

## GROUND WATER ASSESSMENT, DEVELOPMENT AND MANAGEMENT

**Paper Code: ETCE-412**

**Paper: Ground Water Assessment, Development and Management**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

### **INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The course will help students:*

1. *To apply appropriate methods to groundwater resource evaluation;*
2. *Use different methods to estimate groundwater recharge;*
3. *Combine these skills for groundwater resource assessment, Development and Management*

### **UNIT-I**

Types of Water-Bearing Formations, Influence of Physiography and Climate on Ground Water availability, Ground Water Investigations, Surface Investigations, Hydrological Investigations, Test Drilling, Geophysical Methods, Resistivity Method, Electric Logging, Gamma-Ray Logging, electrical Resistivity Surveying, Seismic Refraction Surveying, Ground Water Resource Assessment, methods of Artificial Recharge of Ground Water, Ground Water Pollution, Ground Water Quality, Conjunctive Use of Ground Water with Canal Water. Aquifer Characteristics Influencing Yield of Wells, Static Water Level, Transmissibility, Coefficient of Storage, Specific Yield, Hydraulic Resistance, Leakage Factor, Steady State Radial Flow, Theoretical Aspects of Steady State Flow to Cavity Wells.

**[T1,T2][No. of Hours: 11]**

### **UNIT-II**

Unsteady State Flow to Wells in Unconfined and Confined Aquifers, Procedure for Determining Hydraulic Properties of Confined Aquifers, Cooper-Jacob Method of Solution, Recovery Test, Unsteady State Flow to Cavity Wells, Procedure for Determining Hydraulic Properties of confined Aquifers using Cavity Wells. Pumping Tests, Step Drawdown Test, Significance of Well Loss Coefficient, Pumping Test Procedures, Observation Wells, Well Interference, Interference of Wells in Confined Aquifers. Design of Open Wells, Depth of Well, Thickness of Well Lining, Nomograph for Design of Well Steining, Design of RCC Lining, Weep Holes in Well Lining, Well Curbs, Design of Well Curb, Increasing the Yield of Open Wells, Horizontal Boring in Open Wells, Installation of Radial Filters in Wells in Alluvial Formations, Radial Boring in Open Wells. Pollution Travel in Soil and Aquifers, Location and Design of Wells with Sanitary Protection, Well Location, Well Construction, Disinfection of Wells.

**[T1,T2][No. of Hours: 12]**

### **UNIT-III**

Multiple-Well System, Radial Wells and Infiltration Galleries, Design of Tube Wells, Design of Housing Pipe and Well Casing, Bore Size and Well Depth, Selection of Strata to be Screened, Design of Well Screen, Design of Gravel Pack, Sanitary Protection of Tube Wells, Common Causes of Contamination and Their Remedies, Design of Skimming Wells. Ground Water Exploration, Geologic and hydrologic methods, Surface geophysical methods, Hydro-geologic well logging, Geophysical well logging, Tracer techniques.

**[T1,T2][No. of Hours: 10]**

### **UNIT-IV**

Ground Water Modelling using finite difference, use of appropriate software like Modflow etc, Case Study. Pumping of Water, Design of Centrifugal pumps, Design of Impeller, Shaft Impeller inlet and vane angles, Diameter of the Eye of Impeller, Impeller outlet and vane angle, Design of Impeller vanes, Design of Volute, Design of vanes, effect of Suction lift on discharge and efficiency, Centrifugal pump installation in open wells/tube wells, operation and maintenance. Vertical Turbine pumps and their installation, operation and maintenance, submersible pump and their installation, operation and maintenance, propeller pumps and their operating characteristics and installation, Jet pumps, Performance characteristics and installation.

**[T1,T2][No. of Hours: 12]**

**Text Books:**

- [T1] Karanth K.R., "Ground Water Assessment Development and Management", Tata McGraw Hill Education (P) Ltd., New Delhi.
- [T2] Sondhi M.K., "Water Wells and Pumps", Tata McGraw Hill Education (P) Ltd., New Delhi.

**Reference Books:**

- [R1] Garg S.K., "Environmental Engineering (Vol. 1), Water Supply Engineering", Khanna Publishers.,New Delhi.
- [R2] Ramanathan A.L., Bhattacharya P., Keshari A.K., Bundschuh J., Chandrasekharam D., Singh S.K., "Assessment of Groundwater Resources and Management", I.K. International (P) Ltd., New Delhi.
- [R3] Hiscock K.M., Rivett M.O., Davison R.M., "Sustainable Groundwater Development", Geological Society Special Publication No. 193, London.