2024

GEOLOGY

(Honours Core)

Paper : GLG–HC–4036

(Hydrogeology)

Full Marks : 60

Time : Three hours

**The figures in the margin indicate
full marks for the questions.**

1. Tick the correct answer :   1×7=7

    (a) The porosity of mudstone varies from

        (i)   0·01 to 0·1

        (ii)   0·10 to 0·15

        (iii)   0·35 to 0·45

        (iv)   0·72 to 0·80

(b) The geological formation which may contain water but does not contain any yield is

(i) aquifer

(ii) aquifuge

(iii) aquiclude

(iv) aquitard

(c) In case of a flowing well, the piezometric surface is always

(i) below the ground level

(ii) above the ground level

(iii) at the ground level

(iv) above or below the ground level

(d) Meter square per day is the unit of expression in metric system of

(i) permeability

(ii) transmissivity

(iii) conductivity

(iv) storativity

(e) Excessive pumping in relation to recharge can cause

(i) the water table to decline

(ii) a cone of depression to form

(iii) the well to decline

(iv) All of the above

(f) Which of the following is not an example of artificial aquifer recharge ?

(i) Sprinklers

(ii) Injection wells

(iii) Subsurface dykes

(iv) Percolation tanks

(g) Which of the following equations defines Darcy's law ?

(i) $q = KI$

(ii) $q = K/I$

(iii) $q = Ki\,A$

(iv) $q = Ki/A$

2. Answer the following questions : 2×4=8

(a) A soil scientist collects a cube-shaped soil sample from the field, with dimensions of 20 centimeter for each side, to test the porosity. The scientist crushed and properly dried the sample in an oven to remove all the air and water content, and the dry matter occupies complete space in a container with a volume of 2 litres. Calculate the porosity of the soil.

(b) A well is located in an aquifer with a conductivity of 20 meters per day and a storativity of 0·005. The aquifer is 35 meters thick and is pumped at a rate of 2725 cubic meters per day. Calculate the transmissivity.

(c) A unconfined aquifer with a storativity of 0·13 has an area of 120 square kilometers. The water table drops 5 m during a drought. How much water was lost from storage ?

(d) The required travel time for tracer to travel from an injection well to another well at a distance of 15 m is 3 hours. The difference of water table elevation between these two wells is 0·5 m. Porosity of the aquifer is 20%. Determine the hydraulic conductivity.

3. Write on *any three* from the following :

5×3=15

(a) Hydraulic conductivity and transmissivity

(b) Specific yield and storativity

(c) Interflow and baseflow

(d) Potentiometric surface

(e) Geologic materials as aquifers

4. Answer *any three* of the following questions :

10×3=30

(a) What are the basic principles involved in electrical resistivity method ? Give an account on the various types of surface resistivity methods employed in groundwater exploration. 4+6=10

(b) What do you mean by chemical and physical contamination of ground water ? Describe briefly on the problem of arsenic contamination in groundwater giving emphasis on its distribution in Assam and related health hazards.

4+6=10

(c) What is Rainwater harvesting ? Write a note on the indirect methods of artificial recharge of groundwater with schematics. 3+7=10

(d) What are aquifers, aquitards, aquicludes and aquifuges ? Explain the types of aquifers with suitable illustrations.

4+6=10

(e) What is water table ? Explain the causes of water table. 2+8=10

(f) What is logging ? Write a note on the subsurface borehole logging methods for groundwater exploration. 2+8=10

_____