

**B. SC. GEOLOGICAL SCIENCE EXAMINATION, 2022**

( 3rd Year, 1st Semester )

**HYDROGEOLOGY**

**PAPER – CORE/TH/11**

Time : Two hours

Full Marks : 40

(Use a separate Answer script for each Part)

**PART – I (20 Marks)**

**Answer any four questions from the following:**

**4×5 = 20**

1. Mentions the assumptions to be taken for the application of Darcy's law? What is meant by 'coefficient of permeability'? Establish the relation between 'coefficient of permeability' and 'coefficient of percolation' of a porous media. ( 2+1+2)
2. How does water content of a porous media differ from its degree of saturation? Discuss the effect of compaction & consolidation on the porosity and permeability of an unconfined aquifer. What is meant by the term 'effective porosity'? ( 2+2+1)
3. **Distinguish in between (any two)** (2×2.5)
  - a. Flowing & Non flowing artesian well
  - b. Wilting point & Filed capacity
  - c. Interflow & Base flow
4. A confined aquifer has a source of steady recharge. Permeability of the aquifer measured is 50 m/day, and porosity is 20%. The piezometric head in two observatory wells 1000 m apart is 55 m and 50 m respectively, from a common datum. The average thickness of the aquifer is 30 m, and the average width of the aquifer is 5 km. Compute (a) the seepage velocity of water flowing through the aquifer, (b) the average travel time of the flow through the aquifer to a point 4 km downstream from its recharge point. (5)
5. A field sample of unconfined aquifer is packed in a test cylinder. The length and the diameter of the cylinder are 60 cm and 8 cm respectively. The filed sample tested for a time period of 4 minutes under a constant head difference of 17.5 cm. As a result 47.4 cm<sup>3</sup> of water is collected at the outlet. Determine the hydraulic conductivity of the aquifer sample (in cm/minute). (5)

[ Turn over

[ 2 ]

**PART – II (20 Marks)**

**Answer any four**

1. (a) What is redox reaction?  
(b) Which factors contribute to arsenic dissolution and mobilization in groundwater?  
(c) What is carbonate equilibria, and why is it important for groundwater geochemistry?  
1+2 +2
2. (a) What are the biggest water-related challenges in the world? Justify your answer.  
(b) How does climate change affects groundwater recharge?  
2.5 +2.5
3. (a) What is residence time?  
(b) In the ascending order, list the following based on the typical residence time: World ocean, polar ice, lakes, groundwater, Atmospheric moisture.  
(c) What are the main components of the water budget equation in a regional hydrologic cycle?  
1+2+2
4. (a) Why do we need to estimate hydraulic conductivity?  
(b) How do the hydraulic head characteristics of the flow system in a recharge area differ from the discharge area under a steady state?  
2+3
5. (a) What is meant by water table for confined and unconfined aquifers?  
(b) What are the uses of water level measurements? are there any other alternatives? If yes, which is suitable and why?  
(c) Explain the causes of water table fluctuations in aquifers.  
1 +2+2