Indian Institute of Technology
Course Details Report

Course No: PE6050

Course Name: Exploration and Formation evaluation of oil and gas reservoirs

Course Type:

Theory

Description:

The additional data useful for a basin wide exploration can traditionally be found in potential field data (gravity and magnetic data) and also in electromagnetic data (interestingly enough the oldest exploration tool). Especially in Controlled Source (deep) marine Electro-Magnetic methods can we measure the reservoir resistivity directly which is a direct indicator that it could contain hydrocarbons. On land in remote areas the Magneto-Telluric Method is an efficient exploration tool. However, none of these methods will solve all problems, but in combining them we gain more than just the sum of the individual benefits by using as a constraint in Seismic Inversion.

Course Content:

Gravity, Introduction to Geophysical Methods, The role of Non-Seismic Methods in the E& P business, Gravity Surveying, Determination of contour map anomalies, Calculation of gravity responses, Determination of Gravity resolution of bodies, anticlines and faults, Depth estimation methods: Half-width, Gradient-amplitude, Exercises on paper and using computer software
Magnetics and Electrical Methods, Introduction to Magnetic and Electrical methods, Gravity and Magnetic signatures,(Poisson's) Relationship between Gravity and Magnetic responses, Electrical measurement methods, Calculations of resistivity profiles, effective resistivity, Exercises on paper and using computer software
Electrical and Electro-Magnetic (EM) methods, EM: diffusion or wave-propagation ? Land EM: TEM surveying, Magneto Tellurics (MT): measurements & modelling, Marine EM:CSEM (Controlled Source Electromagnetics) measurements, Calculations of E refraction, MT resolution, EM skin depth & velocity, Exercises on paper and using computer software
CSEM Modeling and Inversion, EM Terminology, Exercises: CSEM Scripps Modelling: 3 layers Exercises: CSEM Scripps Modelling: 5 layers, CSEM & MT: Scripps Occam Inversion, Time-Lapse Gravity & Electrical Methods, Joint Inversion CSEM & MT, Joint Inversion TE & TM Joint Inversion TDEM (Time Domain EM), MT
Sub-surface correlation and mapping from log data. Delineation of fractures from logs.
Production logging. Well logging for metallic and non-metallic minerals: radioactive and nonradioactive evaporates, coal, sulphur. Borehole geophysics for groundwater exploration., Effective pay thickness of an aquifer. Saline water-fresh water interface from log data., Determination of groundwater flow direction by logs.
Theoretical computations of normal and lateral log responses. Identification and delineation of sub-surface formations from well log data. Calculation of reservoir parameters: formation factor,porosity, permeability, resistivity, water and hydrocarbon saturations, and movable oil. Subsurface correlation of formations and interpretation of field data.

Text Books:

1. Kearey, P., Brooks, M., & Hill, I. (2013). An introduction to geophysical exploration. John Wiley & Sons.
2. Telford, William Murray, Lloyd P. Geldart, and Robert E. Sheriff. Applied geophysics. Vol. 1. Cambridge university press, 1990.

Reference Books:

1. D.P Helander ‘Fundamentals Of Formation Evaluation’
2. Dewan.J.T ‘Essentials of Modern Open-Hole Log Interpretation’ Pen Well Books, 1983.