

Paper No- 11: Hydrogeology

Introduction and basic concepts:

Scope of hydrogeology and its societal relevance. Hydrologic cycle: precipitation, evapotranspiration, runoff, infiltration, subsurface movement of water. Rock properties affecting groundwater. Vertical distribution of subsurface water. Types of aquifer, aquifer parameters, anisotropy and heterogeneity of aquifers. **(07 Lectures)**

Groundwater flow:

Darcy's law and its validity. Intrinsic permeability and hydraulic conductivity. Groundwater flow rates and flow direction. Laminar and turbulent groundwater flow. **(04 Lectures)**

Water Wells:

Test holes and well logs. Methods for constructing shallow and deep wells. Well completion and well development. **(03 Lectures)**

Well hydraulics:

Basic Concepts (drawdown; specific capacity etc.). Elementary concepts related to equilibrium and non equilibrium conditions for water flow to a well in confined and unconfined aquifers. **(05 Lectures)**

Groundwater exploration:

Basic concepts, use of remote sensing and GIS in groundwater exploration. Surface based groundwater exploration methods. Introduction to subsurface borehole logging methods. **(03 Lectures)**

Groundwater chemistry:

Physical and chemical properties of water and water quality. Introduction to methods of interpreting groundwater quality data using standard graphical plots. Sea water intrusion in coastal aquifers. **(04 Lectures)**

Geological formations as aquifers:

Groundwater occurrence in igneous, metamorphic and sedimentary rocks. Groundwater in non-indurated sediments. Groundwater provinces of India. **(05 Lectures)**

Groundwater management:

Surface and subsurface water interaction. Groundwater level fluctuations. Basic concepts of water balance studies, issues related to groundwater resources development and management. Rainwater harvesting and artificial recharge to groundwater. **(05 Lectures)**

12 rounds of student presentations will be arranged in Groups on different topics covered under Theory

Practicals

(12 lectures)

1. Preparation and interpretation of water level contour maps and depth to water level maps.
2. Study, preparation and analysis of hydrographs for differing groundwater conditions.
3. Water potential zones of India (map study).
4. Graphical representation of chemical quality data and water classification (C-S and Trilinear diagrams).
5. Simple numerical problems related to: determination of permeability in field and laboratory, Groundwater flow, Well hydraulics etc.

Titles of project:

1. Groundwater occurrence in different states of India. (10-12 students).
2. Projects related to groundwater flow rate assessment based on water level contour maps. (5-6 students).
3. Projects related to use of remote sensing and GIS in groundwater exploration (2-3 students).
4. Projects related to groundwater management in different coastal aquifer of India (10-12 students).
5. Projects on water balance study (4-5 students).
6. Projects related to design of rainwater harvesting and artificial recharge structures (10-12 students).

Suggested Readings:

1. Todd, D.K. 2006. Groundwater hydrology, 2nd Ed., John Wiley & Sons, N.Y.
2. Davis, S.N. and De Weist, R.J.M. 1966. Hydrogeology, John Wiley & Sons Inc., N.Y.
3. Karanth K.R., 1987, Groundwater: Assessment, Development and management, Tata McGraw-Hill Pub. Co. Ltd.