UNIVERSITY OF SWAZILAND
MAIN EXAMINATION PAPER

PROGRAMME: BSC IN LWM, AGRONOMY & HORTICULTURE 3

COURSE CODE: LUM 302

TITLE OF PAPER: IRRIGATION

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: GRAPH PAPER

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS

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QUESTION 1

i) The following data were obtained from a concentric ring infiltrometer. The cross-sectional area of the inner ring was 500 cm^2.

Time (min)	Cumulative infiltration (cm^3)
0	0
2	270
4	450
6	620
8	770
10	900
20	1420
40	2410

    a) Determine the values of a and n for the Kostiakov's equation as shown below using the data in the table above.

$I = at^n$

Where I	the cumulative infiltration	
a and n	are constants	
t	is the time	**[15 marks]**

    b) Calculate the infiltration rates at times 10 and 30 minutes after the start of the infiltration test, comment on the results.

[10 marks]

    c) Draw a graph to show the relationship between the rate of infiltration and time, and determine the steady state infiltration rate.

[5 marks]

ii) Discuss five factors that affect the entry of water into the soil.

[10 marks]

QUESTION 2

a) With the aid of a clearly labelled diagram, explain the concept of pipe size optimisation in as far as irrigation costs are concerned.   **[10 marks]**

b) In irrigation, a pump duty is defined by the required discharge, Q and the required pumping head, H. Briefly discuss what compose the pumping head in a sprinkler system.   **[10 marks]**

c) Explain why and when two or more pumps may either be connected in series or in parallel.   **[10 marks]**

QUESTION 3

Discuss the science involved in the use of the following instruments in real time irrigation scheduling. The discussion should include the merits and demerits of these instruments.

    i)   Neutron probe
    ii)   Electrical resistance meter
    iii)   Tensiometer

[30 marks]

QUESTION 4

Discuss the following concepts as used in irrigation optimisation and management, giving examples where appropriate:

a) Soil moisture deficit
b) Readily available water
c) Gross irrigation
d) p-factor
e) Reference evapotranspiration