

2021

GEOLOGY — HONOURS

Paper : CC-13

(Hydrogeology)

Full Marks : 50

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Question nos. 1 and 2 are compulsory and answer **any three** from the rest.

1. Answer the following questions :

1×10

(a) The percentage of a rock's total volume that is taken up by pore space is called

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|------------------|----------------|
| (i) Permeability | (ii) Recharge |
| (iii) Aquifer | (iv) Porosity. |

(b) The ability of an Earth material to transmit water is a measure of its :

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|--------------------|----------------------|
| (i) Porosity | (ii) Void ratio |
| (iii) Permeability | (iv) Specific yield. |

(c) A local water table positioned above the regional water table is said to be :

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|-----------------|-----------------|
| (i) Stranded | (ii) Perched |
| (iii) Displaced | (iv) Depressed. |

(d) A geological formation which cannot store or transmit water is called

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|----------------|----------------|
| (i) Aquifer | (ii) Aquiclude |
| (iii) Aquitard | (iv) Aquifuge. |

(e) Which of the following materials has the lowest porosity?

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|---------------|-----------------|
| (i) Shale | (ii) Gravel |
| (iii) Granite | (iv) Sandstone. |

(f) Influent streams are

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|---|-----------------------------------|
| (i) more common in arid regions | (ii) more common in humid regions |
| (iii) only found in areas of permafrost | (iv) sinkhole. |

(g) In laminar flow the hydraulic gradient is proportional to the

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|---|--|
| (i) first power of velocity | (ii) second power of velocity |
| (iii) first power of hydraulic conductivity | (iv) second power of hydraulic conductivity. |

Please Turn Over

- (h) The annual groundwater storage in an unconfined aquifer is equal to
- (i) land area \times rise in water table \times specific yield of aquifer
 - (ii) land area \times drop in water table \times porosity of formation
 - (iii) involved area of aquifer \times maximum seasonal fluctuation in water table \times specific yield of aquifer
 - (iv) involved area of aquifer \times maximum seasonal fluctuation in water table \times porosity of formation.
- (i) Channels all around the edge of a sloping roof to collect and transport rainwater to the storage tank is called
- (i) catchment
 - (ii) gutters
 - (iii) mesh
 - (iv) pipe.
- (j) The groundwater province of Kaladgi, Pakhal and Bijawar Series of Cuddapah System belongs to
- (i) Gondwana Sedimentary Province
 - (ii) Precambrian Crystalline Province
 - (iii) Precambrian Sedimentary Province
 - (iv) Cenozoic Sedimentary Province.

2. Answer **any five** questions :

2 \times 5

- (a) Why do water levels in wells rise and fall?
- (b) What is an aquifer?
- (c) What is vadose water?
- (d) What do you mean by artificial recharge?
- (e) Define the term 'transmissivity' of an aquifer?
- (f) What is Darcy's Law?
- (g) What is phreatophytes?
- (h) What is Ghyben Herzberg relation?

3. (a) Describe Darcy's experiment with a schematic diagram.

- (b) Deduce the relationship between discharge velocity and hydraulic gradient.

7+3

4. Distinguish between the following with neat sketches wherever required :

- (a) Confined aquifer and Unconfined aquifer
- (b) Intrinsic permeability and hydraulic conductivity
- (c) Connate water and Meteoric water
- (d) Flow lines and Equipotential lines.

2½+2½+2½+2½

5. (a) Discuss with a neat sketch the systems concept of hydrological cycle.
(b) Why transfer of water from one store to another in hydrological cycle is important?
(c) State the factors affecting runoff in a basin. 6+2+2
6. (a) What is artificial recharge and why is it adopted in the present-day context?
(b) Mention the factors that you will consider if you are assigned the task of artificially recharging the groundwater in an arid to semi-arid area of West Bengal. 5+5
7. Mention the different Groundwater Provinces of India with their basic hydrogeological features. 10
8. Discuss briefly the sources of the following chemical constituent in groundwater : 2×5
(a) Calcium
(b) Iron
(c) Carbonate and Bicarbonate
(d) Chloride
(e) Sulphate.
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