131

UNIVERSITY OF SWAZILAND
RESIT/SUPPLEMENTARY EXAMINATION PAPER

PROGRAMME: BSC ABE 4

COURSE CODE: ABE402/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) Draw a clearly labelled crop coefficient (K_c) curve. **[5 marks]**

b) Explain why a heat-unit based K_c curve may accurately estimate crop evapotranspiration when compared to K_c curve based on days elapsed. Also mention why such an assumption may not hold. **[10 marks]**

c) Explain the conditions under which the Penman-Monteith Equation may better estimate evapotranspiration than either the Blaney-Criddle or Hargreaves equations. **[5 marks]**

d) Explain how the neutron probe is used for measurement of soil moisture content. **[10 marks]**

e) Describe any one approach of determining dependable rainfall, and discuss why it is important in the design of an irrigation system. **[10 marks]**

SECTION II ANSWER ANY TWO QUESTIONS

QUESTION 2

a) Describe the filtration system, providing a clear description of the various types of filters normally used and how they can be maintained to keep them at maximum performance. **[15 marks]**

b) A sprinkler system has a gross irrigation requirement of 131 mm. The operating pressure at the sprinkler nozzle is 380 kPa. The area to be irrigated is 20 ha, and the time of operation is 20 hours. The overall pump efficiency is 70 %. At full operation, the pump is taking water from the ground, with the water table 23 m below the sprinkler nozzle. The head losses to the furthest sprinkler from the pump is 7.6 m. Calculate the total pumping head (m) and the system capacity (m^3/s).

[15 marks]

QUESTION 3

a) Clearly describe the sub-surface drip irrigation, giving its advantages and disadvantages.
. **[20 marks]**

b) Discuss the environmental considerations that have to be taken for a large-scale irrigation project. **[10 marks]**

QUESTION 4

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]**