Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
3rd Year 2nd Semester Examination – Dec./Jan. 2018/2019

Uva Wellassa University

MRT 386-3 Groundwater Flow Modeling

Number of questions: Six (06)
Answer **five (05)** questions only
Time allocation: Three (03) hours
Mark allocation: 100

1.

(a) Distinguish between "Data-driven models" and "Process-based models".

(05 marks)

(b) Briefly describe the three scenarios of mathematical groundwater modeling where purpose-specific models are employed. State the limitations of mathematical groundwater models.

(15 marks)

2.

(a) Explain why a "conceptual model" is needed as an initial step in any groundwater modeling exercise.

(05 marks)

(b) Discuss the components of a conceptual model used in groundwater modeling. Elaborate with examples.

(15 marks)

3.

(a) Describe the advantage of numerical methods over analytical solutions in modeling groundwater flow.

(05 marks)

(b) The hydraulic head h, at a node (i,j) in a 2-dimensional finite difference grid can be expressed as $h_{i,j} = (h_{i-1,j} + h_{i+1,j} + h_{i,j-1} + h_{i,j+1})/4$ for steady-state groundwater flow in an isotropic aquifer where there are no sinks or sources. Briefly describe two iterative techniques to solve this equation.

(15 marks)

94

4.

If an aquifer with a uniform saturated thickness of b and hydraulic conductivity of K is recharged at a rate of R through its top surface, show that the fluid continuity equation under steady state conditions takes the following form where h is the hydraulic head.

$$\frac{\partial^2 h}{\partial x^2}+\frac{\partial^2 h}{\partial y^2}=-\frac{R(x,y)}{Kb}$$

(20 marks)

5.

(a) Explain how the changes in hydraulic head with time can release water from aquifer storage, or take water into storage.

(10 marks)

(b) The time-dependent 2-dimensional fluid continuity equation is given by

$$\frac{\partial^2 h}{\partial x^2}+\frac{\partial^2 h}{\partial y^2}=\frac{S}{T}\left(\frac{\partial h}{\partial t}\right)-\frac{R(x,y,t)}{T}$$

where S is the storage coefficient and T is the transmissivity of the aquifer. $R(x,y,t)$ indicates the recharge/discharge in space and time while h is the hydraulic head. Describe the groundwater flow environment presented in the above equation. [Note: Derivation of the equation is not required]

(10 marks)

Question 6 is based on the Computer Programming Fundamentals Section

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6.

(a) Develop an algorithm by drawing a flow chart for the following scenario.

Colombo City Centre (CCC) maintains a parking area as a service for the customers. They have their own method of calculating the parking rate for each vehicle as mentioned below.

- If the duration of parking is less than or equal to one (01) hour, Rs. 100.00 will be charged.
- After the first hour Rs. 50.00 will be charged per hour up to eight (08) hours.
- If the duration exceeds more than eight (08) hours, Rs.500.00 will be charged which is the rate for twenty-four (24) hours.
- Parking will not be allowed more than twenty-four 24 hours for any vehicle.

(10 marks)

(b) Briefly explain the memory allocation of variables in C programing with suitable examples.

(10 marks)