



**UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER**

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

COURSE CODE: ABE303/ ABE 302

**TITLE OF PAPER: IRRIGATION PRINCIPLES/ PRINCIPLES OF
IRRIGATION**

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO
OTHER QUESTIONS.**

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GRANTED BY THE CHIEF INVIGILATOR**

SECTION I COMPULSORY

QUESTION 1

- a) Discuss the following irrigation systems, with the various types of irrigation under each system and also discussing the capabilities and limitations of each:
- i) Surface irrigation [6 marks]
 - ii) Sprinkler irrigation [8 marks]
 - iii) Micro-irrigation [6 marks]
- b) A cubic metre of a saturated clay soil has a dry mass of 4 kg and a porosity of 0.49. Calculate the void ratio, e , of this soil. [5 marks]
- c) 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 1230 kg/m^3 , determine the available water in mm/m. [5 marks]
- d) 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]
- e) 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]

SECTION II ANSWER ANY TWO QUESTIONS

QUESTION 2

- a) With the aid of a diagram, discuss the 3 stages of evaporation from the time when the soil is saturated with water. [10 marks]
- b) Define the following terms as used in irrigation:
- i) Capillarity [4 marks]
 - ii) Gravitational head [4 marks]
 - iii) Matric head [4 marks]
 - iv) Porosity [4 marks]
 - v) Soil's infiltrability [4 marks]

QUESTION 3

- a) In irrigation scheduling, two major questions have to be answered, when to apply and how much water to apply. Explain how the following methods can be used, also stating the advantages and disadvantages of using them.
- i) Neutron Probe [5 marks]
 - ii) Electrical resistance method [5 marks]
 - iii) Tensiometer [5 marks]
- b) Explain the causes of pressure variation in sprinkler irrigation and how it affects the application uniformity of the system. [15 marks]

QUESTION 4

- a) Describe the process of soil salinization, i.e. what it is, how it affects crop growth and the measures that can be taken to prevent it from occurring.

[15 marks]

- b) Discuss the economic and environmental impacts of over-irrigation.

[15 marks]