Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NGPC542	**Groundwater Geophysics**	3	1	0	4

Course Objective
This subject will provide knowledge on groundwater systems, estimation of aquifer properties. Knowledge on geophysical technology for groundwater management. Knowledge on sustainable techniques for groundwater protection.
Learning Outcomes
The primary objective of the course is to introduce fundamental and advanced aspects of geophysical technology for exploration and management of groundwater. At the end of the course, with acquired knowledge, students will be able to address the keys issues related to sustainability and environmental management and can solve the challenging groundwater problems using geophysical and hydro geochemical approaches.

Unit No.	Topics to be Covered	Lecture Hrs. (L+T)	Learning Outcome
1	Introduction to Groundwater: Groundwater: Problems and definition. Definition of groundwater table. Definition of aquifers, classifications of aquifers; confined and artesian well, unconfined and phreatic, semi and leaky aquifer, perched, aquiclude, aquitard, aquifuge.	4L + 1T	Understanding of groundwater systems and their basic units
2	Saturated and unsaturated aquifer systems, zone of saturation and aeration. Water table and piezometric surface, Meteoric, connate and juvenile water.	4L + 1T	Understanding of aquifer system
3	Darcy laws. Groundwater flow in unconfined aquifer: Theory and mathematical formulation; Hydraulic Properties: Hydraulic properties of soils, porosity, permeability, transmissibility, hydraulic conductivities, empirical relations among hydraulic parameters.	5L + 2T	Basic definition of hydraulic properties and their role for groundwater exploration.
4	*Dar* Zarrouk parameter and geoelectrical layer parameters, Longitudian and transverse resistivity, mean resistivity, anisotropy.	4L + 1T	Study parameters & anisotropy
5	Pumping test method. Geophysical and hydro-geochemical methods for aquifer parameter estimations. Fracture characterization in various hydro-geological settings of India. Multi-scale modelling approach for fracture characterization of heterogeneous medium. Interpretation of hydro-geological sections.	5L + 2T	Estimation of aquifer properties using geophysical and geochemical methods.
6	Hydro-geological cycles and sustainability: Hydrogeological cycles, linkage to other geocycles, their importance to groundwater exploration and sustainability.	5L + 2T	Understanding of hydrogeological cycle and role for sustainability.
7	Geophysical methods for groundwater exploration and management: Application of geophysical methods namely geoelectrical, geoelectromagnetic, seismic, magnetic, well logging and remote sensing and geographical information systems.	5L + 2T	Geophysical methods for groundwater management
8	Groundwater quality assessment: Geophysical and hydro-geochemical methods for groundwater pollution assessment. Assessment of groundwater quality. Various standardization and index for groundwater quality: Bureau of Indian Standards. World Health Organization etc.	5l + 2T	Geophysical and geochemical methods for water pollution study.
9	Modelling of groundwater quality index, quantification of role of each geophysical/hydro-geochemical parameter for groundwater quality assessment. Arsenic pollution and Arsenic pollution source modelling; rock-water interaction process for groundwater quality assessment.	5L + 1T	Development of groundwater modeling & quality analysis
	Total	**42L+14T**	

Text Books

1. Todd, D. K., 1959. Groundwater hydrology, John Wiley and Sons, New York, pp.535
2. Kirsch, R., 2006. Groundwater Geophysics- A Tool for Hydrogeology, Springer-Verlag Berlin Heidelberg, pp. 500

Reference Books

1. Parasnis, D.S., 1997. Principles of Applied Geophysics. Fifth edition, Chapman & Hall, 2-6 Boundary Row, London SE1 8 HN, UK
2. Schwartz, W.F., Zhang, H., 2004. Fundamentals of Groundwater, John Wiley & Sons, Inc. pp. 583
3. Telford, W.M., Geldart, L.P., Sheriff, R.E., 2004. Applied Geophysics, 2nd Edition, Cambridge University Press