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UNIVERSITY OF SWAZILAND
SUPPLEMENTARY 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 OTHER
TWO QUESTIONS

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QUESTION 1

In a water management experiment, soil samples were extracted from a 0-25 cm soil profile. The following were calculated.

Bulk density   1.2 g/cm^3
Water content at present by mass   0.18
Saturation water content by volume   0.55
Field capacity by volume   0.45
Particle density   2.65g/cm^3
Permanent wilting point by volume   0.06

a) If water is used at an average rate of 4 mm/day, how long will it take for the 0-25 cm layer of soil to be at permanent wilting point from the present moisture content?

[10 marks]

b) A rainstorm of 30 mm infiltrates into the soil when it is at a water content of 0.25 on volume basis. To what depth would the water have penetrated if measured

   i)   immediately after the storm   **[5 marks]**
   ii) 24 hours after the storm   **[5 marks]**

c) Explain

   i)   Why a double ring infiltrometer is used instead of a single ring when carrying out an infiltration exercise.   **[10 marks]**
   ii) Why the gravimetric method of measuring soil moisture content may be less accurate when compared to tensiometer or moisture meter.
        [10 marks]

Total = 40 marks

QUESTION 2

Discuss with examples the following methods used in real time scheduling of irrigation:

   i.   Plant indicators   **[8 marks]**
   ii.   Soil water content   **[8 marks]**
   iii. Soil water potential   **[7 marks]**
   iv.   Water balance method   **[7 marks]**

Total = 30 marks

QUESTION 3

a)   Describe the concept of salinity in soils, outlining the following:

    i) How it is caused   [5 marks]
    ii) How it affects yields   [5 marks]
    iii) How it can be prevented or corrected   [5 marks]

b)   Explain how the quality and quantity of water can influence the choice of an irrigation system.   [10 marks]

c)   Briefly describe the relationship between irrigation system uniformity and efficiency.   [5 marks]

Total = 30 marks

QUESTION 4

Briefly discuss the following with respect to irrigation water use:

    i)   Steady-state infiltration rate   [5 marks]
    ii)   Over-irrigation   [5 marks]
    iii)   Soil water characteristic curve   [5 marks]
    iv)   Sub-surface drip irrigation   [5 marks]
    v)   Head losses   [5 marks]
    vi)   Pumping head   [5 marks]

Total = 30 marks