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# UPSC CGS Exam

Hydrogeology Previous Paper

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भू-विज्ञान परीक्षा  
GEOLOGIST EXAM-2017  
HYDROGEOLOGY

ZLX-O-HDY

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.*

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

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

*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.*

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

ZLX-O-HDY

**SECTION A**  
**(Compulsory Section)**

- Q1. Write notes on the following in not more than 5 sentences each : 5×8=40**
- |     |  |   |
|-----|--|---|
| (a) | Specific Yield and Specific Retention          | 5 |
| (b) | Major Hydrogeomorphic Features of Arid Regions | 5 |
| (c) | Spectral Resolution in Remote Sensing          | 5 |
| (d) | Principle of Resistivity Survey                | 5 |
| (e) | Stable Isotopes in Hydrology                   | 5 |
| (f) | Ghyben-Herzberg Relationship                   | 5 |
| (g) | Rooftop Rainwater Harvesting                   | 5 |
| (h) | Application of Darcy's Law                     | 5 |

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**SECTION B**  
**(Attempt any one question)**

- Q2.** (a) Diagrammatically describe the occurrence of groundwater in the zone of aeration and the zone of saturation demarcating the water table. Add a note on hydrographs. 15
- (b) Schematically describe the hydrological cycle. Discuss about the water balance equation. 10
- (c) Write notes on the following : 15
- (i) Porosity and Permeability
- (ii) Meteoric water and Magmatic water
- (iii) Hydrostratigraphic Unit
- Q3.** (a) Define transmissivity and storage coefficient. Discuss how they are determined. 10
- (b) Differentiate between drainage basin and groundwater basin. Give an account of the major hydrogeological features of hard rock terrain in India. 15
- (c) Describe the occurrence of groundwater in the Indo-Gangetic alluvial province. 15

## SECTION C

(Attempt any one question)

- Q4.** (a) (i) Distinguish between ground surface contour and water table contour. Explain how the water table contour map is prepared and state its uses. 10
- (ii) Water levels of three wells are given below. Find out the flow direction. 5

$$W_1 = 15.60 \text{ m}$$



$$W_3 = 15.20 \text{ m}$$



$$W_2 = 14.80 \text{ m}$$

- (b) Explain the laboratory method of determining the permeability of fine grained soil. 15
- (c) During a falling head permeability test on a soil sample of 10 cm diameter and 20 cm length, the head in the stand pipe of 2 cm diameter dropped from 50 cm to 25 cm in 2 minutes. Determine the permeability of the sample. 10

- Q5.** (a) Explain the nature of the groundwater condition in shallow open wells in alluvial soil. Define critical depression head, safe working head and maximum safe yield. 15
- (b) Explain how safe yield and specific capacity of shallow open wells are determined. 15
- (c) A well 3 m dia has a normal water level of 3 m bgl. By pumping, the water level is depressed to 9 m bgl. In a time interval of 4 hours, the water level rises by 4.5 m. Determine the specific yield of the well. What is the safe yield of the well if the working depression head is 3.5 m? 10

**SECTION D**  
**(Attempt any one question)**

- Q6.** (a) Explain how the hydrogeomorphic map is prepared and how it is used in delineating groundwater potential zones. 15
- (b) Discuss the seismic refraction method of prospecting and how it is useful in groundwater exploration. 15
- (c) Discuss the different methods of interpretation of resistivity data with special reference to the curve matching technique. 10
- Q7.** (a) What are the methods of construction of tube-wells ? Describe the cable tool method of drilling tube-wells. 15
- (b) What are the well development procedures followed in completion of a well for optimum yield ? Discuss how the yield of a well is determined. 15
- (c) What are well-logging techniques and how are they useful ? 10

**SECTION E**  
**(Attempt any one question)**

- Q8.** (a) Write notes on the following : 15
- (i) TDS
  - (ii) Total Hardness
  - (iii) Salt Index
  - (iv) SAR
  - (v) Sodium Percentage
- (b) Illustrate the following types of water quality plots : 15
- (i) Stiff diagram
  - (ii) Pie diagram
  - (iii) Piper trilinear diagram
- (c) Explain freshwater-saline water interface in a coastal area. Discuss the precautionary measures to control salt water intrusion in coastal areas. 10
- Q9.** (a) Discuss the problem of arsenic contamination and associated health hazards in our country. Comment on the remedial measures for controlling arsenic contamination. 15
- (b) Elaborate on the idea of conjunctive use of surface and groundwater and its benefits. 10
- (c) Write notes on the following : 15
- (i) Groundwater Legislation
  - (ii) Water-logging
  - (iii) Managed Aquifer Recharge



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