

A-HFP-M-FDND

HYDROGEOLOGY

Time Allowed : Three Hours

Maximum Marks : 200

INSTRUCTIONS

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.

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

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.

PART—I

1. Write a note on each of the following in not more than 5 sentences : 5×10=50
- (a) Storage coefficient 5
 - (b) Driven well 5
 - (c) Void ratio and porosity 5
 - (d) Darcy's law 5
 - (e) Coastal aquifer 5
 - (f) Fluoride content in groundwater 5
 - (g) Piezometric surface 5
 - (h) Groundwater storage in relation to porosity 5
 - (i) Need for groundwater legislation 5
 - (j) Transmissivity 5

PART—II

Section—A

2. (a) Explain hydrogeological properties of rocks that control storage and movement of groundwater. 15

(b) Detail the construction of flow net. From flow-net analysis of a well, pumping at the rate of 75000 lpm, the following data was obtained :

(i) Number of flow channels : 20

(ii) Head drop between successive piezometric contours : 3 m

(iii) Thickness of the aquifer : 20 m

Determine transmissibility and permeability of the aquifer. 15

3. Write a note on each of the following : $6 \times 5 = 30$

(a) Types of springs 6

(b) Criteria of classifying groundwater province 6

(c) Unconfined and confined aquifers 6

(d) Factors affecting infiltration 6

(e) Hydraulic conductivity 6

Section—B

4. Explain non-equilibrium methods of solutions for computing aquifer parameters. Mention the difference between equilibrium and non-equilibrium methods. 30

5. Write a note on each of the following : $6 \times 5 = 30$

- (a) Determination of specific yield by field method 6
- (b) Leaky artesian aquifer 6
- (c) Bailer and slug test 6
- (d) Electric analog method of groundwater modeling 6
- (e) Design of well screen 6

Section—C

6. (a) State the physical and chemical constituents that determine the quality of groundwater. Explain the standards for the constituents that decipher the quality of groundwater for drinking purpose. 15
- (b) Explain the tracer techniques used in groundwater studies. Add a note on its application in tracing groundwater contamination. 15
7. Write a note on each of the following : $6 \times 5 = 30$
- (a) Total dissolved solids 6
 - (b) Groundwater quality in different rock types 6

- (c) Pie diagram for representing water quality 6
- (d) Problem of arsenic in groundwater 6
- (e) Attenuation of pollution 6

Section—D

8. (a) Explain hydrogeomorphic mapping using images of different satellites. 15
- (b) Explain the principle and field procedure to conduct electrical resistivity survey. Write a note on interpretation of resistivity data. 15
9. Write a note on each of the following : $6 \times 5 = 30$
- (a) Lithological classification in relation to hydrologic properties 6
 - (b) Springs as source of water supply 6
 - (c) Role of geologic structures in ground-water movement 6
 - (d) Lineament mapping 6
 - (e) Acoustic logging for delineation of aquifers 6

Section—E

10. (a) Discuss the groundwater problems encountered in underground mines and in tunneling. 15
- (b) What is meant by groundwater mining? What are the criteria for selecting groundwater recharge sites? Describe induced recharge method. 15
11. Write a note on each of the following : $6 \times 5 = 30$
- (a) Effects of overexploitation of groundwater and measures to control it 6
- (b) Microwatershed development 6
- (c) Groundwater balance 6
- (d) Groundwater development in hard rock terrain 6
- (e) Sustainability of groundwater resources 6

★ ★ ★