

Semester	JAN 2022
Open to semester	6,8,22
Course code	EC3274/EC6244
Course title	Geoelectromagnetic Exploration
Credits	4 /4
Course Coordinator & participating faculty (if any)	Rahul Dehiya
Nature of Course	Lectures
Pre-requisites	Basic knowledge of any computer programming would be required for solving assignments.
Objectives (goals, type of students for whom useful, outcome etc)	<p>This course introduces basic concept of electromagnetic wave propagation in matter and its application in subsurface imaging.</p> <p>Outcomes: At the end of the course, a student would; Learn basic mathematical concept used in modeling of electromagnetic wave propagation in subsurface of the earth. Learn different electrical/electromagnetic methods used in geophysics, how to design field experiment for data acquisition and learn basic mathematical tools used in analysis of recorded data.</p>
Course contents (details of topics /sections with no. of lectures for each)	<p>Introduction: Application of electrical and electromagnetic methods in earth sciences, electrical properties of rocks and minerals</p> <p>Electrical and Electromagnetic theory: Maxwell's equations in time and frequency domain, constitutive relations, Helmholtz equation, wave and diffusion equation, skin depth, whole space Green's function, boundary and interface conditions, solution of the Helmholtz equation for 1-dimension model, depth of investigation, vertical resolution, apparent resistivity and phase, isotropic and anisotropic medium.</p> <p>Electrical Method: Introduction to Resistivity methods, Instruments for Resistivity methods, principle of superposition, principle of reciprocity, resistivity array configurations (Wenner, Schlumberger, dipole-dipole, pole-pole, pole-dipole), sounding and profiling techniques,</p>

	<p>potential distribution over a layered earth, resistivity transfer function, recurrence relations, apparent resistivity functions, resistivity data analysis, principle of equivalence, induced polarization and self-potential methods.</p> <p>Electromagnetic method: Time and frequency domain electromagnetic methods, Green's function & convolution operator and their applications for different source geometries, active and passive source method, formulation of Magnetotelluric (MT) response for 1D earth model, MT response function for 1D, 2D and 3D earth model, very low frequency (VLF) technique, controlled-source electromagnetic techniques, airborne electromagnetic methods, ground penetrating radar.</p>
<p>Evaluation /assessment</p>	<p>End-Sem Examination-40% Mid-Sem Examination-30% Others-30 (assignments + quizzes)%</p>
<p>Suggested readings (with full list of authors, publisher, year, edn etc.)</p>	<ol style="list-style-type: none"> 1. Electrical Methods of Geophysical Prospecting: G. V. Keller (1980) Pergamon Press. 2. Geosounding Principles: Resistivity Sounding Measurements: O. Koefoed (1980) Elsevier. 3. The Geoelectrical methods in Geophysical exploration: M. S. Zhdanov and G. V. Keller (1994) Elsevier 4. Geophysical Electromagnetic Theory and Methods: M.S. Zhdanov (2009) Elsevier 5. Electromagnetic Methods in Geophysics, Vol. I Theory: M.N. Nabighian (1987) Society of Exploration Geophysics 6. Electromagnetic Methods in Geophysics Vol. II Applications: M.N. Nabighian (1991) Society of Exploration Geophysics. 7. Geoelectromagnetism: J.R. Wait (1982) Academic Press