Uva Wellassa University, Sri Lanka
Faculty of Science and Technology
Mineral Resources and Technology Degree Programme
1st Semester Examination – March/April 2013

Uva Wellassa University

MRT 451-2 Advanced of Hydrogeology

Instructions to candidates
Total 04 (four) questions.
Answer all questions.
Time allocation: Two (02) hours
Draw sketch diagrams where necessary.
You will not be provided with extra graph papers
Total: 100 marks

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1.

a. i. What is a zero flux plane? (5 marks)
ii. Discuss its behaviour at different climatic conditions. (5 marks)

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

c. Describe the parameters associated with the unsaturated hydraulic conductivity and their relationships. (5 marks)

2. a. Discuss following.

i. Major differences between Theim and Theis solutions. (5 marks)
ii. Development of Cooper–Jacob solutions from Theis solutions. (5 marks)

b. In a test of a confined aquifer, the pumping rate was 2500 m^3day^{-1}. Drawdown data were collected at an observation well that is 60 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. (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		

3.

a. Given below are information obtained from a step drawdown test.

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

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

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 discharge of 0.035 $m^3 s^{-1}$. (10 marks)

4. a. Explain the following with proper illustrations.

i. Drawdown vs. Time curve, when the cone of depression of a pumping well hits a Dirichlet boundary.
ii. Drawdown vs. Time curve, when the cone of depression of a pumping well hits a Neumann boundary.
iii. Drawdown vs. Time curve of a pumping unconfined aquifer.
iv. Matric(x) Suction vs. Volumetric Moisture Content of a draining chalk
v. Matric(x) Suction vs. Volumetric Moisture Content of a draining fractured sandstone

(25 marks)

b. Discuss behaviour of fluid flow and solute transport in a dual porous medium.

(5 marks)

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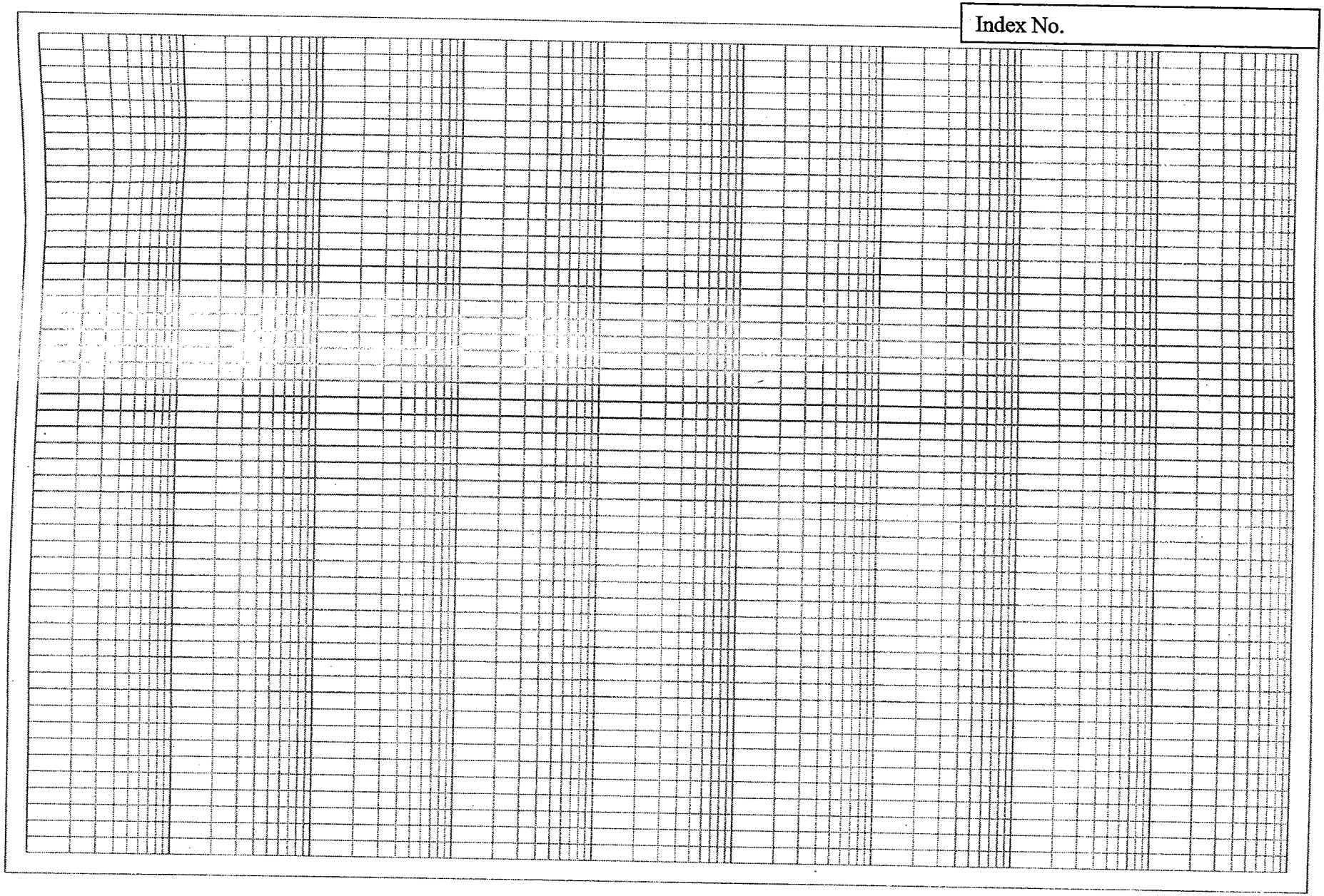

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