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UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

2014

PROGRAMME: B.SC.

COURSE CODE: ABE 302

TITLE OF PAPER: IRRIGATION PRINCIPLES

ALLOWED TIME: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: CALCULATOR.

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS

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SECTION ONE: COMPULSORY QUESTION

QUESTION 1

a) Name any three (3) soil physical properties of interest to irrigators? {6 marks}

i).....

ii).....

iii).....

b) A famer is to apply urea 46%N at a rate of 120 Kg/ha. If he has three (3) hectares, how many 50 kg bags must he buy? {6 marks}

c) Convert the following units to the appropriate units on the right {6 marks}

i)	16 µg	→	kg
ii)	500 milli seconds	→	minutes
iii)	1000 kg/m^2	→	Tons/ha

d) A soil has a root depth of 0.4 m. A farmer decides to irrigate his field when the soil is at 8 percent volumetric water content. What is the soils volumetric water content at field capacity when the amount of irrigation is 65 mm. How much water in (m^3) must be added to the field if its area is 2.5 ha? Assume density of water equals 1.0 g/cm^3 and density of soil particles equals 2.65 g/cm^3. {6 marks}

e) A cylindrical soil sample has a diameter of 0.10 m and a height of 0.30 m. The wet weight of the sample is 4.12 kg and its dry weight is 3.18 kg. Assume density of water equals 1.0 g/cm^3 and density of soil particles equals 2.65 g/cm^3. Calculate the following;

i)	The gravimetric water content	{3 marks}
ii)	The soil bulk density	{ 5 marks}
iii)	The soils volumetric water content	{ 2 marks}
iv)	The soils porosity, N	{ 2 marks}
v)	The void ratio, e	{ 2 marks}
vi)	The degree of saturation.	{ 2 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) Draw a soil water balance diagram and explain the important components. (10 marks)

QUESTION 4

a) Sixteen (16) points were marked along a furrow channel in the LUM farm, and water allowed to flow during an irrigation event. Readings (in depths) were taken at the points as shown below (not necessarily in order).

80	70	68	74
78	66	64	70
52	56	54	64
74	60	56	86

From the readings; (show your working) {10marks}

i) determine the distribution uniformity (DU) and {5marks}

ii) the Christiansen Uniformity coefficient (CU). {5marks}

b) A farmer wants to design a sprinkler irrigation system. If the expected discharge from the sprinkler nozzles is 22.2 liters per minute, the depth of water to apply is 60 mm and the sprinkler stand time is 12 hours;

i) What should be the sprinkler spacing? {4 marks}

ii) If the irrigation system efficiency is 80%, how much water must be pumped from the river if the area is 20 hectares and the irrigation cycle is 6 days. {6 marks}