# OilField Geomechanics Training Courses - Spring Series – 2022

## Course Matrix

### Spring Series April 4 - 8, 2022

| # | Course | Dates | Hours | Days | Schedule |
|---|---|---|---|---|---|
| *1* | **Geomechanics for Unconventionals** | April 4-8 | 20 | 5 | 8am -12pm |
| *2* | **Geomechanics for Managers** | April 4th | 4 | 1 | 1pm - 5pm |
| *3* | **Geomechanics Data: Lab, Logs and Field Sources** | April 5-7 | 12 | 3 | 1pm - 5pm |
| *4* | **Geomechanics for the Energy Transition** | April 8th | 4 | 1 | 1pm - 5pm |

### Spring Series April 11 - 15, 2022

| # | Course | Dates | Hours | Days | Schedule |
|---|---|---|---|---|---|
| *5* | **Drilling & Completion Geomechanics for G&G&RE Practitioners** | April 11-13 | 12 | 3 | 8am -12pm |
| *6* | **Monitoring Techniques in Geomechanics** | April 14-15 | 8 | 2 | 8am -12pm |
| *7* | **Geomechanics in Drilling Operations** | April 11-12 | 8 | 2 | 1pm - 5pm |
| *8* | **Geomechanics Applied to Hydraulic Fracturing** | April 13-14 | 8 | 2 | 1pm - 5pm |

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# Course Descriptions

## #1. *GEOMECHANICS FOR UNCONVENTIONALS (20 hours -5 mornings) Cost: $950*

This course has been taught now for more than 13 years, with hundreds of attendees, and has been updated continuously as critical issues and technologies have changed. The target audience for the course is scientists and engineers with several years of experience and working on Unconventionals.

The course begins with an introduction to geomechanics fundamentals including stress and strain, rock mechanical properties, pore pressure and the role of geometry. The effects of rock fabric (natural fractures, laminations, heterogeneities) are also presented. This first part of the course concludes with presentations on how to build and calibrate well-based and field-based geomechanical models. The second part of the course is devoted to hydraulic fracturing and the geomechanical concepts that underpin its proper design, implementation, monitoring and optimization – especially with regard to rock fabric and formation heterogeneity. In addition, more recent hot topics, like frac hits (FDIs) and the role of fiber optic and microseismic monitoring, are also presented.

## Course Content

### Part 1: Geomechanics Fundamentals

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|---|---|
| Module 0 | Introduction to Geomechanics |
| Modules 1&2 | Principles of Stress and Strain (with field stress measurements) |
| Module 3 | Pore Pressure Evaluation |
| Modules 4&5 | Mechanical Rock Behavior |
| Module 6 | Geomechanical Modeling and Workflows |

### Part 2: Geomechanics for Unconventional Developments

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|---|---|
| Modules 7&8 | Hydraulic Fracturing Fundamentals |
| Module 9 | Stress Shadows (single, multi-stage and multi-well fracs) |
| Module 10 | Rock Fabric Characterization |
| Module 11 | Shale Geomechanics |
| Module 12 | Hydraulic Fractures (HFs) / Natural Fractures (NFs) and operational effects |
| Module 13 | Depletion Effects and Refracs (optional) |
| Module 14 | Multi-well Completions (optional) |
| Module 15 | HF Monitoring and Frac Models (as time permits) |

**#2. *GEOMECHANICS FOR MANAGERS (4 hours – 1 morning) Cost: $325.***

It is not easy to assess the value and timing of a geomechanics program in overall field development. In this course we will present field operations, such as drilling, hydraulic fracturing and well completions, reservoir development and EOR operations (e.g., water flooding) in light of their potential geomechanical challenges. We will present methods managers can use to reduce cost and add value to their projects by asking the right questions, at the right time, and defining the clear geomechanics goals required.

## Course Content

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|---|---|
| Module 0 | Introduction to Geomechanics |
| Module 1 | Fundamentals of Geomechanics |
| Module 2 | Geomechanics in Drilling |
| Module 3 | Geomechanics in Hydraulic Fracturing and Completions |
| Module 4 | Geomechanics in Reservoir Engineering |
| Module 5 | Geomechanics in Unconventional Developments |
| Module 6 | Geomechanics Program Specification and QC |

**#3. *GEOMECHANICS DATA: LAB, LOGS AND FIELD SOURCES (12 hours – 3 afternoons) Cost: $750.***

This course addresses the different sources and procedures to obtain the data to define the geomechanical components in a project: in-situ stresses, pore pressure, and mechanical properties over a specific geometry of interest - a well, a fault, natural fractures, a reservoir or underground structure. Each of the primary sources of data (laboratory, core-based; wireline log; and field and seismic) are reviewed with a particular emphasis on: 1) accuracy; 2) coverage; 3) timing; and 4) cost.

## Course Content

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|---|---|
| Module 0 | Introduction to Geomechanics & Geomechanics Data Flow |
| Module 1 | Mechanical Property Data from Lab Testing – Correlations |
| Module 2 | Geomechanics Data from Wireline Logs – Static vs. Dynamic & Anisotropy |
| Module 3 | Geomechanics Field Data – Drilling Data, Injectivity Tests & Seismic Data |
| Module 4 | Geomechanics Monitoring Tools and Methods |
| Module 5 | Model Validation with Field Data – Well Scale and Reservoir Scale. |

## #4. ***GEOMECHANICS FOR THE ENERGY TRANSITION (4 hours – 1 afternoon). Cost $325***

Energy transition is a topic of utmost relevance for oil and gas practitioners in today's environment. And geomechanics serves as a key discipline in the on-going energy transition efforts. In this course, the critical topics of geothermal applications, carbon capture and storage (CCS) and hydrogen storage potential are presented and discussed from the aspect of their geomechanics components and drivers.

### Course Content

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|---|---|
| Module 0 | Introduction to Geomechanics |
| Module 1 | Geomechanics Fundamentals |
| Module 2 | Geomechanics in Geothermal Applications |
| Module 3 | Carbon Capture and Storage Geomechanics |

## #5. ***DRILLING AND COMPLETION GEOMECHANICS FOR G&G&RE PRACTITIONERS (12 hours – 3 mornings) Cost: $750.***

Many participants in our geomechanics courses come to us with a simple question: "How do I (as a geoscientist, petrophysicist or reservoir engineer) best help, and provide impact to, drilling and completion operations?" In order to consider this, we first need to consider: "What support/data do drilling and completions need?" and "What data is relevant to the engineering side and how/when is it best to provide support for the main decisions?" This course focuses on the geomechanics drivers in drilling and completion operations, the timing of decisions and windows for data collection as well as considerations on how to "push" engineers to new ideas.

### Course Content

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|---|---|
| Module 0 | Introduction to Geomechanics |
| Module 1 | Geomechanics Fundamentals |
| Module 2 | Geological Scenarios for Drilling and Completions |
| Module 3 | Role of Rock Fabric in Drilling and Completions |
| Module 4 | Seismic and Petrophysics in Geomechanics for Drilling and Completions |
| Module 5 | Main Workflows and Actions to Support and Impact Drilling and Completions |

## 6. *MONITORING TECHNIQUES IN GEOMECHANICS (8 hours – 2 mornings) Cost: $550.*

In any geomechanics workflow, monitoring, both for base-line data and later calibration, is critical to the success of the project. In this course, we first look at the geomechanics program/workflow and highlight the importance and value of monitoring plans. Then we look at specific monitoring efforts and tools, as well as their specific applications in oil & gas operations.

### Course Content

| | |
|---|---|
| Module 0 | Introduction to Geomechanics |
| Module 1 | Geomechanics Fundamentals |
| Module 2 | Wellbore and Reservoir Monitoring |
| Module 3 | Seismic/Microseismics |
| Module 4 | Tiltmeters |
| Module 5 | Fiber Optics |
| Module 6 | InSar |

## #7. *GEOMECHANICS IN DRILLING OPERATIONS (8 hours – 2 afternoon) Cost: $550.*

Wellbore stability has historically been the "classic" application of geomechanics in the oil & gas industry. Within this course, we will review the geomechanical parameters and methods (both numerical and analytical) for wellbore stability analyses in order to determine the safe mud weight window. The safe mud weight window is a necessary input for well design. In addition, we will consider the effect of wellbore geometry, pore pressure, mechanical properties and stresses on model results and consider methods to validate/calibrate the models. We will also review "failure" and tolerance to failure, the significance of the choice of failure model and consider interactions with drilling fluids which might create a dynamic stability environment. The wellbore stability components will then be presented as part of an integration between drilling parameters, fluids and geomechanics in a complete framework for attacking drilling problems. Finally new trends in wellbore stability, including field real-time monitoring, are presented.

### Course Content

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|---|---|
| Module 0 | Introduction to Geomechanics |
| Module 1 | Geomechanics Fundamentals |
| Module 2 | Building a Wellbore-based Geomechanical Model |
| Module 3 | Drilling Event Analysis and Pressure and Stress Indicators |
| Module 4 | Stresses around a Wellbore – Elastic and Elastoplastic Solutions |
| Module 5 | Modes of Failure; Failure along Weak Planes |
| Module 6. | Wellbore Stability Analysis |
| Module 7 | Fluid/Rock Interaction and Its Effect on Wellbore Stability |
| Module 8 | QRA in Wellbore Stability |
| Module 9 | Real-Time Wellbore Stability |

**#8. *GEOMECHANICS APPLIED TO HYDRAULIC FRACTURING (8 hours - 2 afternoons). Cost: $550.***

Hydraulic fracturing is a mature technology, first commercialized some 70 years ago in the Hugoton Field. However, in many cases today the critical geomechanics inputs and aspects of hydraulic fracturing are simply assumed or even overlooked in order to maintain a rig schedule or achieve production targets. The consequences of this include increasing frac hits (FDIs), increasing casing deformations, lost reserves and, ultimately, additional development costs.

This course addresses the main hydraulic fracturing concepts and geomechanical influences as well as caveats addressing uncertainties in the data and models employed. A principal goal of the course is to help develop a framework for fit-for-purpose geomechanics input to completion operations.

## Course Content

| | |
|---|---|
| Module 0 | Introduction to Geomechanics |
| Module 1 | Geomechanics Fundamentals |
| Module 2 | Hydraulic Fracturing (HF) Basics - Fracture Mechanics Concepts |
| Module 3 | Geomechanical Parameters and Their Influence on HF Propagation |
| Module 4 | Fracturing Tight Sands vs. Fracturing Shales |
| Module 5 | HF and Rock Fabric |
| Module 6 | HF Design Models |
| Module 7 | HF Optimization |