



**UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION PAPER**

PROGRAMME: BSC ABE 4

COURSE CODE: ABE 403

TITLE OF PAPER: IRRIGATION DESIGN AND MANAGEMENT

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

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

**DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN
GRANTED BY THE CHIEF INVIGILATOR**

SECTION I COMPULSORY

QUESTION 1

a) Explain with examples how the following factors are key in choosing an appropriate irrigation system:

- i) Quality of water
- ii) Available expertise
- iii) Type of crop
- iv) Cost of energy
- v) Slope of land

[20 marks]

b) Calculate the Centre Pivot (CP) irrigation system capacity (in L/s) and peak application rate (mm/h) at the distal end of the CP, for the following:

Crop – maize

Climate – Hot

$ET_{peak} = 7$ mm/d

Centre Pivot irrigation application efficiency, $E_a = 0.87$

Desired actual irrigation interval for the peak season, $f = 1$ d

Total time to complete an irrigation event, $T = 22$ h

Impact sprinkler selected with an effective wetted diameter, $D_w = 20$ m (distal sprinkler)

The leaching requirement (or fraction), $LF = LR < 0.1$

Length of the centre pivot lateral, $R_s = 405$ m

[20 marks]

SECTION II ANSWER ANY TWO QUESTIONS

QUESTION 2

- a) Given the following weather data observed and recorded on the 2nd March 2018, calculate the vapour pressure deficit (VPD)

Maximum temperature (T_{\max}) = 31 °C

Minimum temperature (T_{\min}) = 21 °C

Maximum relative humidity (RH_{\max}) = 0.83

Minimum relative humidity (RH_{\min}) = 0.62

[10 marks]

- b) Explain how the following factors affect the rate of transpiration:
- i) Bulk (leaf layer boundary) resistance
 - ii) Cuticular resistance
 - iii) Temperature
 - iv) Soil moisture content
 - v) Crop height

[20 marks]

QUESTION 3

- a) Using diagrams showing the pattern of water application, explain how the operating pressure affects system uniformity. [15 marks]
- b) Describe how one can determine the sprinkler system uniformity using a grid of sprinklers, clearly explaining the equations used in the test. [15 marks]

[15 marks]

QUESTION 4

- c) Chemigation is defined as the application of chemicals via an irrigation application system. These chemicals may include fertilizers, soil amendments, herbicides, insecticides etc. Discuss the advantages and disadvantages of chemigation. **[10 marks]**
- d) What do the following terms mean with regard to canal design for furrow irrigation system.
- i) Freeboard
 - ii) Command
 - iii) Seepage
 - iv) Wetted perimeter
 - v) Stream size
- [20 marks]**