

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.*

(Compulsory Section)

Q1. Write short notes on the following in not more than 5 sentences each :

5×8=40

- | | |
|------------------------|---|
| (a) Artesian aquifers | 5 |
| (b) Specific yield | 5 |
| (c) Gravimeter | 5 |
| (d) Specific retention | 5 |
| (e) Drawdown | 5 |
| (f) Secondary porosity | 5 |
| (g) Drilling-time log | 5 |
| (h) Magnetic methods | 5 |

SECTION B

Attempt any **one** question.

- Q2.** (a) Discuss Global Water Cycle and add a note on Water Budget. 15
- (b) Explain the types of aquifers. Add a note on the direction of groundwater flow and the volume of the aquifers. 15
- (c) What are groundwater basins ? Explain their geophysical characteristics. 10
- Q3.** (a) Describe the concepts of groundwater flow. Add a note on water flow rates and their direction techniques. 15
- (b) Define permeability and hydraulic conductivity of aquifers. Add a note on their ranges in representative rocks. 15
- (c) Explain the concepts of groundwater dispersion and diffusion. How do they relate with other aquifer properties ? 10

SECTION C

Attempt any **one** question.

- Q4.** (a) What is Bernoulli's equation ? Explain its application in groundwater studies. 15
- (b) Explain Darcy's law with an illustration. Add a note on its validity in isotropic and anisotropic media. 15
- (c) Describe porosity and representative porosity range. 10
-
- Q5.** (a) Give an account on the effects of stream-flow and base-flow on the quantity and quality aspects of groundwater. 10
- (b) Explain the types of wells used for groundwater exploration. Add a note on the methods of constructing shallow wells and tube wells. 15
- (c) What are slug tests ? Differentiate the results of slug tests between unconfined and confined aquifers. 15

SECTION D

Attempt any **one** question.

- Q6.** (a) Explain the major geological features identifiable in satellite images, that are suitable for groundwater exploration. 15
- (b) Describe the principle and procedure for conducting electrical resistivity profiles. Add a note on the method of interpreting the profiling data. 10
- (c) Explain the purpose of conducting geophysical logging techniques. Add a note on the types of geophysical logging methods employed in groundwater surveys. 15
- Q7.** (a) Explain the principles of seismic methods employed in subsurface investigations. Add a note on their suitability in groundwater prospecting. 15
- (b) What are pumping tests ? Enumerate their types. Give an account on the procedures of conducting a pumping test, and their uses in hydrogeological studies. 15
- (c) Explain the direct and indirect impacts of global climate change on groundwater resources. 10

SECTION E

Attempt any **one** question.

- Q8.** (a) Elucidate with suitable sketches the changes in hydrochemical facies of groundwater and thermodynamic impacts due to rock-water interaction and its effect on groundwater quality. 15
- (b) Discuss the concept of mass balance calculations implied in groundwater and various methods of graphical representation of chemical data. 15
- (c) Elucidate the concept of B.O.D. and C.O.D. and the role of micro-organisms in groundwater. 10
-
- Q9.** (a) Discuss various parameters that ascertain the groundwater quality along with suitability criteria for drinking, industrial and agricultural utility of groundwater. 15
- (b) Enumerate and elaborate the impact of urbanisation and solid-liquid waste disposal on the groundwater regime along with plume migration detection. 15
- (c) Elucidate the role of stable and unstable isotopes in the study of groundwater regime. Add a note on the age determination of groundwater. 10