

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DSE-4 Application of Hydrogeology in Industries and Mining (L3, P1)	4	3	0	1	12th pass with science	Studied Earth System Science and Structural Geology, Hydrogeology or Equivalent

Learning Objectives

The course introduces the students to the legal and constitutional framework of ground water governance in India. It aims to provide knowledge about the scientific processes and protocols involved in impact assessment and comprehensive hydrogeological studies for developmental projects involving groundwater extraction.

Learning outcomes

After completing the course, students will become familiar with the salient aspects of India's ground water governance framework. They will develop an understanding of the groundwater resources estimation methods, and acquire basic skill to undertake impact assessment, comprehensive hydrogeological and water audit studies for developmental projects involving groundwater extraction. Learners will be trained to write professional grade Impact Assessment Report, Comprehensive Hydrogeological Report and Water Audit Report. They will be skilled with capability of formulating and processing No Objection Certificate (NOC) application for ground water extraction.

SYLLABUS OF DSE-4

Theory (45 hours)

Unit 1: (9 hours)

Detailed content

Ground water governance: Ground water ownership: The Indian Easement Act 1882. Constitutional provisions regarding ground water. National Water Policy. Environment Protection Act 1986 – Central Ground Water Authority (CGWA) and State Ground Water Regulatory Bodies. National Green Tribunal.

Unit 2: (9 hours)

Detailed content

Guidelines to regulate and control ground water extraction in India: Preamble and background: exemptions from seeking No Objection Certificate, Drinking & Domestic use for Residential apartments/ Group Housing Societies/ Government water supply agencies in urban areas, Agriculture Sector, Commercial Use, Industrial Use, Mining Projects, Infrastructure projects, Ground water abstraction/ restoration charges, Bulk Water Supply, Abstraction of Saline ground water, Protection of Wetland Areas, General compliance conditions in No Objection Certificate, Monitoring of compliance of No Objection Certificate Conditions, Renewal and extension of No Objection Certificate, Delegation of powers against illegal ground water withdrawal, Ground Water Level Monitoring, Environmental Compensation, Provision of penalty and other important conditions. No Objection Certificate Application Portal (NOCAP). Water Audit Report. Accreditation of Ground Water Professional.

Unit 3: (9 hours)

Detailed content

Ground Water Resources Estimation: Dynamic ground water resources of unconfined aquifers for command and non-command areas: assessment unit, estimation of monsoon and non-monsoon recharge from all sources and provision for natural discharges, estimation of monsoon and non-monsoon extraction by different sectors, categorization of assessment blocks and validation. Poor ground water

quality area. Waterlogged and shallow water table areas. In-storage ground water resources of unconfined aquifer. INGRES portal.

Unit 4: (9 hours)

Detailed content

Impact Assessment Report (IAR): Buffer zone demarcation, Land Use Land Classification (LULC), Digital Elevation Model (DEM), geomorphology, details of water bodies, geological set up. Hydrogeological set up: aquifer characteristics, depth to water level, water table contours and ground water flow, surface ground water interaction, hydrogeological map, seasonal and long-term water level fluctuation, ground water quality, water quality of nearby water bodies. Assessment of impact of proposed ground water extraction using analytical modelling/numerical solutions, etc. Socio-economic analysis and mitigation measures. Case studies.

Unit 5: (9 hours)

Detailed content

Comprehensive Hydrogeological Report (CHR): Buffer zone demarcation, Land Use Land Classification (LULC), Digital Elevation Model (DEM), geomorphology, details of water bodies, geological set up. Hydrogeological set up: geophysical studies and aquifer characteristics, depth to water level, water table contours and ground water flow, surface - ground water interaction, hydrogeological map, seasonal and long-term water level fluctuation, ground water quality, water quality of nearby water bodies. Mine plan and seepage estimation. Assessment of impact of proposed ground water extraction using analytical modelling/numerical solutions, etc. Socio-economic analysis and mitigation measures. Case studies.

Practicals (30 hours)

Students will be trained to carry out Ground Water Resource estimation, hands on exercises on IAR and CHR, hands on exercises on Water Audit, and exercises based on analytical modelling/numerical solutions for impact assessment, mine seepage estimation analysis.

Essential readings

Todd, D.K., 2004. Ground Water Hydrology, John Wiley & Sons, New York.
Fetter, C.W., 1984. Applied Hydrogeology, McGraw-Hill Book Co., New York
Ministry of Jal Shakti (Department of Water Resources, River Development and Ganga Rejuvenation) (Central Ground Water Authority). Guidelines to regulate and control ground water extraction in India. Notification No. 2941. The Gazette of India: Extraordinary [Part II—Sec. 3(ii)]. 24th September, 2020. Weblink: <https://cgwb.gov.in/CGWA/CGWA%20New%20Guidelines%202020.pdf>

Recommended Readings

Raghunath, H.M., 1987. Ground Water, Wiley Eastern Ltd., Calcutta.
Ministry of Water Resources, River Development & Ganga Rejuvenation Government of India. 2017. Report of The Ground Water Resource Estimation Committee (GEC-2015) Methodology. Weblink: http://cgwb.gov.in/Documents/GEC2015_Report_Final%2030.10.2017.pdf
Central Ground Water Authority, Ministry of Jal Shakti. 2022. Standard Operating Procedures: Impact Assessment Report and Comprehensive Hydrogeological Report. Weblink: <https://cgwa-noc.gov.in/landingpage/UserAssistance/ImpactAssessmentRepMin3.pdf>
Central Ground Water Authority, Ministry of Jal Shakti. 2023. Notification of Guidelines dated 24th September 2020 & Amendments dated 29th March 2023: Standard Operating Procedure for Implementation of Guidelines. Weblink: <https://cgwa-noc.gov.in/LandingPage/UserAssistance/STANDARDOPERATINGPROCEDUREV-9.1.pdf> (SOPs are updated at regular intervals and the updated SOP from CGWA site will be additional reference material)