# Ollscoil *na* hÉireann, Gaillimh
National University *of* Ireland, Galway

## SUMMER EXAMINATIONS 2000

## FOURTH SCIENCE EXAMINATION - HYDROLOGY

Examiners: Professor P.E. O'Connell
Professor C. Cunnane
Mr. T. Henry

Time allowed is *three* hours.

Attempt *five* questions.
Answer Question 1 (Section A), and two questions each from Section B and Section C.
*All questions carry equal marks.*

## SECTION A

1. Answer any *eight* of the following:

   (a) What factors affect *transpiration* in *conifers*?
   (b) What is the *cumulative frequency distribution* in the context of a hydrological data series, and how is it obtained?
   (c) What is the Permanent Wilting Point?
   (d) What is the difference between *available soil moisture* and *available water capacity*?
   (e) Briefly explain the guidelines developed by Malin Falkenmark to evaluate the adequacy of global water supplies.
   (f) What is the *Peclet Number*? What does the magnitude of its value express?
   (g) How does the nature of a spill affect the pattern of contaminant migration in the *unsaturated* zone?
   (h) What are the three source control measures used to deal with leachate arising from solid waste? Write a brief note on each.
   (i) What is the difference between *drainage* and *imbibition*?
   (j) What is the basic difference between *advection* and *dispersion*?

   [*2.5 marks each*]

## SECTION B

2. Discuss, using examples, how manipulation of vegetation affects water yield.

   [*20 marks*]

3. Compare and contrast three methods available for determining an effective uniform depth of rainfall for a basin. Include the advantages and disadvantages of each method in your discussion.

   [*20 marks*]

4. Answer (a), (b) or (c).

(a) The Aral Sea has been called a "sandy graveyard." Explain how this situation arose, and offer some suggestions as to how the problems could be addressed.

[20 marks]

*or*

(b) The Colorado River has been described as the most legislated river in the United States. How did it earn this somewhat dubious title?

[20 marks]

*or*

(c) Should water be treated like any other natural resource such as oil, gas or coal? Whatever your answer, support it with examples and with reference to the various issues that arose in class.

[20 marks]

5. Explain how soil moisture content is a limiting factor on evaporation. Your answer should look at several of the many variables that affect this relationship.

[20 marks]

## SECTION C

6. A column filled with uniform sand has an input and output pipe attached. A continuous supply of water is introduced into the system, and, when steady state is reached, a continuous supply of tracer is added to the column. Explain how the tracer will behave in the column.

[20 marks]

7. There are six broad categories of groundwater contamination. List them, and discuss two in detail.

[20 marks]

8. Offer a detailed explanation of the theory and process of soil-vapour extraction as a remediation technique. Include an explanation of sparging in your answer.

[20 marks]

9. An aquifer is contaminated as a result of a contaminant spill. Your company has been contracted to deal with the problem. Assuming the legal aspects have been dealt with, you are asked to devise a strategy to deal with the problem. Outline this strategy, providing specific action options that could be used.

[20 marks]