UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER

PROGRAMME: BSC ABE 3, BSC AGRON 3, BSC HORT 3

COURSE CODE: ABE 302

TITLE OF PAPER: PRINCIPLES OF IRRIGATION

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS.

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SECTION I COMPULSORY

QUESTION 1

a) A sandy loam soil has volumetric water content of 19 % two days after heavy sprinkler irrigation. It is known that plants (in this case maize plants) would not be able to extract any water when the soil water content reaches 9 %. The farmer has decided that a good water management strategy for his crop would be to adopt a maximum allowable depletion level (MAD) of 40 %.

Considering the information above:

(i) What would be the irrigation trigger point, in terms of depth of water depleted, assuming a rooting depth of 0.9 m?

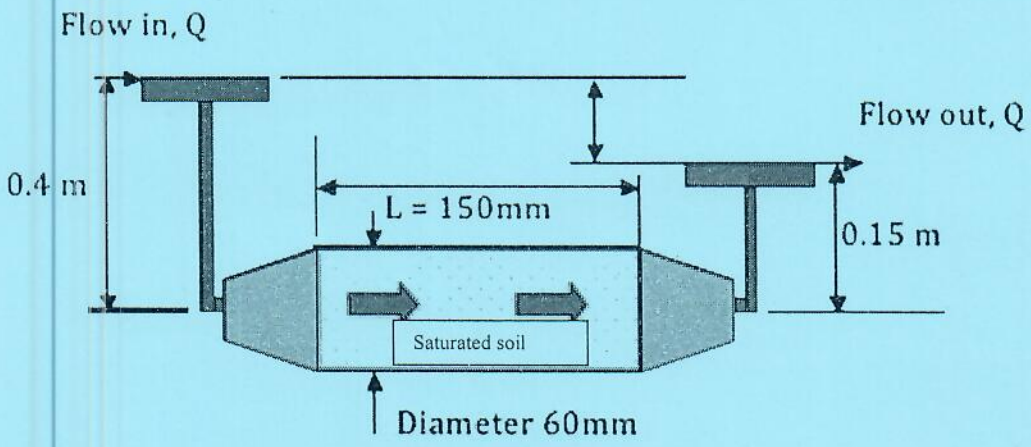
After several evaluation tests it was established that the sprinkler irrigation system had an application efficiency of only 65 % due to regular wind effects in the area. Considering that the average ET, during the considered period is 9.1 mm/day. Calculate

(ii) The gross water depth to be applied to bring the root zone to field capacity.
(iii) The number of days between irrigations
(iv) The irrigation system required flow (m^3/s) for the farmer's 200 ha field if he irrigates his field in 14 hours.

[25 marks]

b) A soil physics test was carried out to determine the hydraulic conductivity of a soil sample. The diagram shows the outflow to be 2.8 L/day. What is the hydraulic conductivity of the soil sample?

Darcy's Law: Hydraulic gradient through soil sample



[15 marks]

SECTION II ANSWER ANY TWO QUESTIONS

QUESTION 2

a) Discuss how soil texture affects the following soil moisture characteristics, giving appropriate examples.

i) Saturation
ii) Field capacity
iii) Permanent wilting point
iv) Available water

[12 marks]

b) Discuss four (4) factors that affect the soil's infiltrability.

[12 marks]

c) Various equations are used to model infiltration, and one of them is the Green and Ampt Equation. Explain the equation, its components and also shortcomings.

[6 marks]

QUESTION 3

a) In irrigation scheduling, two major questions have to be answered, when to apply and how much to apply. Explain how the following methods can be used, also stating the advantages and disadvantages of using them.

i) Neutron Probe
ii) Electrical resistance method
iii) Tensiometer

[15 marks]

b) With the aid of a diagram, describe the crop coefficient curve, and how it is used to determine crop evapotranspiration (ET_c).

[15 marks]

QUESTION 4

a) Discuss 5 factors to consider when choosing an irrigation system.

[15 marks]

b) Discuss the environmental impacts of irrigation.

[15 marks]