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UPSC CGS Exam

Mains Hydrogeology Paper

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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 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 Booklet must be clearly struck off.

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

SECTION A
(Compulsory Section)

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

5×8=40

- | | |
|------------------------------------|---|
| (a) Infiltration | 5 |
| (b) Cavity Wells | 5 |
| (c) Terrameter | 5 |
| (d) Incrustation and Corrosion | 5 |
| (e) Saline and Alkaline Soils | 5 |
| (f) Conjunctive Use of Groundwater | 5 |
| (g) Groundwater Budget | 5 |
| (h) Piezometric Surface | 5 |

SECTION B

Attempt any **one** question.

- Q2.** (a) Give an account of the vertical distribution of groundwater. Describe the controlling factors of soil water movement in unsaturated zone. 15
- (b) What are springs ? How are they classified ? 15
- (c) Explain the laboratory method of determination of permeability. 10
- Q3.** (a) Explain water table contour and flow nets. How are water table contour maps useful in the identification of flow boundaries ? 15
- (b) Describe the aquifer properties of common crustal rocks. Explain specific yield of common formation material. 15
- (c) Following data is obtained from an area. Find out the groundwater storage. 10
- Area = 1 km²
- Rainfall = 500 mm
- Normal fluctuation of water table = 2.2 m
- Specific yield = 2%

SECTION C

Attempt any **one** question.

- Q4.** (a) Explain the logic and principles behind pumping tests. Describe the methods of evaluating the efficacy of an open dug well. 15
- (b) Describe Bailer and Slug methods of testing the wells. 10
- (c) A 20 cm well penetrates 40 m below static water level. After a long period of pumping at a rate of 1500 lpm, the drawdown in the wells at 10 m and 25 m from the pumped well were 1.5 m and 0.5 m respectively. Determine the transmissibility of the aquifer. 15
- Q5.** (a) Discuss the pros and cons of bore wells and open wells. Describe the procedure for designing a tube well drilled in multiple layers of confined aquifer. 15
- (b) Describe the various drilling equipment and their applications in diverse geological formations. 15
- (c) Describe the impact of global climate change on groundwater. 10

SECTION D

Attempt any **one** question.

- Q6.** (a) What are the important criteria for selection of a site for sinking well (open well) of a medium to high yielding type ? 15
- (b) Explain the electrical resistivity method for locating a suitable bore well in a hard rock terrain. 10
- (c) Write notes on the following : 15
- (i) Radioactive Logging
- (ii) Sonic Logging
- (iii) Downhole Photography
- Q7.** (a) Explain the fundamentals and advancements in remote sensing techniques for groundwater exploration. 15
- (b) Briefly describe various procedures for developing a completed tube well. 15
- (c) Write notes on the following : 10
- (i) Tracer Logging
- (ii) Seismic Refraction Method

SECTION E

Attempt any **one** question.

- Q8.** (a) Explain how lithology and climate affect the composition of groundwater. List down the physical and chemical parameters of potable water as per WHO standards. 15
- (b) Describe various ways of representing the chemical data of groundwater. 15
- (c) Evaluate the conditions of coastal aquifers. Explain the relationship between fresh water – salt water interface in a sedimentary sequence and alluvial sediments. 10
- Q9.** (a) Briefly describe the groundwater potential in India. 15
- (b) Explain stable and unstable isotopes. Discuss the stable isotopes commonly used in groundwater studies. 10
- (c) Explain the various artificial recharge methods being followed in India. 15



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