Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
300 Level 1st Semester Examination – June/July 2017
MRT 352-2 Principles of Hydrogeology

Uva Wellassa University

Instructions to candidates
Duration: Two (02) hours
Number of questions: Four (04) Essay
Answer all questions
Mark allocation: 100 Mark

1.

a. For a watershed, from 1996 to 2016, the precipitation is 1000 mm/yr and average stream flow is 5.32 m^3/sec. The watershed area is 482 km^2. Estimate the average annual evapotranspiration in mm/yr for the watershed mentioning the assumptions that can be made for long-term water balance. (Consider 1 year = 365.25 days) (10 mark)

b. An aquifer has three different formations which are located below each other. Formation A has a thickness of 8.2 m and a hydraulic conductivity of 23.5 m/d. Formation B has a thickness of 2.9 m and a hydraulic conductivity of 139 m/d. Formation C has a thickness of 34 m and a hydraulic conductivity of 36 m/d. Assume that each formation is isotropic and homogeneous. Compute both the overall horizontal and vertical conductivities in m/d. (10 mark)

c. A constant-head permeameter has a sample of medium-grained sand 15 cm in length and 25 cm^2 in cross sectional area. With a head of 5.0 cm, a total of 100 mL of water is collected in 12 min. Find the hydraulic conductivity in m/d. (10 mark)

2. The following data were collected at a nest of piezometers (several piezometers of different depths located within a few meters of each other)

	A	B	C
Elevation at surface (meters above mean sea level)	225	225	225
Depth of piezometers (meters)	150	100	75
Depth to water (meters below surface)	80	77	60

a. What is the hydraulic head at A, B, and C? (6 mark)
b. What is the pressure head at A, B, and C? (6 mark)
c. What is the elevation head in each well? (6 mark)
d. What is the vertical hydraulic gradient between the piezometers? Explain to which direction water flows between A and B, B and C, and A and C. (6 mark)

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3. A soil sample was collected in the field and placed in a container with a volume of 75.0 cm^3. The mass of the soil at the natural moisture content was 150.25 g. The soil sample was then saturated with water and reweighed. The saturated mass was 155.55 g. The sample was then oven-dried to remove all the water and reweighed. The dry mass was 129.50 g. Note that masses were determined by weighing on a balance. All measurements were made at 26 °C. (Consider that the density of water at 26 °C is 0.997 g/cm^3)
Determine the following,
   a. Soil porosity (4 mark)
   b. Gravimetric water content under natural conditions (4 mark)
   c. Volumetric water content (4 mark)
   d. Saturation ratio (4 mark)
   e. Dry bulk density (4 mark)
   f. Particle density (4 mark)
   g. Soil porosity using the relationship between soil porosity, dry bulk density and particle density (4 mark)

4. The properties of a fresh-water-table aquifer (A) and two confined saline-water-aquifers (B,C) which are located below each other are given in the table.

Aquifer	Water density (kg/m^3)	Elevation head (m)	Point-water head (m)
A	1000	55	56
B	1040	32	52
C	1100	6	50

   a. If a hole is bored to connect the A and B aquifers, to which direction water will flow? From A to B or B to A? Explain with calculations. (6 mark)
   b. If a hole is bored to connect the B and C aquifers, to which direction water will flow? From B to C or C to B? Explain with calculations. (6 mark)
   c. If the A and C aquifers are connected using a large diameter PVC pipe, to which direction water will flow? From A to C or C to A? Explain with calculations. (6 mark)