Geophysical Data Acquisition and Design

1. GENERAL

1.1 Course Number: PE324

1.2 Contact Hrs: 3-0-0 Credits: 9

1.3 Semester -Offered:

1.4 Prerequisite: Introduction to Petroleum Technology

1.5 Syllabus Committee Member: Dr. Satish Sinha; Dr. Piyush Sarkar

2. Objective: This course is offered to build foundations of the geological and geophysical methods used in hydrocarbon exploration and prospecting. In the previous geology courses, students have been taught about rocks, sedimentary processes, structural geology and petroleum geology. In this course, the students will learn about the geophysical techniques and data interpretation involved in finding oil and gas, how to select an exploration area and generate prospects for drilling. Various geophysical methods (with emphasis on the seismic methods) will be covered in this course and the students will learn how to integrate geological and geophysical information for oil and gas exploration. There will be several class projects in this course. Groups of students will be working in different teams for various sedimentary basins. Students are required to submit their progress reports every two weeks and the final report will be due towards the end of the semester.

3. Course Content

Unit wise distribution of content and number of lectures

Units	Topics	Sub Topics	Lectures
1	Seismic fundamentals	Foundation of seismic waves propagation and signal processing Seismic Waves, Snell's Law, Seismic wave velocities and rock densities, Impedance, Reflection Coefficient, Synthetic Seismogram, Signal and noise, Fourier analysis of a signal	6
2	Seismic Data Acquisition & design	Seismic sources and receivers, 2D and 3D seismic, Land and Marine seismic, Borehole seismic, Data recording spread design, line grid design, recording equipment, quality control, survey position fixing, Map scale and	14

		projections.	
3	Gravity Data Acquisition & design	Principles of gravity methods; Gravimeters; Survey design, Acquisition and processing of gravity data, Applications of gravity data in Exploration	10
4	Magnetic Data Acquisition & design	Principles of magnetic methods; Magnetometers; Survey Design, Acquisition and processing of magnetic data, Applications of magnetic data in explorations	10
		Total	**40**

4. Readings

4.1 Text Books:

1. Fred Aminzadeh Shivaji Dasgupta, "Geophysics for Petroleum Engineers", Elsevier
2. W. M. Telford, L. P. Geldart and, R. E. Sheriff "Applied Geophysics", Cambridge University Press
3. Allen, P. A and Allen, J. R., Basin Analysis: Principles and Applications, Blackwell Publishing

4.2 Reference Books:

1. R. E. Sheriff and L. P. Geldart, "Exploration Seismology", Cambridge University Press
2. Oz Yilmaz, "Seismic Data Analysis (Vol I and II)", SEG Publication
3. P. Kearey, M. Brooks and I. Hill, "An Introduction to Geophysical Exploration", Wiley-Blackwell
4. Journals from the American Association of Petroleum Geologists
5. Journals from the Society of Exploration Geophysicists
6. Journals from the Society of Petroleum Engineers

5. Outcome of the Course

- Know the process of imaging subsurface with reflection and refraction seismic
- Understanding of various geophysical data and its role in petroleum exploration
- Hands-on experience in interpreting seismic data with industry standard software
- Creating structure map for drilling location