Indian Institute of Technology
Course Details Report

Course No: PE5010

Course Name: Petroleum Geomechanics

Course Type:

Theory

Description:

This course will examine the theory and applications of Petroleum Geomechanics and Petroleum Geostatistics at fundamental levels. Primary focus will be on the integration of Petrophysical, Geomechanical and Seismic measurements applied to both conventional and unconventional hydrocarbon reservoirs.

Course Content:

Stress fields, poromechanics, rock mechanics, rock strength
Stress Patterns, The Principal Stresses, Stress Variations, Calculation of Overburden Stress, Stress Orientations and Relative Magnitudes, Absolute Stress Magnitudes in Sedimentary Basins, Depletion and Stress paths, Predicting Porosity and Permeability Changes, Stress Rotations Associated with Depletion, Elasticity, Elastic Moduli and Seismic Wave Velocity, Elastic Anisotropy, Poroelasticity and Effective Stress, Poroelasticity and Dispersion, Thermoporoelasticity, Failure Criteria, Strength and Pore Pressure, Rock Strength from Geophysical Logs, Rock Strength Anisotropy, Hydraulic Fracture, Estimating Rock Strength from Geophysical Logs
Faults and Fractures, Wellbore stability
Opening Mode Fractures and Shear Faults, Observations of Fractures and Faults at Depth, Fracture Mechanics in Metals & Non-metals, Computational Fracture Mechanics, Drilling-Induced Tensile fractures, Basic Concepts of Critically Stressed Faults, Observations and Modeling of Fault Damage Zones, Sealing and Leaking Faults, Dynamic Hydrocarbon Migration, Fractured Reservoirs and Permeability Anisotropy, Compressional Wellbore Failure, Wellbore Breakouts, Basic Principles of Deviated Wellbore, Tensile Fractures and Borehole Breakouts in Deviated Wells, Estimating Stress from Failure of Deviated Wells, A Criterion for Wellbore Stability, Wellbore ballooning, Case Studies
Geomechanics of shale gas and tight oil production
Opportunities of Shale Gas Production, Horizontal Drilling and Multi-stage Hydraulic Fracturing, Physical Properties of Shale Gas Reservoir Rocks, Microseismic Events and Reservoir Stimulation, Microseismic Events and Production, Stimulation of Fracture Networks, Shale and Permeability Sorption, Long Period Long Duration Seismic Events, Geomechanical Constraints on Fracture Networks, Horizontal Drilling and Multi-Stage Hydraulic Fracturing, Environmental Protection
Improved reservoir characterization
Geostatistics, Modeling and Analysis 2 - Applications and Uncertainty is the second course in the series, Geostatistics, Modeling and Analysis 1 - Data Structures and Theory. It introduces practical applications of geostatistics in the geosciences and explains the associated statistical uncertainty of the results. It covres areas such as uncertainty and probability, visualization and spatial analysis, practical data management, and where possible this is explained through worked examples
Induced and triggered seismicity
Injection-Induced Earthquakes, Triggered Slip on Basement Faults, Predicting Slip on Potentially Active Faults, Case Studies
- Practical: Assignments and hands-on experience with live projects

Text Books:

[1] Berkhout, A. J. (1987). Applied seismic wave theory.
[2] Fjar, E., Holt, R. M., Raaen, A. M., Risnes, R., & Horsrud, P. (2008). Petroleum related rock mechanics (Vol. 53). Elsevier.
[3] Meyers, M. A., & Chawla, K. K. (2009). Mechanical behavior of materials (Vol. 2, pp. 420-425). Cambridge: Cambridge University Press.

Reference Books:

[1] Zoback, Mark D. (2010). Reservoir Geomechanics. Cambridge University Press.