physics and Petrophysics for Seismic interpretation
- Seismic Reservoir Characterization
- Petro-elastic and Seismic Reservoir Characterization?
- What is Petro-Elastics?
- Why do We Need Rock-Physics?
- How does it Work in Practice
- Synthesis
- Definitions
- Hypothesis
- Static & Elastic Moduli
- Study of Seismic Velocities
- Impact of Reservoir Properties on Velocity
- Porosity Definition
- Influence of Porosity
- Influence of Lithology
- Effect of Effective Pressure
- Pressures-Overpressures

- Basics for Pore Pressure Prediction from Seismic Data
- Eaton's Method
- Confining Pressure
- Hydrostatic Pp
- Results
- Principals of Well Prediction
- Pore Pressure Prediction from Seismic Velocities
- Overpressures with Normal Trend from Closest Wells
- Pore Pressure Prediction from Prospect Location
- Comparisons between the Two Approaches
- Effect of Fluids
- Effect of Temperature
- Some Other Factors
- Modeling Fluid Impact on Elastic Parameters
- Composite Materials
- Ground Media and Wave Propagation
- Anisotropy
- Viscoelastivity/Quality Factor
- Velocity & Dispersion
- Synthesis
- From Rock Physics to Geophysics
- Why do We Need Rock-physics?
- What do We Need
- What do We Need – Fluid Data
- Identification of Main Influent Factors
- Rock Physics Model (RPM)
- RPM in Reservoir Seismic Characterization
- Rock Physics & Petrophysics for Seismic Interpretation
- Rock Physics & Fluid Replacement Modelling
- Basic Rock Physics
- What is Rock Physics
- Why Study Rock Physics
- Density

- Density versus Water Saturation
- P & S- Wave Velocities
- Definitions
- Elastic Moduli
- Bulk Modulus
- Shear Modulus
- Young's Modulus
- Hooke's Law
- Velocity Equations Using K and μ
- Poisson's Ratio
- Velocity vs Saturation using Volume Averaging
- The Biot-Gassmann Equations
- Biot-Gassmann – Shear Modulus
- Biot-Gassmann – Saturated Bulk Modulus
- Biot Formulation
- The Rock Matrix Bulk Modulus
- The Fluid bulk Modulus
- Estimating K_{dry}
- Data Examples
- Velocity vs Saturation of Gas
- Poisson's Ratio vs Saturation of Gas
- Poisson's Ratio vs Saturation of Oil
- Tips for Using Gassmann's Equation
- Patchy Saturation
- The Mudrock Line
- Using the Biot-Gassmann Equations
- Conclusions
- Rock Physics and Petrophysics for Seismic interpretation
- Rock Physics – The Link
- Connection between Seismic Event and Rock Properties
- Predicting Change in Seismic Event Following Time-Lapse
- Bulk Density, Pore Fluids, Porosity
- Assessing Change in Bulk Density – Pressure Depletion Effects

- Range of Bulk Stiffness for Rock Frame and Pore fluids
- Amplitude Versus Offset (AVO)
- Rock Physics and Petrophysics for Seismic interpretation
- Introduction to Petrophysics
- Defining Petrophysics
- Petrophysics – Basic Deliverables for a Well
- Data Acquisition Methods
- Scale
- Data Acquisition
- Vertical Resolution of Well Logs
- Petrophysical measurements
- Family of Nuclear Tools
- Quick Look Evaluation
- Quick Look Evaluation – Lithology
- Shale Fraction
- GR-VSH Quick Look Evaluation
- Porosity
- Interpretation/Uses
- Quick Look Evaluation – Porosity
- Neutron Logging
- Sonic Logging
- Saturation
- Resistivity – Induction & Lateorlog
- Quick Look Evaluation – Saturation
- Net/Gross
- Quick Look Evaluation – Summary
- Formation Pressure
- Free Water Level vs Oil Water Contact
- Permeability Fundamentals
- Permeability – Source of Information
- Permeability
- Summary Petrophysics
- Benefits of Integrating Rock Physics with Petrophysics

- The Integrated Workflow
- Integration Yields Best Results
- Integration Benefit
- Rock Physics
- Where is the Gas
- Petrophysics, Log
- Amplitude Variations with Offset (AVO)
- The PSTM CDP Gather
- AVO Gradient Analysis
- AVO Analysis
- Seismic Petrophysics
- Crossplot of P&G
- LithSies Modeling Methodology
- Conventional Seismic Modeling
- Rock Modeling Summary
- 1000 Models
- From Shale to 6% Porosity Sand Wet. Gas
- From Shale to 10% Porosity Sand Wet. Gas
- From Shale to 14% Porosity Sand Wet. Gas
- From Shale to 18% Porosity Sand Wet. Gas
- From Shale to 22% Porosity Sand Wet. Gas
- From Shale to 26% Porosity Sand Wet. Gas
- From Shale to 30% Porosity Sand Wet. Gas
- From Shale to 34% Porosity Sand Wet. Gas
- From Shale to 38% Porosity Sand Wet. Gas
- From Shale to 42% Porosity Sand Wet. Gas
- From Shale to 46% Porosity Sand Wet. Gas
- Laminated Sands
- From Shale to 30% Porosity Sand Wet. Gas
- From Shale to 30% Porosity, Laminated Sand Wet. Gas
- Thickness
- Sand with Porosity from 0 to 46% 4ms Thick
- Sand with Porosity from 0 to 46% 8ms Thick

- Sand with Porosity from 0 to 46% 12ms Thick
- Sand with Porosity from 0 to 46% 16ms Thick
- Sand with Porosity from 0 to 46% 20ms Thick
- Sand with Porosity from 0 to 46% All Thicknesses
- Results of 1000's Models 100's Data Sets
- Rocks vs. Distance & Direction
- How does this Fit with Reality?
- AVO Type Tendencies
- Seismic Petrophysics Workflow
- Seismic lithology/AVO Response
- Examples Depositional Facies
- Lithology/Fluid and AVO Types
- Lithology/Fluid Response, Surface
- AVO Type Response, Surface
- LithSeis data, Section Views