3 (Sem–4/CBCS) GLG HC 3

2022

GEOLOGY

(Honours)

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 : ***(any seven)*** 1×7=7

   (a) Darcy's law is valid when the flow is

   (i) laminar and steady

   (ii) non-uniform

   (iii) turbulent

   (iv) both laminar and turbulent

(b) Which aquifer is called a water table aquifer ?

(i) Confined aquifer

(ii) Unconfined aquifer

(iii) Ground aquifer

(iv) Connate aquifer

(c) What is the pressure at the upper surface of unconfined aquifer ?

(i) Very high pressure

(ii) Lower than atmospheric pressure

(iii) Equal to atmospheric pressure

(iv) Greater than atmospheric pressure

(d) What is the volume of voids in a rock mass expressed in percentage of total volume of rock called ?

(i) Porosity

(ii) Void ratio

(iii) Permeability

(iv) Specific yield

(e) The unit for specific capacity is

(i) m^3/sec

(ii) m^2/sec

(iii) m/sec

(iv) unitless

(f) Which among the following is the best example of aquiclude ?

(i) Granites

(ii) Gravels

(iii) Compacted clays

(iv) Sandstones

(g) A stream that provides water to the water table is termed as

(i) affluent stream

(ii) influent stream

(iii) ephemeral stream

(iv) perennial stream

(h) Which of the following radiation logging methods is used for determination of bulk density of formation ?

(i) Gamma Gamma logging

(ii) Natural gamma logging

(iii) Neutron logging

(iv) Beta logging

(i) Isohyet is a line joining all places having

(i) the same atmospheric pressure

(ii) the same depth of rainfall

(iii) the same temperature

(iv) the same depth to the groundwater table

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

(i) permeability

(ii) transmissivity

(iii) conductivity

(iv) storativity

2. Answer ***any four*** from the following : 2×4=8

(a) A laboratory test on a sample from an aquifer revealed a porosity of 35 % and specific retention of 15%. Calculate the specific yield of the aquifer material.

(b) Calculate and interpret the SAR value for a sample with Na^{+}, Ca^{++} and Mg^{++} concentrations of 45, 78 and 34 (all values in meq/l).

(c) Determine Darcy's velocity for the flow of groundwater in an aquifer between two wells 20*mts* apart with a difference in their water surface elevation being $0.5m$. Hydraulic conductivity is $864m/day$.

(d) Hydrogeological survey of a sub basin measuring $50km^2$ shows average rise in the phreatic water level in the valley fill sediment at the end of the wet period lasting 15 days, at $0.8m$. Specific yield in the zone of fluctuation is 0.10. Estimate the average recharge rate that occurred during the wet season.

(e) A well is located in an aquifer with a conductivity of 15 meters per day and a storativity of 0.005. The aquifer is 20 meters thick and is pumped at a rate of 2725 cubic meters per day. Calculate the transmissivity.

(f) An artesian aquifer $20m$ thick has a porosity of 20% and bulk modulus of compression of $10^8 N/m^2$ Estimate the storage co-efficient of the aquifer.

(g) An unconfined aquifer with a storativity of 0.13 has an area of 300*sq. km.* The water table drops 2 meter during a drought. How much water was lost from storage.

(h) Calculate the fresh water flow in a coastal aquifer extending to a length of $40km$ along the coast, assuming permeability of $40m^3/day/m^2$, average thickness of the aquifer is $20m$, and the piezometric gradient of $50m/km$.

3. Answer ***any three*** from the following questions : 5×3=15

(a) Hardness of groundwater and its significance

(b) Storage coefficient in confined and unconfined aquifer

(c) Factors affecting infiltration

(d) Rainwater harvesting

(e) Drawdown and cone of depression

(f) Fluoride content in groundwater

(g) Piezometric surface

(h) Specific discharge and specific capacity

4. Answer ***any three*** from the following questions : 10×3=30

(a) Which is of utility in groundwater investigations — seismic reflection or refraction method, and why ? Elaborate on the relevant method.

(b) With a neat sketch, differentiate between confined aquifer and unconfined aquifer. Write a note on perched aquifer and its significance in water supply schemes.

(c) With a neat sketch, describe the vertical distribution of groundwater. Write a note on the seasonal variation of groundwater level fluctuations.

(d) What are the basic principles involved in electrical resistivity method ? Give an account on the types of surface resistivity methods employed in groundwater exploration.

(e) What is artificial recharge of groundwater considered an important strategy for groundwater management ? Write a note on different methods of artificial recharge of groundwater.

(f) What do you mean by quality of water ? Write a note on the physical and chemical properties of water.

(g) What is logging ? What are well logging techniques and how are they useful ?

(h) What are the assumptions for Theis non-equilibrium formula ? Explain Theis non-equilibrium method for computing aquifer parameters.

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