UNIVERSITY OF SWAZILAND

SUPPLEMENTARY EXAMINATION PAPER

2013

PROGRAMME: B.SC.

COURSE CODE: ABE 302

TITLE OF PAPER: PRINCIPLES OF IRRIGATION

ALLOWED TIME: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE.

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS

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SECTION ONE: COMPULSORY QUESTION

QUESTION 1
a)   A cylindrical soil sample has a diameter of 0.10 m and height of 0.30 m. The collected sample has a mass of 4.12 kg and an oven dry weight of 3.18 kg. Calculate the volumetric water content, the soil bulk density, the porosity, the void ratio and the degree of saturation.   (20 marks)

b)   At full development, a tomato crop is measured in an unrestricted soil profile to have an active root zone of 1.50 m. The maximum equivalent crop ET at the midpoint of the growing season is 9 mm/day. Assume that each irrigation fills the soil profile up to field capacity. For a sandy loam soil (field capacity = 21% and permanent wilting point = 9%) how many days are allowable between irrigations if 40% and 65% depletion of available water is allowed, respectively?   (10 marks)

c)   Find the quantity of water in m^3 or litres that must be added to raise the water content from 0.1 cm^3/cm^3 to 0.3 cm^3/cm^3 in a 1.2 m deep soil, if the field to be wetted is 1 hectare?   (10 marks)

SECTION TWO: ANSWER ANY TWO QUESTION

QUESTION 2
a)   After having been hit by three consecutive years of drought, a farmer decides to use irrigation to produce feeds for his livestock. As an Agricultural expert discuss any four factors that the farmer must consider before selecting the appropriate irrigation method for his farm.   (15 marks)

b)   Happy Sam irrigates his 25 ha field once a week. Because he is uncertain of his crop water requirements and in an effort to thoroughly irrigate the field, he loses an areal average of 2 cm to deep percolation with each irrigation. His pumping plant requires 75 kW of power and the average application rate of his irrigation system is 1 cm/hr. Assume water costs are 55 cents per 100 m^3 and energy costs 5 cents per kwh. How much is Sam paying for his deep percolation over a 12 week growing period?

(15 marks)

QUESTION 3
i)   Discuss briefly how you would determine the field capacity of a soil. Explain why the method is less accurate compared to other methods.   (10 marks)

ii)   With the aid of a clearly drawn diagram, discuss why a double ring infiltrometer is commonly used instead of a single ring infiltrometer when carrying out an infiltration rate test.   (10 marks)

iii)   Discuss how a tensiometer is used for measuring changes in soil moisture for irrigation scheduling purposes.   (10 marks)

QUESTION 4
State three (3) advantages and disadvantages of the following irrigation methods

       Furrow   (6 marks)
       Boarder   (6 marks)
       Basin   (6 marks)
       Sprinkler   (6 marks)
       Center Pivot   (6 marks)