Near Surface Geophysics

1.1. Course Number: GE521

1.2. Contact Hours: 3-0-0 Credits: 9

1.3. Semester Offered: 5th Year-Odd

1.4. Prerequisite: Overview of Petroleum Geophysics would be useful

1.5. Syllabus Committee Members: Dr. Satish Sinha and Dr. Piyush Sarkar

2. **Objective:** The course introduces to geophysical methods for mapping and monitoring the physical properties of ground at shallow depth. Emphasis is given to seismic, GPR, and electrical methods

3. **Course Content:** Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topics	Lectures
1	Introduction	Definition of near-surface geophysics, its branches and users. Near surface problems their models and fundamental parameters. Rock Physics Principles for near surface geophysics: Identity and properties of components, volume fractions of components, Geometry of the components, interaction between components. Elastic and Electromagnetic Properties of near-surface soil.	10
2	Electro-seismic	Concept and application of electro-seismic and seismo-electrics in geophysical investigation.	3
3	Geophysical Tomography	Concept of various Tomography, Fundamentals of up-hole seismic tomography, Cross-hole seismic tomography, Up-hole Shear-wave velocity tomography and their application for near surface investigation. Seismic Refraction Tomography (SRT) and Electrical resistivity Tomography (ERT) study for near surface characterization. Basic principle and application of Multichannel Analysis of Surface waves (MASW), Refraction Microtremor (ReMi) and GPR for near surface characterization. Data acquisition, processing and interpretation for near surface characterization. Estimation of geo-engineering properties, Vs30 estimation, site classification.	15
4	Case Studies	Case studies of Geophysical methods (Seismic, Resistivity, EM, GPR, and Magnetic) in Near surface Geophysics (Seismic, Resistivity, EM, GPR, and Magnetic) geophysical problems: resource mapping, void/old mine working detection, coal mine fire, dam seepage, archaeological study etc. Case studies on application of electro-seismic and seismo-electrics.	12

Total	**40**

4. Readings:

4.1. Textbook:

- Dwain K. Butler, Near-Surface Geophysics. SEG, 725pp.
- Kramer, S. L., “Geotechnical Earthquake Engineering”, Pearson Education.

4.2. Reference books:

- Mark E. Everett., Near-Surface Applied Geophysics. Cambridge University Press.
- William Lowrie., Fundamental of Geophysics. Cambridge University Press.
- Telford, W. M., Geldart, L. P., Sheriff, R. E. and Keys, D. A., Applied Geophysics. Cambridge University Press.
- Ansal, A., “Recent Advances in Earthquake Geotechnical Engineering and Microzonation”, Springer.

5. Outcome of the course:

Knowledge on fundamental concept of different near-surface geophysical techniques.