NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

APPLIED PHYSICS DEPARTMENT

MAPH 6121 – HYDROLOGY AND CONTAMINANT PROCESSES

MSC PART 2: JUNE 2005   DURATION: 4 HOURS

ANSWER **ALL** QUESTIONS.

NOTE: You are encouraged to make use of sketches to further illustrate your answers where possible.

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1.   (a) Give an illustrative description of the chemical evolution of meteoric ground

water.   [10]

(b) Briefly explain two (2) methods for measuring flow in streams.   [6]

(c) Show how total porosity is related to density measurements.   [4]

(d) Write down the relation used in fluid flow and explain clearly its usage. [5]

(e) State the general rules of permeability   [3]

(f) Write short notes to explain the following terms (i) confined aquifer and (ii)

unconfined aquifers?   [4]

(g) Give a concise description of the 'slug test', showing how it is used to

determine transmissivity and storativity.   [8]

2.   (i) Explain the use of water balance models, illustrating a few components of any modeling technique.   [10]

   (ii) Describe how electric flow is used to simulate / model groundwater flow.

                [10]

3.   (i) Consider a strip of aquifer with flow occurring in the direction from borehole X to borehole Y (figure below). The hydraulic conductivity is 20 m/day. How much water flows through in a day?
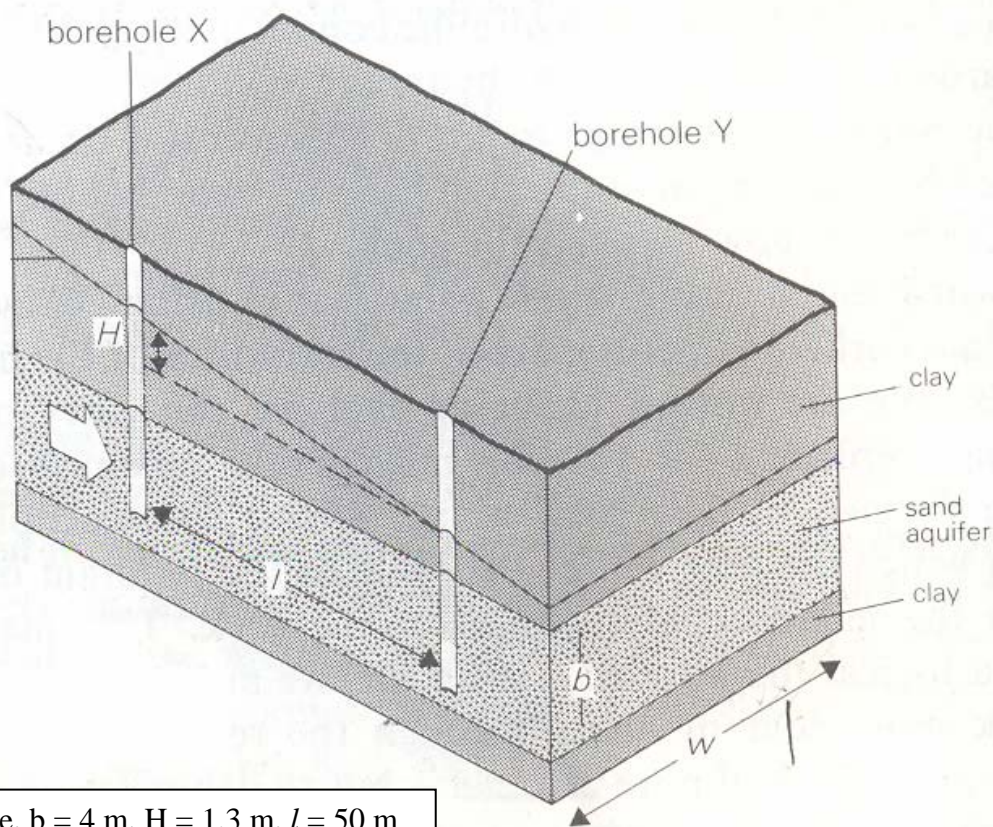
Where, b = 4 m, H = 1.3 m, l = 50 m and w = 15 m.

                [10]

   (ii) Using the Ghyben – Herzberg relation, explain how the shape and location of the interface between fresh water and salt water is determined in a salt-water / fresh-water interaction.   [7]

(iii) Give one major disadvantage of the Ghyben – Herzberg relation in the above mentioned analysis. [3]

4.   (i) Give a definition of the term 'Total Dissolved Solids', relating the definition to water hardness. [5]

(ii) Describe briefly, two mechanisms for the movement of contaminants through an aquifer. [10]

(iii) Justify the use of septic tanks in waste disposal. [5]

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