

HYDROGEOLOGY

Time Allowed : Three Hours

Maximum Marks : 200

QUESTION PAPER SPECIFIC INSTRUCTIONS

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

There are **NINE** questions divided under **FIVE** Sections.

Candidate has to attempt **FIVE** questions in all.

The **ONLY** question in Section—A is **compulsory**.

Out of the remaining **EIGHT** questions, the candidate has to attempt **FOUR**, choosing **ONE** from each of the other Sections B, C, D and E.

The number of marks carried by a question/part is indicated against it.

Symbols, abbreviations and notations have their usual standard meanings.

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

Wherever required, graphs/tables are to be drawn on the Question-cum-Answer (QCA) Booklet itself.

Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly.

Any page or portion of the page left blank in the Question-cum-Answer (QCA) Booklet must be clearly struck off.

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

SECTION—A

(Compulsory Section)

1. Write short notes on the following in not more than 5 sentences each : 5×8=40

- (a) Piezometric nests
- (b) Types of springs
- (c) Aquitard
- (d) Effective porosity
- (e) Confined aquifers
- (f) Hydraulic head
- (g) Vadose zone
- (h) Bouguer anomaly

SECTION—B

Attempt *any one* question.

2. (a) Define specific discharge. Compute the Darcy's velocity when groundwater flows through an alluvial aquifer having a hydraulic conductivity of 70 m/day and a hydraulic gradient of 0.02. 10
- (b) Discuss isotropic and anisotropic aquifers with special reference to hydraulic conductivity. Illustrate your answer with suitable sketches. 15
- (c) Explain the zone of aeration, zone of saturation, capillary zone and perched aquifer with neat schematic diagrams. 15
3. (a) Define transmissivity of an aquifer and calculate the transmissivity of an unconfined aquifer that has a hydraulic conductivity of 250 cm/day and a saturated thickness of 18 m. 10
- (b) Discuss the laboratory methods for determination of hydraulic conductivity. 15
- (c) Elaborate groundwater flow through dispersion and diffusion, and explain their relationship with permeability. 15

SECTION—C

Attempt *any one* question.

4. (a) Compare slug test and aquifer performance test. 10
- (b) What is the specific capacity of a dug well? Explain the method in brief. If the discharge of the well is 90 cubic metres and the drawdown Δs is 3 metres, what should be the well capacity of the aquifer? 15
- (c) What are the different methods of groundwater level monitoring? Explain the use of groundwater fluctuation data. 15
5. (a) Explain different types of porosity in an aquifer and calculate the porosity, if the total pore space is 4 cubic metres and the total volume of the aquifer is 80 cubic metres. 10
- (b) Describe the impact of climate change and overexploitation of groundwater from the Indo-Gangetic alluvial plain. 15
- (c) Discuss the relationship between lowering of groundwater levels and land subsidence with suitable examples. 15

SECTION—D

Attempt *any one* question.

6. (a) What is the potentiality of remote sensing techniques in groundwater investigation? In microwave remote sensing, which wavelength band is suitable for groundwater prospecting in unconfined arid zone? 15
- (b) What are the benefits and limitations of using proton precession magnetometer for identifying groundwater in alluvium and hard rock terrains? 10
- (c) Explain different types of drilling methods in hard rocks, alluvial and bouldery geological formations. 15
7. (a) Elaborate electrical resistivity method for groundwater exploration with a specific note on self-potential. 15
- (b) What is radiation logging? Explain the potential of natural gamma logging with gamma-gamma logging. 15
- (c) What is rose diagram? Explain the potential of this structural geological property for groundwater exploration in hard rock area. 10

SECTION—E

Attempt *any one* question.

8. (a) Give an account on natural chemical constituents in groundwater. Write a few names of major cations, anions and trace elements. 15
- (b) Discuss about the groundwater pollution due to urbanization with some examples. 15
- (c) Elaborate the applications of stable isotopes in groundwater studies. 10
9. (a) Describe different methods of artificial recharge for groundwater rejuvenation in hard rock and alluvial terrains. 15
- (b) Explain the characteristics of groundwater basins of India. 15
- (c) Describe the utility of trilinear diagram for representing the analysis of groundwater quality data. 10

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