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? 6

(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 m^3/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 :

$W(u) = 1 \cdot 00$ and $u = 1 \times 10^{-2}$ for which s and r^2/t are read as 0·18 m and 150 m^2/minute respectively

Determine the transmissivity and storativity by Theis method. 15

5. Write short notes on the following : 6×5=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 : 6×5=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 ground-water resources be carried out? 15

11. Write short notes on the following : 10×3=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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