PetroSkills

Basic Geophysics - BGP - eLearning course

COURSE

About the Course

This workshop will be delivered virtually through PetroAcademy. Each PetroAcademy offering integrates multiple learning activities, such as self-paced e-Learning, virtual instructor-led sessions, discussion forums, group exercises, case studies, quizzes, field trips, and experiential activities.

In addition to the scheduled sessions, this course is available on-demand, wherein the course work is self-paced and instructor-led sessions are available any time as videos.

Activities include 2 hours of instructor-led, virtual training sessions, plus approximately 47 hours of self-paced work.

See example Geophysics eLearning module

This course is designed to familiarize anyone using seismic data with the nature of the data and what they specifically represent. One of the key goals of the course is to explain the confusing amount of jargon that is used by the geophysical community when they use seismic data. The course is supplemented by a large number of case histories that concretely illustrate the principles in the course material. These are updated with every course presentation to keep up with the rapidly developing technology in this field.

Target Audience

Geoscientists, engineers, team leaders, geoscience technicians, asset managers, and anyone involved in using seismic data that needs to understand and use this data at a basic level or to communicate with others that use it

You Will Learn

Seismic Image and Geological Association with Seismic Reflections

This skill module explains at the awareness level how to identify a seismic image and how it relates to geology. Also explained are how seismic images are formed and displayed, and the differences in analyzing seismic images in time and depth domains. This skill module is designed to explain the basics of the seismic process.

You will learn how to:

- Differentiate between depth and time
- Identify how a seismic image is displayed
- Describe how a seismic image is formed
- Identify a seismic image
- Explain how a seismic image relates to geology
- Changes in lithology
- Velocity and density
- The influence of porosity and pore filling material

Wavelets and Seismic Velocities

This skill module explains why the vertical resolution of the seismic data is a critical issue and how the resolution is controlled by the propagating wavelet that is generated by the acquisition parameters. The skill module also discusses the recorded wavelet and its phases and the data display polarity and display conventions. Also explained is how velocity can be estimated by the seismic image construction and used as an approximation to derive a depth converted geologic model from time imaged seismic or a depth image seismic. It covers how to directly measure depth versus vertical seismic travel time through Check Shot Surveys and Vertical Seismic Profiles and how vertical seismic profiling can be extended to 2, 3, and even 4 dimensions to tie the other direction of velocity to the seismic image.

You will learn how to:

- Identify why the vertical resolution of the seismic data is a critical issue
- Explain how the resolution is controlled by the propagating wavelet that is generated by the acquisition parameters
- Identify the recorded wavelet and its phase
- Describe the data display polarity and display conventions
- Identify seismic imaging velocities and how they are used to construct the seismic image
- Describe how imaging velocities are derived from the stacking process
- Describe velocity spectrum and how it applies to stacking and migrating the data
- Explain the relationship between depth and time and the ambiguity between the two domains
- Recognize overpressure in the seismic data
- Identify the jargon associated with anisotropy
- Recognize how a vertical seismic profile directly measures the time to depth relationship at various depths in a well bore and how that facilitates tying it into seismic

Seismic Acquisition, Processing, and Migration

This skill module explains the seismic data acquisition process and components for marine and land data. Also included is a comparison of the costs of seismic data acquisition for marine and land data. It also explains the concept of seismic processing flow and deconvolution. The skill module also explains what the processors do to produce the seismic image. Finally, we discuss the process of forming the seismic image by

migration. There are several ways to migrate the data, including post-stack, pre-stack, time, and depth migration. For this skill module, Kirchhoff migration is used as a word picture for the process of allowing constructive and destructive interference to build the migrated image. Other methods will be discussed with their pros and cons.

You will learn how to:

- Describe the marine configuration for a 3D survey including:
- Components used for data acquisition
- Arrays to attenuate noise
- Bin gathering as a CMP assemblage of reflections
- Describe the land configuration for a 3D survey including bin gathering for a land 3D survey
- Compare the costs of 2D and 3D surveys
- Describe processing flow
- Explain the concept of deconvolution
- Identify what the processors do to produce the seismic image
- Identify migrated displays
- Describe the matrix of "icons" explaining migration in time, depth, pre-stack, and post-stack
- Explain the relevance of each seismic migration domain
- Identify the "best" seismic migration domain

Seismic Mapping

This interpretation exercise incorporates all aspects, from start to finish, in interpreting a 3D data set, including the final conversion to depth. Several discussion points on tying faults and the style of contouring are included.

You will learn how to:

- Identity the layout of a 3D seismic survey
- Turn the interpretation into a data reduction process resulting in an interpretation and a structural map originally in time

Direct Hydrocarbon Indicators and Amplitude vs. Offset

This skill module explains that the effect of hydrocarbons as a pore filling material in our seismic data is at the core of seismic interpretation. This skill module also includes a section on rock physics. Amplitude variation with offset is used to modify risk in hydrocarbon prospects. This skill module introduces the concept, process and application of the technology.

You will learn how to:

- Explain the effect of hydrocarbons in the seismic data

- Detect hydrocarbons in the seismic data
- Describe rock physics
- Define amplitude variation with offset/angle (AVO/AVA)
- Make approximations to the Zoeppritz equations, including:
  - Aki-Richards equation
  - Shuey's equation
- Identify the Rutherford and Williams classification
- Describe slope, intercept, and the fluid line
- Describe the methods for prestack inversion, including:
  - Simultaneous Inversion
  - Elastic Impedance and Extended Elastic Impedance
- Lambda Rho and Mu Rho

Seismic Inversion and Attributes

What is done to the data is very simple, but the impact on our interpretation has become a huge issue. In this skill module, we learn to 'inverse' the seismic data into a rock property, specifically impedance. Also discussed are the types of inversion algorithms and their application. Seismic data is typically not viewed in frequency or phase domain, but they are becoming popular displays. This skill module introduces the concept of attributes and explains what they are and how they are used to determine prospectivity of hydrocarbons.

You will learn how to:

- Explain the seismic inversion processes, both forward and inverse
- Identify relative and absolute impedance in seismic inversion
- Identify the inversion algorithms and their application
- Define attributes
- Identify the importance of attributes
- Describe spectral decomposition attributes
- Explain spectral notching
- Identify the concepts of attenuation and Q
- Describe the Hilbert Transform attributes
- List the multi-trace attributes
- Describe the coherency attribute
- Describe the curvature attribute
- Explain the application of self-organizing maps in predicting reservoir rock properties
- Identify the duplicity of attributes
- Relate how the application of attributes is far more important to know than the different types of attributes

Seismic for Unconventional Reservoirs

This skill module explains why unconventional reservoirs are becoming increasingly important and how we can use conventional geophysical tools for their analysis. We also learn that ‘brittleness’ is the most important rock physics property and how to perform seismic analysis for unconventional reservoirs properties to contribute to sweetspot highgrading. Finally, the skill module explains the concept of microseismic recording, microseismic monitoring, and explains how the microseismic is interpreted using Hodograms in source orientation determination.

You will learn how to:

- Identify rock physics for shale reservoirs
- Describe seismic analysis for unconventional reservoirs
- Describe microseismic, including surface and subsurface recording arrays
- Describe source (event) recording and location detection
- Describe three component recording
- Identify the role of Hodograms in source orientation
- Identify the importance of microseismic monitoring in different stress areas

Course Content

- Seismic Image and Geological Association with Seismic Reflections
- Wavelets and Seismic Velocities
- Seismic Acquisition, Processing, and Migration
- Seismic Mapping
- Direct Hydrocarbon Indicators and Amplitude vs. Offset
- Seismic Inversion and Attributes
- Seismic for Unconventional Reservoirs

Product Details

Categories: Upstream

Disciplines: Geophysics

Levels: Basic

Product Type: Course

Formats Available: On-Demand Virtual

Instructors: John Logel

On-Demand Format

| Course | On-Demand (Available Immediately) $3,890.00
