

BSMN 325 - HYDROGEOLOGY

NOTES:

- This examination has 5 questions on 3 pages.
- Question Q1 is of 30 marks and is compulsory. Each of the questions Q2-Q5 has 20 marks and you choose any 2 of them.
- There are 70 possible marks for this examination.
- Clarity and organization of the answers are important.
- Duration: 2 Hours

Q1.

- a) In a field test a time of 6 hours was required for a tracer to travel between two observation wells 42 m. If the difference in water table elevation in these wells were 0.85 m and porosity of the aquifer is 20%. Calculate the coefficient of the permeability.

[5 Marks].

- b) In a horizontal, confined aquifer, hydraulic conductivity changes in the direction of flow linearly from $K_a=0.2$ m/d at point A to $K_b=0.1$ m/d at point B, and porosity changes linearly from $n_a=0.1$ to $n_b=0.2$ (A and B are along a typical flow path). Is the velocity of ground water constant along the flow path? Why or why not?

[5 Marks].

- c) A chemical tracer has been injected in a deep confined aquifer, and its concentrations monitored at observation wells. Expected arrival time was calculated based on advective velocity. Give at least one reason for each of the following cases: (i) the tracer arrived slightly earlier than expected; (ii) the tracer arrived much earlier than expected; (iii) the tracer arrived slightly later than expected; and (iv) the tracer arrived much later than expected.

[5 Marks].

d) A core sample from unsaturated zone is 10 cm long, 5 cm in diameter, weighs 420.3 g before drying and 369.2 g after drying. Calculate gravimetric water content, volumetric water content, porosity, void ratio, saturation percentage, and bulk density.

[5 Marks].

e) What is the difference between hydraulic head h and hydraulic potential Φ ? What are common units of each? Write an equation relating a change Δh in hydraulic head to a change $\Delta\Phi$ in hydraulic potential.

[5 Marks].

f) Write Darcy's law in terms of hydraulic head h and conductivity K , and again in terms of fluid potential Φ and permeability k . When might it be most convenient to use the first form of Darcy's law? The second?

[5 Marks].

Q2.

a) A well penetrates into an unconfined aquifer having a saturated depth of 50 m. The discharge is 250 lpm at 8 m drawdown. What would be the discharge at 10m drawdown? The radius of influence in both the cases may be taken as same. **[10 Marks].**

b) A confined stratified aquifer has a total thickness of 12 m and is made up of three layers. The bottom layer has a coefficient of permeability of 30 m/day and a thickness of 5 m. The middle and top layers have permeability of 20 m/day and 45 m/day respectively and are of equal thickness. Calculate the transmissibility of the confined aquifer and the equivalent permeability, if the flow is along the stratification.

[10 Marks].

Q3.

a) Describe Chow's method for the estimation of aquifer parameters. **[8 Marks]**

b) A well is located in a 25 m confined aquifer of permeability 30 m/day and storage coefficient 0.005. If the well is being pumped at the rate of 1750 lpm, calculate the drawdown at a distance of (i) 100 m and (ii) 50 m from the well after 20 hrs of pumping.

[12 Marks].

Q4.

a) Describe any one method of construction of tube well.

[10 Marks].

b) Describe the electrical resistivity method for the estimation of thickness of subsurface formations in a horizontal surface.

[10 Marks].

Q5.

- a) What are the applications of electrical resistivity method?
[5 Marks].
- b) Describe the seismic refraction method for the estimation of thickness of subsurface formations in a horizontal surface with a neat sketch.
[15 Marks].