



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2405: IRRIGATION ENGINEERING I

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: 10 May 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, Drawing Instruments, Scientific calculator, examination pass and student ID

This paper consists of five questions. Attempt question ONE (Compulsory) and any other TWO questions.

Question One

- a) Enumerate or outline the four stages of irrigation Engineering **(5 marks)**
- b) Outline three factors which govern the necessity of irrigation **(7 marks)**
- c) Give three reasons why charges must be levied on the farmers in an irrigation scheme **(5 marks)**
- d) A stream of 135 l/s was diverted from a canal and 100 l/s were delivered to the field. An area of 1.6 ha was irrigated in eight hours. The effective depth root zone was 1.8 m. The runoff loss in the field was 4.32 cm. The depth of water penetration varied linearly from 1.8 m at the head end to 1.2 m at the tail end. Available moisture holding capacity of the soil is 20 cm per metre depth of soil
Determine:
 - i. The water conveyance efficiency **(3 marks)**

- ii. Water application efficiency (3 marks)
- iii. Water storage efficiency (3 marks)

- iv. Water distribution efficiency

Irrigation was started at a moisture extraction level of 50% of the available moisture.
(4 marks)

Question Two

(a) What data is required to design farm irrigation system? (3 marks)

(b) Write the net irrigation requirement that is derived from the field balance equation
(2 marks)

(c) Discuss the importance of metering diverted and applied irrigation water in irrigation system management. (5 marks)

(d) A small holder irrigation project in West Pokot has an area of 15 Ha. The Reference Evapotranspiration (ET_0) is estimated at 5.5 mm/day (Woodhead simplified) and the crop factor for horticultural crops $K_c = 0.9$

The number of hours of irrigation per day (HPD) = 8 hrs.

The conveyance efficiency, field canal efficiency and field application efficiency are 85%, 80% and 82% respectively.

Calculate the required scheme design flow. (10 marks)

Question Three

a) Discuss 3 different types of irrigation highlighting their advantages and disadvantages. (8 marks)

b) Design a rectangular irrigation canal for Yata irrigation scheme to carry a flow of 5.75 m³/s. The slope of the canal is 1.2%.

Assume Manning's coefficient $n = 0.017$; Normal depth $d = \frac{1}{2}$ of width of the irrigation canal. (12 marks)

Question Four

a) Describe three demerits of irrigation (6 marks)

b) Outline the three resources of irrigation (6 marks)

c) Briefly describe the merits of three types of materials used in canal lining.
(8 marks)

Question Five

- a) Outline the three types of lining in irrigation canals **(6 marks)**
- b) A stream of 135l/s was diverted from a canal and 100 l/s were delivered to the field. An area of 1.6ha was irrigated in eight hours. The effective depth root zone was 1.8m. The runoff loss in the field was 432m³.the depth of water penetration varied linearly from 1.8m at the head end to 1.2m at the tail end. Available moisture holding capacity of the soil is 20cm per metre depth of soil

Determine:

- v. The water conveyance efficiency **(4 marks)**
- vi. Water application efficiency **(4 marks)**
- vii. Water storage efficiency **(6 marks)**

Irrigation was started at a moisture extraction level of 50% of the available moisture.