

Sl. No. 0004763

A-IGQ-O-JHD

**HYDROGEOLOGY**

Time Allowed : Three Hours

Maximum Marks : 200

**INSTRUCTIONS**

*Please read each of the following instructions carefully before attempting questions.*

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

The marks allotted to each question are indicated at the end of the question.

All parts and sub-parts of a question are to be attempted together in the answer-book.

Attempt of a part/question shall be counted in chronological order. Unless struck off, attempt of a part/question shall be counted even if attempted partly.

Any page or portion of the page left blank in the answer-book must be clearly struck off.

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

Symbols and abbreviations are as usual.

Wherever graphs/tables are required to be drawn, these may be plotted on the answer-book itself.

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

## PART—I

1. Write a note on each of the following in *five* or *six* sentences : 5×10=50 ●
- |  |   |
|--|---|
| (a) Evapotranspiration                               | 5 |
| (b) Safe yield                                       | 5 |
| (c) Partially penetrating wells                      | 5 |
| (d) Cone of depression                               | 5 |
| (e) Radon in groundwater                             | 5 |
| (f) Pie diagram for groundwater quality presentation | 5 |
| (g) Basic principle of gravity method                | 5 |
| (h) Spring as a source of groundwater                | 5 |
| (i) Water logging                                    | 5 |
| (j) Relevance of groundwater legislation             | 5 |

## PART—II

### Section—A

2. (a) Explain different types of aquifers with neat sketches. Add a note on water table contour maps. 15
- (b) Explain the factors which control groundwater level fluctuations. 15

3. Answer (a) and (b), and write notes on (c), (d) and (e) : 6×5=30
- (a) What is the hydraulic conductivity of an aquifer, if Darcy velocity is 10 cm/day and hydraulic gradient is 0.002? 6
- (b) What is the transmissivity of a 10 m thick sandstone, if hydraulic conductivity is 10 cm/day? 5
- (c) Porosity and specific retention 6
- (d) Hydrographs 6
- (e) Rainfall-runoff relationship 6

### Section—B

4. (a) Explain hydrogeologic boundaries and their implications in groundwater flow behaviour. 15
- (b) A 20 cm diameter well penetrating a confined aquifer is pumped at a uniform rate of  $2592 \text{ m}^3/\text{day}$  and the drawdowns are measured in an observation well 60 m away. From the type curve and the data curve for a match point, the following is noted :
- $W(u) = 1.00$  and  $u = 1 \times 10^{-2}$  for which  
 $s$  and  $r^2/t$  are read as 0.18 m and  
 $150 \text{ m}^2/\text{minute}$  respectively
- Determine the transmissivity and storativity by Theis method. 15

5. Write short notes on the following :  $6 \times 5 = 30$
- (a) Drawdown 6
  - (b) Gravel packing 6
  - (c) Darcy's law 6
  - (d) Hydraulic connectivity 6
  - (e) Basic assumptions of Theis method 6

**Section—C**

6. (a) What are stable isotopes and how are they useful in groundwater studies? 15
- (b) Give an account of different sources of groundwater pollution. 15
7. Write short notes on the following :  $6 \times 5 = 30$
- (a) Schoeller's diagram for representing hydrochemical data 6
  - (b) Upconing of saline water in oceanic islands 6
  - (c) Microorganisms in groundwater 6
  - (d) Hill-Piper diagram 6
  - (e) Sea level rise and its impact on coastal aquifers 6

**Section—D**

8. (a) Explain how structural geological mapping is useful in groundwater exploration. 15
- (b) Give basic principles of surface geophysical methods and explain briefly one of them used in groundwater exploration. 15
9. Write short notes on the following : 6×5=30
- (a) Rose diagram 6
- (b) Temperature logging 6
- (c) Electromagnetic radiation 6
- (d) Neutron logging 6
- (e) Radar imagery in groundwater studies 6

**Section—E**

10. (a) Discuss the procedure of groundwater balance estimation. 15
- (b) What are the consequences of over-exploitation of groundwater and how can sustainable development of groundwater resources be carried out? 15

**11.** Write short notes on the following :  $10 \times 3 = 30$

- (a) Increasing dependency on groundwater use 10 ●
- (b) Groundwater quality and recharge problems in arid regions 10
- (c) Groundwater problems associated with canals 10

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