

HYDROGEOLOGY

Time Allowed : Three Hours

Maximum Marks : 200

INSTRUCTIONS

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

There are SIX questions divided under TWO Sections.

Candidate has to attempt ALL the SIX questions.

ALL the parts in the ONLY question in Section—A are compulsory.

In Section—B, THREE parts out of FOUR are to be attempted in each of the FIVE questions.

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

All parts and sub-parts of a question are to be attempted together in the answer-book.

Attempts of questions shall be counted in chronological 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 answer-book must be clearly struck off.

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

Answers must be written in ENGLISH only.

Section—A 0102

1. Write a note on each of the following in not more than 5 sentences : $5 \times 10 = 50$
- (a) Zone of aeration
 - (b) Hydrograph and its parts
 - (c) Perched aquifer
 - (d) Leaky aquifer
 - (e) Geohydrologic boundaries
 - (f) Reynolds' number
 - (g) Palaeochannel
 - (h) Hydrostratigraphy
 - (i) Secular and seasonal variation in groundwater table
 - (j) Effect of high nitrate in groundwater

Section—B

2. Answer any *three* of the following : $10 \times 3 = 30$
- (a) Give an account of the causes for fluctuation of water levels in aquifers due to pressure changes, tides, nearness to rivers and application of load. 10

- (b) Explain how the porosity can influence the hydraulic conductivity and transmissivity of an aquifer. 10
- (c) Describe the occurrence of groundwater in Deccan Trap Province and the Himalayan Highland Province. 10
- (d) Write short notes on the following : $2\frac{1}{2} \times 4 = 10$
- (i) Connate water and meteoric water
 - (ii) Consumptive use
 - (iii) Infiltration capacity
 - (iv) Capillary zone

3. Answer any *three* of the following : $10 \times 3 = 30$

- (a) (i) Explain the difference between aquifer performance test and step-drawdown method. 5
- (ii) If the discharge of groundwater is 10000 lph and drawdown of the well water is 2.5 m in one log cycle of time, calculate the transmissivity of the aquifer by using Jacob-Cooper method. 5

(b) Explain the cable tool method of drilling deep tube wells. Discuss about the development and maintenance of wells. 10

(c) Discuss the basic flow equations. 10

(d) Write short notes on the following :
 $2\frac{1}{2} \times 4 = 10$

(i) Steady-state flow

(ii) Use of bentonite mud in drilling

(iii) Textural analysis of drill cuttings for assembly designing

(iv) Recovery method

4. Answer any *three* of the following : $10 \times 3 = 30$

(a) What are the possible geogenic sources of fluoride in groundwater? Discuss its removal techniques. 10

(b) What are the sources of saline water intrusion into coastal and other aquifers? Explain the Ghyben-Herzberg relationship between saline water and freshwater. 10

(c) Explain the quality criteria determination for irrigation water. 10

(d) Write short notes on the following :
2½×4=10

(i) Stiff's diagram

(ii) Hardness of groundwater

(iii) Effect of mercury in drinking water

(iv) Representation of aerial distribution of groundwater quality

5. Answer any *three* of the following : 10×3=30

(a) Discuss the method of hydrogeomorphic mapping in hard rock areas and in alluvial terrains. 10

(b) Explain the geological methods of groundwater exploration. 10

(c) Explain the seismic refraction method to decipher the groundwater table. 10

(d) Write short notes on the following :

$2\frac{1}{2} \times 4 = 10$

- (i) Gravity survey in groundwater exploration
- (ii) Fracture analysis
- (iii) Horizontal profiling
- (iv) Role of dykes in storage and movement of groundwater

6. Answer any *three* of the following : $10 \times 3 = 30$

- (a) (i) What is meant by rainwater harvesting? Explain how the rooftop rainwater harvesting is carried out in urban areas. 5
- (ii) Calculate how much water can be obtained by rooftop rainwater harvesting from a building which has a rooftop area of 100 m^2 built in an area where the annual average rainfall is 600 mm, assuming the rainfall coefficient as 80%. 5
- (b) What are the groundwater problems in arid regions and its remediation? 10

(c) Describe the impact of canals on groundwater system. 10

(d) Write short notes on the following :
 $2\frac{1}{2} \times 4 = 10$

(i) Importance of groundwater legislation and its implementation in the current scenario

(ii) Basin method of artificial recharge

(iii) Groundwater mining

(iv) Effect of earthquake on groundwater levels
