



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

INSTITUTIONAL BASED PROGRAMME (DECEMBER SESSION)

EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE IN LAND AND
WATER MANAGEMENT

KRM 509: IRRIGATION AND DRAINAGE

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DATE: WEDNESDAY 2ND MAY 2012

TIME: 2.00 P.M. – 5.00 P.M.

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INSTRUCTIONS

Answer Q.1 and any other Three
Graph papers are provided

Question One (30 marks)

1. a) In evaluating irrigation potential of an area, what aspects would you consider in the following irrigation resources?
 - i) Land and soils
 - ii) Water
 - iii) Human (3 marks)
- b) By defining sustainable irrigation, explain how the following factors contribute to sustainability of irrigation development.
 - i) Farmers participation
 - ii) Sound design
 - iii) Improved irrigation efficiency (3 marks)
- c) What are the main factors that need to be considered when selecting an appropriate irrigation method for a given site? Give and explain at least 8 factors. (4 marks)

- d) By using appropriate illustrations of soil moisture characteristics and availability, explain the following:
- i) Available soil moisture
 - ii) Readily available moisture
 - iii) The dynamic soil moisture availability concept (3 marks)
- e) Why is the clay fraction in a soil especially important when evaluating a soil for irrigation development? (2 marks)
- f) A 200 cm³ soil sample taken in the field had a wet weight of 363 g. the sample was dried at 105° C to a constant weight of 285 g. making appropriate assumptions and using normal notation, compute
- i) θ_m
 - ii) ρ_b
 - iii) θ_v
 - iv) ϕ
 - v) ϕ_a
- why is ϕ_v preferred over ϕ_m in irrigation system design? (5 marks)
- g) What are the adverse effects of poor agricultural land drainage? (4 marks)
- h) What are the irrigation management options for the following salt affected soils?
- i) Saline soils
 - ii) Alkaline soils
 - iii) Waterlogged soils (6 marks)

Q.2 A client needs to invest in irrigated agriculture in a farm he has recently bought in Laikipia, which is semi-arid. The clients has no previous experience in irrigation.

- i) What irrigation system would you advise him to adopt?
- ii) What are the possible advantages and disadvantages of the suggested irrigation system? (10 marks)

Q.3 a) Why is it important to determine the infiltration characteristics of the soil at a proposed irrigation site before embarking on design? (3 marks)

- b) The data in Table Q3 were obtained with a double ring infiltrometer set during an infiltration test in a site with a loamy soil

Table Q.3

Time (Minutes)	Cumulative infiltration (cm)
	1.7
10	3.0
15	3.9
25	5.6
35	6.9
45	8.2
60	10.1
75	11.9
90	13.9
110	15.5
130	16.3

- i) Plot on the same graph the cumulative, the instantaneous and the average infiltration curves.
 - ii) If 14.0 cm of irrigation depth is to be applied, how long does one have to irrigate at one point?
 - iii) If one irrigates for 1 ½ hours at one point, how much water will have been applied?
 - iv) Estimate the basic infiltration rate and state its importance in irrigation system design. (7 marks)
- Q.4
- a) Under what conditions would you recommend drip irrigation system to a horticultural farmer? (3 marks)
 - b) How does salinity affect solid water availability to a crop? (2 marks)
 - c) In what ways to the following atmospheric parameters affect the crop water requirements of an irrigated crop?
 - i) relative humidity
 - ii) solar radiation
 - iii) wind speed (5 marks)
- Q.5
- a) What factors should be considered in the selection of an irrigation system for an area? (5 marks)
 - b) Discuss how irrigation development can be stimulated in Kenya. (5 marks)