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**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.**

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GRANTED BY THE CHIEF INVIGILATOR**

SECTION I COMPULSORY**QUESTION 1**

a) Discuss how the following factors affect the choice of an irrigation system.

- i) Value of crop
- ii) Quality of water
- iii) Water availability
- iv) Available expertise
- v) Type of crop

[20 marks]

b) Explain the environmental considerations that have to be taken for a large-scale irrigation project.

[20 marks]

SECTION II ANSWER ANY TWO QUESTIONS**QUESTION 2**

a) A sandy loam soil has volumetric water content of 19 % at field capacity, and 9 % at permanent wilting point. The farmer has decided that a good water management strategy for his crop would be to adopt a maximum allowable depletion level (MAD) of 40 %.

Considering the information above:

- (i) What is the readily available water (RAW) in mm, assuming a rooting depth of 0.9 m?

If the application efficiency is 70 %, and the design ET is 9 mm/day, calculate:

- (ii) The gross water depth to be applied to bring the root zone to field capacity.
- (iii) The number of days between irrigations

[15 marks]

- b) Clogging is a problem in trickle irrigation due to the narrow passages and small orifices. Thus the quality of water used in irrigation should be of a high standard, but sometimes there is no alternative supply with good quality water. Filtration and chemigation will thus be required. Describe the two processes as they are carried out in trickle irrigation system maintenance. [15 marks]

QUESTION 3

- a) Discuss the capabilities and limitations of the various types of sprinkle irrigation. [10 marks]
- b) A trial configuration of a hand move sprinkler has a lateral running downslope from a mainline along a constant grade of 0.005 m/m. The design operating pressure of the nozzle is 350 kPa. The lateral has a length of 450 m between the first and last sprinkler.

Compute the maximum allowable headloss due to friction. [10 marks]

- c) A sprinkler system has a gross depth of irrigation required equal to 131 mm. The operating pressure at the sprinkler nozzle is 380 kPa. The area to be irrigated is 20 ha with a time of operation of 20 hours. The overall pump efficiency is 70 %. At full operation, the pump is taking water from a water table 23 m below the height of the sprinkler nozzle. The head losses up to the sprinkler nozzle are equivalent to 7.6 m of head.

Determine the system capacity (m^3/s). [10 marks]

QUESTION 4

Irrigation performance can be measured in terms of *efficiency, uniformity and adequacy*. Clearly explain what these are, the factors affecting them, and how they can be determined for a sprinkler system.

[30 marks]