

Course Type	Course Code	Name of Course	L T P	Credit
DE	NGPD511	Near-surface Geophysics and Geotechnical Modelling	3 0 0	3

Course Objective

- Elastic and Electromagnetic Properties of Near surface soil. Understanding fundamental concept of different near-surface geophysical techniques.
- Understanding basics of different geotechnical modelling techniques.
- Understanding on the association of rock physics principles with geotechnical parameters.

Learning Outcomes

- Understanding of rock physics principles for near surface geophysics and association with geotechnical parameters.

Sl. No.	Description of Lectures	Lecture Hrs.	Learning Outcome
1.	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	Understanding of near-surface geophysics
2.	Concept and application of electro-seismic and seismo-electrics in geophysical investigation. Case studies on application of electro-seismic and seismo-electrics.	7	Understanding of electro-seismic and seismo-electrics and their applications
3.	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 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.	10	Engineering geophysics and Geotechnical modeling

4.	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.	7	Understating of different near-surface problems and their applications
5.	Concept of geotechnical modelling/characterization. Liquefaction and lateral spreading - Liquefaction related phenomena, Liquefaction susceptibility. Evaluation of liquefaction by cyclic stress and cyclic strain approaches, Lateral deformation and spreading, Criteria for mapping liquefaction hazard zones. Seismic Cone Penetrometer Test, Cone Penetration Test, Standard Penetration Test, Cyclic Stress Ratio, Cyclic Resistance Ratio, estimation of blow count 'N' of SPT from Shear Wave.	8	Understating of different geotechnical problems and characterization using geotechnical engineering approaches
Total Classes		42	

Text Books

1. Dwain K. Butler, 2005, Near-Surface Geophysics. SEG, 725pp.
2. Kramer, S. L., "Geotechnical Earthquake Engineering", Pearson Education.

Reference Books

1. Mark E. Everett, 2013. Near-Surface Applied Geophysics. Cambridge University Press, pp400.
2. William Lowrie, 2007, Fundamental of Geophysics. Cambridge University Press pp 381.
3. Telford, W. M., Geldart, L. P., Sheriff, R. E. and Keys, D. A., 1990, Applied Geophysics. Cambridge University Press, pp770.
4. Ansal, A., "Recent Advances in Earthquake Geotechnical Engineering and Microzonation", Springer