



**UNIVERSITY OF SWAZILAND  
RESIT EXAMINATION PAPER**

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

**COURSE CODE: ABE303/ 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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GRANTED BY THE CHIEF INVIGILATOR**

**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  $1230 \text{ kg/m}^3$ , 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  $\text{m}^3$  should be delivered in the field to irrigate the whole field.

[5 marks]

b) Discuss with examples the following methods used in real time scheduling:

- (i) Plant indicators
- (ii) Soil water content determination
- (iii) Soil water potential determination
- (iv) Water balance method

[6 marks]

[6 marks]

[4 marks]

[4 marks]

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**SECTION II: ANSWER TWO QUESTIONS FROM THIS SECTION**

**QUESTION 2**

a) Explain how the following climatic factors affect evapotranspiration in agroecosystems:

- (i) Solar radiation [5 marks]
- (ii) Relative humidity [5 marks]
- (iii) Air temperature [5 marks]
- (iv) Wind [5 marks]

b) Discuss the economic and environmental impacts of over-irrigation. [10 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**

Irrigation is about the replenishment of water in the root zone. For that to be achieved, the water has to infiltrate into the soil. Infiltration is affected by a number of factors. Discuss five of these factors.

[30 marks]

