COURSE OVERVIEW DE0895
Seismic Reflection
(E-Learning Module)

Course Title
Seismic Reflection (E-Learning Module)

Course Reference
DE0895

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 seismic reflection. It covers the geophysics, waves, seismic waves, wavefronts and raypaths; the parameters associated with a wave including the types of waves; the particle motion, elastic deformations, wave energy, wave velocity and typical p-wave velocities; the Huygens principle, reflections and critical refractions; the reflection and transmission coefficient, critical angle, energy arrivals and refracted waves; and the spherical waves and attenuation.

During this course, participants will learn the spherical divergence, bandpass filter panels of raw shot record; the seismic trace, geologic section, generation of noise-free seismic trace, coincident sources and receivers and traces recorded from coincident sources and receivers; the normal moveout for a dipping reflector, simple and simple multiple NMO model; the temporal resolution, temporal aliasing and simple migration model; the processing and migration of seismic recordings, the seismic methods and surveying; the elastic moduli and P and S velocities; the reflection and transmission; the typical rock velocity ranges; the factors affecting velocity; and the reflection surveying, seismic reflection processing, demultiplexing, editing and muting.

Course Objectives

After completing the course, the employee will be able to:-

- Apply and gain a comprehensive knowledge on seismic reflection
- Discuss geophysics, waves, seismic waves, wavefronts and raypaths
- Identify the parameters associated with a wave including the types of waves
- Describe particle motion, elastic deformations, wave energy, wave velocity and typical p-wave velocities
- Explain Huygens principle as well as reflections and critical refractions
- Identify reflection and transmission coefficient, critical angle, energy arrivals and refracted waves
- Recognize spherical waves and attenuation including spherical divergence, bandpass filter panels of raw shot record
- Review seismic trace, geologic section, generation of noise-free seismic trace, coincident sources and receivers and traces recorded from coincident sources and receivers
- Determine normal moveout for a dipping reflector and differentiate simple and simple multiple NMO model
- Employ temporal resolution and temporal aliasing as well as review simple migration model
- Process and migrate seismic recordings and carryout seismic methods and surveying
- Determine elastic moduli and P and S velocities and employ reflection and transmission
- Identify the typical rock velocity ranges and the factors affecting velocity
- Illustrate reflection surveying, seismic reflection processing, demultiplexing, editing and muting

Who Should Attend

This course provides an overview of all significant aspects and considerations of seismic reflection for geoscientists and engineers having a basic understanding of rock physics and seismic imaging, and who would like to learn more about seismic inversion tools capable of improving their knowledge of conventional and unconventional reservoirs.

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

- Geophysics
- Aim
- Waves
- Seismic Waves – Generation
- Wavefronts
- Raypaths
- Wavefronts and Raypaths
- The Seismic Experiment
- Parameters Associated with a Wave
- Wave Types
- Body Waves
- P and S Waves
- Surface Waves
- Rayleigh and Love Waves
- Particle Motion
- Elastic Deformations
- Wave Energy
- Wave Velocity

- Typical P-Wave Velocities
- Huygens Principle
- Interfaces
- Reflections and Refractions
- Reflection
- Refraction
- Critical Refraction
- Mode Conversion
- Interfaces - Mode Conversion
- Reflection and Transmission Coefficient
- Reflection Coefficient
- Reflection Coefficient – Example
- Critical Angle
- Energy Arrivals
- Refracted Waves
- Multiples
- Multiples - Example
- Ghosts
- Diffractions
- Example of Diffractions
- Summary
- Reflection Seismology
- P waves and S waves
- Wave Motion Particle Motion
- Reflection Seismic
- Surface Waves
- Shear Waves
- Rayleigh Waves
- Love Waves
- Spherical Waves and Attenuation

- Spherical Divergence
- Attenuation
- Bandpass Filter Panels of Raw Shot Record
- With Geometric Spreading
- Acoustic Impedance
- Seismic Reflectivity
- Rock Velocity vs Density
- Seismic Trace
- Geologic Section
- Generation of Noise-free Seismic Trace
- Coincident Sources and Receivers
- Traces recorded from Coincident Sources and Receivers
- One Source Shot into Multiple Receivers
- Traces recorded from one Source into Multiple Receivers
- NMO (Normal Moveout Correction)
- Normal Moveout for a Dipping Reflector
- Midpoints, Sacking and Fold
- NMO
- Simple NMO Model
- Simple Multiple Model
- NMO Corrected
- Stack
- NMO Stretch
- Stretch Varies with Offset
- Useable Offsets
- Frequency and Time
- Temporal Resolution
- Phase
- Temporal Aliasing
- Simple Migration Model

- The Seismic Recordings are Further Processed and Migrated
- Decibel (dB)
- Decibel (dB) Scale
- Seismic Methods
- Seismic Surveying
- Elastic Waves
- Waves-a Reminder
- Body Waves P-Waves
- Body Waves S-Waves
- Body Waves S-and S Waves
- Elastic Moduli
- P and S Velocities
- Surface Waves
- Reflection and Transmission
- Amplitudes Reflected and Transmitted
- Diffraction
- Critical Incidence
- Head Wave
- Factors Affecting Velocity
- Nafe-Drake Curve
- Typical Rock Velocity Ranges
- Seismic Methods: Waves and Rays-II
- Normal Move Out (NMO)
- Multiple Layers
- NMO for Layers
- Factors Affecting Velocity
- Seismic Sources
- Seismic Receivers
- Deployment
- Seismic Methods: Seismic Reflection – I

- Reflection Surveying
- Shot Gathers
- Common Midpoint Gathers
- 3D Surveys
- Seismic Reflection Processing
- Demultiplexing
- Editing and Muting
- Gain Recovery
- Static Corrections
- Reflectivity and Convolution
- Convolution
- Seismic Methods: Seismic Reflection – IV
- Dipping Layers
- Migration
- Diffraction Hyperbolae
- A Non-Migrated Section
- Anticlines and Synclines
- Migration Procedure
- Velocity Distortions
- Faults Distortions
- Lateral Velocity Variations
- Source, Reservoir and Trap
- Salt Dome
- Faults and Flat Spots
- Delineating Bedrock
- Locating Faults
- Seismic Methods: Waves and Rays – I
- Seismic Surveying
- Elastic Waves
- Waves - a Reminder

- Body Waves P-Waves
- Body Waves S-Waves
- Body Waves P and S-Waves
- Elastic Moduli
- P and S-Velocities
- Surface Waves
- Velocity Sensitivity
- Source Spectrum
- Attenuation
- Reflection and Transmission
- Amplitudes Reflected and Transmitted
- Reflection and Transmission
- Diffraction
- Critical Incidence
- Head Wave
- Factors Affecting Velocity
- Nafe-Drake Curve
- Birch's Law
- Typical Rock Velocity Ranges
- Seismic Methods: Waves and Rays – II
- Reflection and Transmission
- Amplitudes Reflected and Transmitted
- Normal Move Out (NMO)
- Multiple Layers
- NMO for Layers
- Diffraction
- Critical Incidence
- Head Wave
- Factors Affecting Velocity
- Nafe-Drake Curve

- Birch's Law
- Typical Rock Velocity Ranges
- Seismic Sources
- Seismic Receivers
- Deployment
- Seismic Methods: Seismic Reflection – I
- Reflection Surveying
- Shot Gathers
- Common Midpoint Gathers
- 3D Surveys
- Seismic Reflection Processing
- Demultiplexing
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- Seismic Methods: Seismic Reflection – Iv
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- Dipping Layers
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- Diffraction Hyperbolae
- A Non-Migrated Section
- Anticlines and Synclines
- Migration Procedure
- Velocity Distortions
- Faults Distortions
- Lateral Velocity Variations
- Source, Reservoir and Trap
- Salt Dome

- Fault and Flat Spots
- Delineating Bedrock
- Groundwater
- Locating Faults
- Locating Voids
- Seismic Methods: Refraction I
- Pre-Critical Incidence
- Critical Incidence
- Post-Critical Incidence
- Horizontal Interface
- Three-Layer Model
- Multiple-Layered Models
- Horizontal Vs. Vertical Velocity Contrasts
- Mapping Vertical Contracts
- Dipping Layers
- Reserving Lines
- Dipping Layer Traveltime
- Dipping Layer
- Seismic Methods: Refraction II Advanced Interpretation
- Real Earth “Flat” Layers
- Phantom Arrivals
- Separation of Delay Times
- The Plus Minus Method
- Generalized Reciprocal Method
- Experiment Design
- Low Velocity Layers
- Hidden Layers
- Velocity and Rock Strength
- Seismic Methods: Refraction III Examples and Limitations
- Generalized Reciprocal Method

- Rockhead Determination
- Archeological Investigations
- Air sparging: Testing Effectiveness
- Quarry Survey
- Crustal Structure of the Alps
- Seismic Reflection
- Geophysical Methods
- Potential Fields Methods
- Seismic Methods
- Seismic Waves
- Wave Propagation Concepts
- Classification of Seismic Waves
- Wave Elements
- Wave Front
- Recorded Seismic Waves
- Ray Paths
- Ghost Reflection
- Multiple Reflection
- Seismic Refraction
- Attenuation of Seismic Waves
- Seismic Waves Velocity
- Reservoir Velocity Estimation
- Time Average Equation to Estimate Porosity
- Reflection and Transmission of Seismic Rays
- Reflection Coefficient
- Overview of Seismic Data Acquisition
- Seismic Data Acquisition Fields
- Seismic Data Acquisition Systems
- Seeing Energy Sources
- Seismic Receivers

- Seismic Acquisition Geometries
- Mutiple Shotpoints
- Common Mid Points
- Seismic Data Recording
- Noises Affecting Seismic Recording
- Classification of Noises
- Noises Example
- Overview of Seismic Data Processing
- Introduction
- Basic Seismic Processing Flow
- Demultiplexing
- Gain Recovery
- Automatic Gain Control
- Trace Editing
- Trace Muting
- Static Corrections
- Deconvolution
- F/K Filtering
- Frequency Filtering
- V.11 CMP Sorting (Gathering)
- Normal Moveout Correction (NMO)
- Multiples Attenuation
- CMP Stacking
- Migration
- Overview of Seismic Data Interpretation
- Two Dimensional Versus Three Dimensional
- Seismic to Well Tie
- The Synthetic Seismogram
- Seismic Structural Interpretation
- Seismic Stratigraphic Interpretation

- Coherence Interpretation
- Special Decomposition Interpretation
- Seismic Interpretation
- Multi-Component Seismic Interpretation
- Amplitude Versus Offset (AVO) Interpretation