KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURE
SECOND SEMESTER 2024/2025
[JANUARY – APRIL, 2025]

AGEN 353: IRRIGATION AND DRAINAGE

STREAM: Y3 S2 **TIME: 2 HOURS**

DAY: THURSDAY, 12:00 - 2:00 P.M. **DATE: 17/04/2025**

INSTRUCTIONS:
1. Do not write anything on this question paper.
2. Answer question ONE in section A (Compulsory) and any other TWO questions from section B.

SECTION A;(30 MARKS)

QUESTION ONE

a) Irrigation water is supplied to supplement the water available from rainfall and the contribution of soil moisture from ground water. Explain conditions in which irrigation is necessary (4 marks)

b) Differentiate between natural sub- surface irrigation method and artificial subsurface irrigation method. Explain why artificial subsurface irrigation method is not common. (4 marks)

c) Discuss the conditions that lead to the establishment of drainage systems (4 marks)

d) The quality of irrigation water affects the constituents of the soil, which is to be irrigated. Explain the various types of impurities, which make the water, unfit for irrigation (4 marks)

e) Explain different types and location of irrigation projects in Kenya (4 marks)

f) Differentiate between delta and duty of a crop (2 marks)

g) If wheat requires about 7.5 cm of water after every 28 days, and the base period for wheat is 140 days, find out the value of delta for wheat. (2 marks)

h) Explain the causes of water logging (4 marks)

i) Explain two types of drainage systems (2 marks)

SECTION B; (40 MARKS)

QUESTION TWO

2. a) With the help of diagrams, examine the designs, merits and applications of the following surface irrigation methods
   i. Border irrigation method
   ii. Basin irrigation method
   iii. Furrow irrigation system (12 marks)

b) What is the classification of irrigation water having the following characteristics : Concentration of Na, Ca, and Mg are 22,3 and 1.5 mill-equivants per litre respectively and the electrical conductivity is 200 micro mhos per cm at 25 ^{0}c (4 marks)

c) The materials used in manufacture of drain pipes are clay tiles pipes, concrete pipes and plastic pipes. A client has consulted you on drain pipes selection. Explain the advantages and disadvantages of each pipe (4 marks)

QUESTION THREE

3. a) A commercial farmer has consulted you on water productivity issues. Describe what is deficit, total and supplemental irrigation and how they can be applied to the commercial farm (6 marks)

b) A stream of 130 l/s was diverted from a canal and 100 l/s were delivered to the field. An area of 1.6 hectares was irrigated in 8 hours. The effective depth of root zone was 1.7m. The runoff loss in the field was 420 m^3. Available moisture holding capability of the soil was 20 cm per metre depth of soil. Irrigation was started at a moisture extraction level of 50% of the available moisture. Calculate

i. Water application efficiency (3 marks)

ii. water storage efficiency (4 marks)

c) An irrigation scheme of 100 ha with sandy loam soils and general slope of less than 5% has a main drain of 2.5 Km long with a difference in elevation of 1m. What is the time of concentration? (3 marks)

d) In c above, the rainfall with a return period of 5 years is estimated at 8.5 mm and the runoff coefficient for sandy loam arable land with a slope of less than 5% = 0.30. What is the design discharge of the drain? (4 marks)

QUESTION FOUR

4 a) A large scale Galana – Kulalu irrigation project is being established in Tana river County, Kenya. Outline the importance and disadvantages of the project (10 Marks)

b) With the help of diagrams, explain the following drainage systems

i. open drains

ii. pipe drains (4 marks)

c i) Determine the time required to irrigate a strip of land of 400 m^2 area from a tube well with Q = 0.02m^3/s, f = 5cm/hr and y = 10 cm (4 marks)

ii) Maximum area that can be irrigated (2 marks)

QUESTION FIVE

5. a) The hydraulic design of the drainage channels are normally designed using the Manning's equation. Illustrate Manning's equation and define the variables (6 marks)

b) With the aid of diagrams, explain the layout, components, advantages, and disadvantages of the following irrigation systems

i) Sprinkler irrigation system

ii) Drip irrigation system (14 marks)