

## HYDROGEOLOGY

Time Allowed : Three Hours

Maximum Marks : 200

### INSTRUCTIONS

Candidates should attempt **SIX** questions in all including Question No. 1, which is compulsory, from **PART—I** and attempt **ONE** question each from Sections A, B, C, D and E from **PART—II**.

The number of marks carried by each question is indicated at the end of the question.

Answers must be written only in **ENGLISH**.

Symbols and abbreviations are as usual.

Neat sketches may be drawn to illustrate answers, wherever required.

Wherever graphs/tables are required to be drawn, these may be plotted on the answer-book itself. No separate graph sheet is required.

### PART—I

1. Attempt any *ten* of the following :  $5 \times 10 = 50$

(a) Sketch *only* the conditions favouring the development of—

(i) confined water table;

(ii) perched water table.

- (b) What do you understand by capillary fringe?
- (c) What is meant by cone of depression?
- (d) Write a short note on hydraulic conductivity.
- (e) Comment on validity of Darcy's law in relation to Reynolds number.
- (f) Briefly describe groundwater modelling.
- (g) Give a schematic diagram of spontaneous potential in unconsolidated rocks.
- (h) Write a short note on major natural sources of Ca and Mg in groundwater.
- (i) Give a schematic diagram of electrical resistivity log in unconsolidated rocks.
- (j) Write a short note on tracer test.
- (k) Write a short note on perennial yield.
- (l) Write a short note on specific retention.

## **PART—II**

### **Section—A**

2. Elaborate in detail hydrogeological characteristics of and groundwater conditions in volcanic province, with suitable examples. 30

3. Write notes on the following : 10×3=30
- (a) Relation between specific yield and permeability
  - (b) Storativity of an aquifer
  - (c) Field characteristics affecting groundwater recharge

**Section—B**

4. Write notes on the following : 10×3=30
- (a) Groundwater contours and flow directions in case of unconfined aquifer
  - (b) Radius of influence and of interference with regard to wells
  - (c) Implication(s) of stable isotopes in groundwater
5. Write notes on the following : 10×3=30
- (a) Construction of flow net
  - (b) Filter pack
  - (c) Equation for groundwater balance

**Section—C**

6. Discuss various graphic/tabular methods of presentation of groundwater quality data. 30
7. Write notes on the following : 10×3=30
- (a) ISI quality standards for drinking water
  - (b) Quality requirements of water for paper industry
  - (c) Fluorides in groundwater

### Section—D

8. Explain seismic refraction method for groundwater investigation. 30
9. Write notes on the following : 10×3=30
- (a) Electrode arrangements in (i) Wenner and (ii) Schlumberger configuration
  - (b) Natural gamma logging
  - (c) Signatures in remote sensing for groundwater investigation

### Section—E

10. Enumerate the problems involved in mining operations due to groundwater. Suggest remedial measures to overcome these problems. 30
11. Write notes on the following : 10×3=30
- (a) Need for groundwater legislation
  - (b) Concept of groundwater basin management
  - (c) Advantages and disadvantages of surface reservoirs

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