Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
400 Level 1st Semester Examination – June/July 2017
MRT 451-2 Advanced Hydrogeology

Uva Wellassa University

Instructions
Duration: 02 hours
Number of questions: 04
Answer All questions
Mark allocation: 100 marks
Illustrate your answers with sketches/diagrams where necessary. Additional graph sheets are not provided

Index Number:-

1. a. i. What is a zero flux plane? (5 marks)

   ii. If an area received a rainfall after a drought period and followed by another longer dry period and a rainfall, draw the unsaturated zone (assuming permeable) soil water potential curve for the entire period and label each event (5 marks)

   b. What is explained by hysteresis? (5 marks)

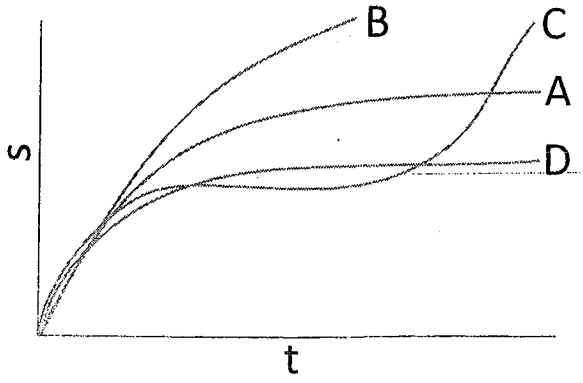
   c. Compare the saturated and unsaturated hydraulic conductivities with their associated parameters. (5 marks)

   d. Explain the working principle TDR and Neutron probe methods used to estimate volumetric moisture content with their limitations. (5 marks)

2. a. Discuss following.

   i. Development of Cooper–Jacob solutions from Theis solutions. (5 marks)
   ii. Why the parameter "r" is important in estimating "S" of an aquifer. (5 marks)
   iii. Why the Storativity cannot be measured of an aquifer that is at steady sate. (5 marks)

   b. Identify the following time vs drawdown curves and justify your answer. (5 marks)



43 50

3. In a test of a confined aquifer, the pumping rate was 1000 m^3day^{-1}. Drawdown data were collected at an observation well that is 45 m away.

i. Calculate Transmissivity and Storativity based on Cooper – Jacob solutions using time and drawdown data given below. (10 marks)

ii. What are the additional assumptions you should make? (5 marks)

iii. Prove the assumptions made in part (ii.) are correct or not. (5 marks)

$$T = \frac{2.3Q}{4\pi\Delta s}, S = \frac{2.25Tt_0}{r^2} \text{ and } (u = \frac{rS}{4Tt}, \text{ if necessary})$$

N. B. All above are conventional notations

Time (min)	Drawdown (m)	Time (min)	Drawdown (m)	Time (min)	Drawdown (m)
0	0.00	10	0.57	120	1.00
1	0.20	12	0.60	150	1.04
1.5	0.27	14	0.63	180	1.07
2	0.30	18	0.67	210	1.10
2.5	0.34	24	0.76	240	1.12
3	0.37	30	0.81		
4	0.41	40	0.85		
5	0.45	50	0.90		
6	0.48	60	0.93		
8	0.53	100	0.96		

4.

a. Given below are information obtained from a step drawdown test of a pumping water well.

Drawdown (m)	Discharge ($m^3 s^{-1}$)
1.14	0.0058
5.57	0.0174
13.54	0.0289
23.67	0.0450

$$s = BQ + CQ^2 \qquad E_w(\%) = 100(S_c B)$$

$$E_w = \left(\frac{BQ}{s_w}\right) 100\% = \left(\frac{BQ}{BQ + CQ^2}\right) 100\%$$

N. B. All above are conventional notations

i. Calculate well loss coefficient and aquifer loss coefficient. (10 marks)

ii. Calculate the well efficiency for a pumping rate of 0.035 $m^3 s^{-1}$. (5 marks)

b. Explain the Aquifer loss, Well loss and their behavior with respect to the drawdown. (5 marks)

c. How would you identify that a production well has lost its efficiency due to clogging? Briefly explain the processes that makes a production well clogged. (5 marks)

d. Briefly explain the importance of followings in water well industry. (5 marks)

i. Drilling fluid

ii. Gravel pack