MWENDERA 99

UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER

PROGRAMME: BSC AGRIC. 4 (LWM)

COURSE CODE: LUM 408

TITLE OF PAPER: IRRIGATION THEORY AND PRACTICES

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS.

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SECTION I: COMPULSORY QUESTION

QUESTION 1

Briefly but **concisely** discuss any:

a) **five** factors that influence the design and operation of a furrow irrigation system. (10 marks)
b) **five** strategies for applying water in furrows. (10 marks)

(c) A lateral runs down-slope on a ground surface with constant slope of 0.01 m/m. The actual friction loss in the lateral is 0.0085 m/m and the lateral length is 274 m. A 1.2 m riser is required for the crop. The pressure required at the mainline is 448 kPa. Determine the operating pressure for the nozzle. (20 marks)

SECTION II: ANSWER TWO QUESTIONS FROM THIS SECTION

QUESTION 2

Briefly and concisely, describe what is meant by the following terms:
a) soil moisture characteristic curve; (6 marks)
b) hydraulic equilibrium in soil water; (6 marks)
c) total water potential in the soil; (6 marks)
d) hysteresis in soil water; (6 marks) and
e) unavailable water to plants. (6 marks)

QUESTION 3

Discuss the key design and operating parameters of a furrow irrigation system. (30 marks)

QUESTION 4

Discuss the merits and demerits of using tensiometers for scheduling irrigation. (30 marks)

SOME USEFUL EQUATIONS

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$$H_L = \frac{[\theta\,(H_{DP}) - H_Z]}{L} \qquad (1)$$

where

H_L = max. allowable head loss due to friction (m/m)
θ = max. allowable pressure difference (fraction)
H_{DP} = nozzle design pressure head (m)
H_Z = increase in elevation in the direction of water flow between the two critical sprinklers (m)
L = dist. between the two critical sprinklers (m)

$$H_m = H_{sp} + [0.75\,(H_f + H_e) + H_r]\,9.81 \qquad (2)$$

where

H_m = required entrance pressure at mainline (kPa);
H_{sp} = designed nozzle operating pressure (kPa);
H_f = total friction head loss in lateral (m);
H_e = increase in elevation of lateral from inlet to position of critical sprinkler (m);
0.75 = factor to produce the average operating pressure near the mid-point of lateral;
H_r = height of sprinkler rise (m);