UNIVERSITY OF SWAZILAND
SPECIAL ASSESSMENT

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

COURSE CODE: ABE303

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 I: COMPULSORY QUESTION

### QUESTION 1

a) A sandy clay loam has a saturation of 44 %, field capacity of 30 %, and permanent wilting point of 15 %, all on weight basis. With a bulk density of 1.2 g/cm$^3$, determine the available water in mm/m.

**[10 marks]**

b) If a crop with a potential rooting depth of 1.1 m is planted in the soil as described in (c) above, and the peak ET is 6.1 mm/day, calculate the design net irrigation using an allowable depletion of 60 %.

**[5 marks]**

c) If the crop is grown in 2.3 hectares, and the application and conveyance efficiencies are 0.7 and 0.85 respectively, determine how much water in m$^3$ should be delivered in the field to irrigate the whole field.

**[5 marks]**

b) Discuss how the following instruments and/or methods are used in real time scheduling:

(i) Plant indicators **[6 marks]**
(ii) Tensiometers **[6 marks]**
(iii) Neutron probe **[4 marks]**
(iv) Water balance method **[4 marks]**

## SECTION II: ANSWER TWO QUESTIONS FROM THIS SECTION

### QUESTION 2

Write notes on how the soil's infiltrability can be determined using a double ring infiltrometer. **[30 marks]**

### QUESTION 3

a) Describe the following methods of irrigation:

(i) Solid set sprinkler irrigation **[5 marks]**
(ii) Sub-surface drip irrigation **[5 marks]**
(iii) Centre pivot **[5 marks]**
(iv) Low energy precision application (LEPA) **[5 marks]**

b) Briefly discuss four factors to consider when choosing an irrigation method or system. **[10 marks]**

### QUESTION 4

Discuss the following concepts as used in the physics of soil and water:

a) Field capacity
b) Matric potential
c) Particle density
d) Bulk density
e) Porosity

**[30 marks]**