UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION PAPER

PROGRAMME: BSc. AGRICULTURAL AND BIOSYSTEMS ENGINEERING YR 3
BSc. AGRONOMY YR 3
BSc. HORTICULTURE YR 3

COURSE CODE: ABE 302

TITLE OF PAPER: IRRIGATION PRINCIPLES
TIME ALLOWED: 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 ONE

a) A soil sample with a wet weight of 300g has a 28.0 percent water content on a mass basis. Its saturated water content is 36.1 percent on a mass basis. Assume density of water equals 1.0 g/cm^3 and density of soil particles equals 2.65 g/cm^3.

i) Find the mass of water, volume of pores, and volume of air of the sample at 28.0 percent water content. {10marks}

ii) How much water (m^3) must be added to a field of area 3 ha to increase the volumetric water content of the top 40 cm from 16 to 28 percent? Assume density of water equals 1.0 g/cm^3 and density of soil particles equals 2.65 g/cm^3. {10marks}

b) Define the following terms used in irrigation; {20marks}

- Field capacity
- Permanent wilting point
- Management allowed depletion
- Eluviation
- Texture

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SECTION TWO: ANSWER ANY TWO QUESTION

QUESTION TWO

a) Farmer Joe irrigates his 30 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 3 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 1cm/hr. Assume water costs are 55 cents per 100 m^3 and energy costs 8 cents per kwh. How much is Joe paying for his deep percolation over a 16 week growing. (10 marks)

b) A farmer irrigates sugarcane which is at full canopy. The maximum evapotranspiration for the crop is 8 mm/day. Assuming a crop coefficient of 1 for sugarcane in the month of November;

i) complete the attached Profit and loss sheet for the farmer (14 marks)
ii) How many irrigations were done over the 20 day period (3 marks)
iii) What was the lowest stress experienced over the time period (3 marks)

QUESTION THREE

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. (20 marks)

b) A soil has a root depth of 0.4 m. A farmer decides to irrigate his field when the soil is at 12 percent volumetric water content.

I) What is the soils volumetric water content at field capacity when the amount of irrigation is 60 mm. {4 marks}

II) How much water in (m^3) must be added to the field if its area is 5.0 ha? {2 marks}

III) How long will it take to empty a 5,000 litre tank if three sprinklers each discharging 0.36 L/s are used. {4 marks}

Assume density of water equals 1.0 g/cm^3 and density of soil particles equals 2.65 g/cm^3.

QUESTION FOUR

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) Discuss briefly any four (4) soil physical properties of interest to irrigators. (12 marks)

iii) A farmer wants to know whether it is possible to irrigate a particular soil type in his farm. Discuss how you could help the farmer answer this question. (8 marks)

PROFIT AND LOSS RECORD BOOK

Field / Ha

HARVEST - MONTH

CURRENT - MONTH November

CROP FACTOR 1.0

TAM 80.0

RAM / MAD 40.0

DATE	Eff. RAIN	RAIN	ET.	Eff. ET	Balance (MM)	IRRIG APPLIC.	
Last month	C/F				12.0		
1			6.0				
2			5.0				
3			5.0				
4			14.0				
5			13.0				
6		45.0	2.0				
7			8.0				
8			9.0				
9			6.0				
10			7.0				
11		4.0	4.0				
12			5.0				
13			6.0				
14			7.0				
15			8.0				
16			3.0				
17			6.0				
18		25.0	4.0				
19			7.0				
20			4.0				