Uva Wellassa University
End Semester Examination – February/ March 2012
MRT 451-2 Advanced Hydrogeology
Time: Two (02) hours

Uva Wellassa University

Total **04** Questions
Answer **all** questions
Draw sketch diagrams where necessary
You will not be provided with **additional** graph papers

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01) (i) Discuss the of behaviour of the moisture content with respect to the matrix suction upon draining of following soil/rock types and make a comparison

(a) Silty sand (3 marks)
(b) Clay (3 marks)
(c) Chalk (4 marks)

(ii) Explain the process of development of a zero flux plane. (5 marks)
(iii) What is explained by the hysteresis? (5 marks)
(iv) Discuss the parameters associated with the unsaturated hydraulic conductivity and their relationship. (5 marks)

(Total – 25 marks)

02) (i) Discuss followings;

(a) Major differences between Theim and Theis solutions. (3 marks)
(b) Evolution of Theis solutions into Cooper – Jacob solutions. (5 marks)
(c) Shape of the Neuman type curve of the water level in a pumping unconfined aquifer. (4 marks)

(ii) In a test of a confined aquifer, the pumping rate was 500 m^3day^{-1}. Drawdown data collected at an observation well 300 m away are given below.

(a) Calculate transmissivity and storativity based on Cooper – Jacob solutions using time and drawdown data given below. Give the units in dimensions of meters and days

(10 marks)

(b) What are the additional assumptions you should make? (4 marks)

(c) Prove the assumptions made in part (b) are correct. (4 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)
1.00	0.03	10.83	0.95	117.21	2.70
1.27	0.05	13.74	1.11	148.74	2.89
1.61	0.09	17.43	1.27	188.74	3.07
2.04	0.15	22.12	1.44	239.5	3.26
2.59	0.22	28.07	1.61	303.92	3.45
3.29	0.31	35.62	1.79	385.66	3.64
4.18	0.41	45.20	1.97	489.39	3.83
5.30	0.53	57.36	2.15	621.02	4.02
6.72	0.66	72.79	2.33	788.05	4.21
8.53	0.80	92.37	2.52	1000	4.39

(Total – 30 marks)

03) (i) Given below are information obtained from a step drawdown test.

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

(b) Calculate the well efficiency for a discharge of 0.0029 $m^3 s^{-1}$. (5 marks)

Drawdown (m)	Discharge (m^3 day^{-1})
1.81	80.12
4.02	176.04
4.94	209.82
6.13	250.70

(ii) Discuss the behaviour of well loss and aquifer loss at a given pumping rate. (5 marks)

(iii) Explain the importance of performing a step drawdown test. (5 marks)

(Total – 25 marks)

04) (i) What are the boundary conditions that you would come across while performing a pumping test? Explain their effects on the cone of depression. (6 marks)

(ii) Discuss the properties of following media in terms of a drilling fluid;

(a) Bentonite (3 marks)
(b) A polymer (3 marks)
(c) Air (3 marks)

(iii) Critically evaluate the role of fracture aperture in Cubic Law in different fracture flow models. (5 marks)

(Total – 20 marks)