UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 8 Examination in Engineering: December 2018

Module Number: CE 8252 Module Name: Irrigation and Watershed Management (TE)

[Three Hours]

[Answer **all questions**, each question carries fifteen marks]

Q1. a) What are the major forms of water resource data?

[1.0 Mark]

b) State the factors which need to be considered in evaluating the performance of the water resource data with respect to the following criteria:

i) Quality.
ii) Accessibility.
iii) Efficiency.

[3.0 Marks]

c) State the benefits of Integrated Water Resources Management (IWRM) to the following sectors:

i) Environment.
ii) Agriculture.
iii) Water supply and sanitation.

[3.0 Marks]

d) IWRM is said to be a 'shared responsibility'. Explain the validity of the above statement giving examples.

[4.0 Marks]

e) Considering one selected river basin in Sri Lanka, describe how water resources are managed within that particular river basin to balance the need of environment and society.

[4.0 Marks]

Q2. a) To ensure the optimum growth of a vegetable crop, calculate the frequency of irrigation for the crop using the following data:
Available soil moisture = 140 mm/m
Root zone depth of crop = 60 cm
Daily consumptive use of water = 10 mm
Assume allowable moisture depletion of 40% from the available soil moisture.

[3.0 Marks]

b) Explain the significance of the following soil moisture levels on the frequency of irrigation:

i) Field capacity.
ii) Permanent wilting point.

[4.0 Marks]

c) Vegetable farm land is irrigated using furrow method. Though it seems no shortage of water flowing in the furrows, it has been noted that the root zone of the vegetable plants has remained dry. State all possible reasons that could give rise to the above situation.

[4.0 Marks]

d) Having a fixed irrigation schedule may reduce the water application efficiency of Border method of irrigation. Explain the above statement.

[4.0 Marks]

Q3. a) Define the following terms:

i) Conveyance efficiency.
ii) Field canal efficiency.
iii) Field application efficiency.
iv) Project efficiency.

[2.0 Marks]

b) List the design principles that need to be considered in water distribution system in an irrigation scheme to ensure equitable distribution of water.

[3.0 Marks]

c) Describe the following structures with sketches and explain their operations:

i) Inverted siphon.
ii) Flow dividing structure.

[5.0 Marks]

d) Explain the impact of following factors on the irrigation requirement:

i) Stored soil water.
ii) Leaching requirement.

[5.0 Marks]

Q4. a) i) List the methods available to estimate the reference crop evapotranspiration (ET_0).

ii) Discuss the data requirement and accuracy of each method.

[5.0 Marks]

b) Carrots are planted in an upland farm on 01st of May. During the growing season, RH_{min} is 75% and wind speed ranged from 5 to 8 m/sec. ET_0 at initial stage is 7.5 mm/day. Irrigation frequency during the initial stage can be assumed to be 7 days.

Length of growth stages;

Initial stage:	25 days
Crop development stage:	35 days
Mid season stage:	40 days
Late season stage:	20 days

Use the data in the attached Data Sheets for your calculations.

i) Calculate the Crop Coefficient (K_c) for the four stages of crop development.
ii) Draw the 'crop coefficient curve'.

[10.0 Marks]

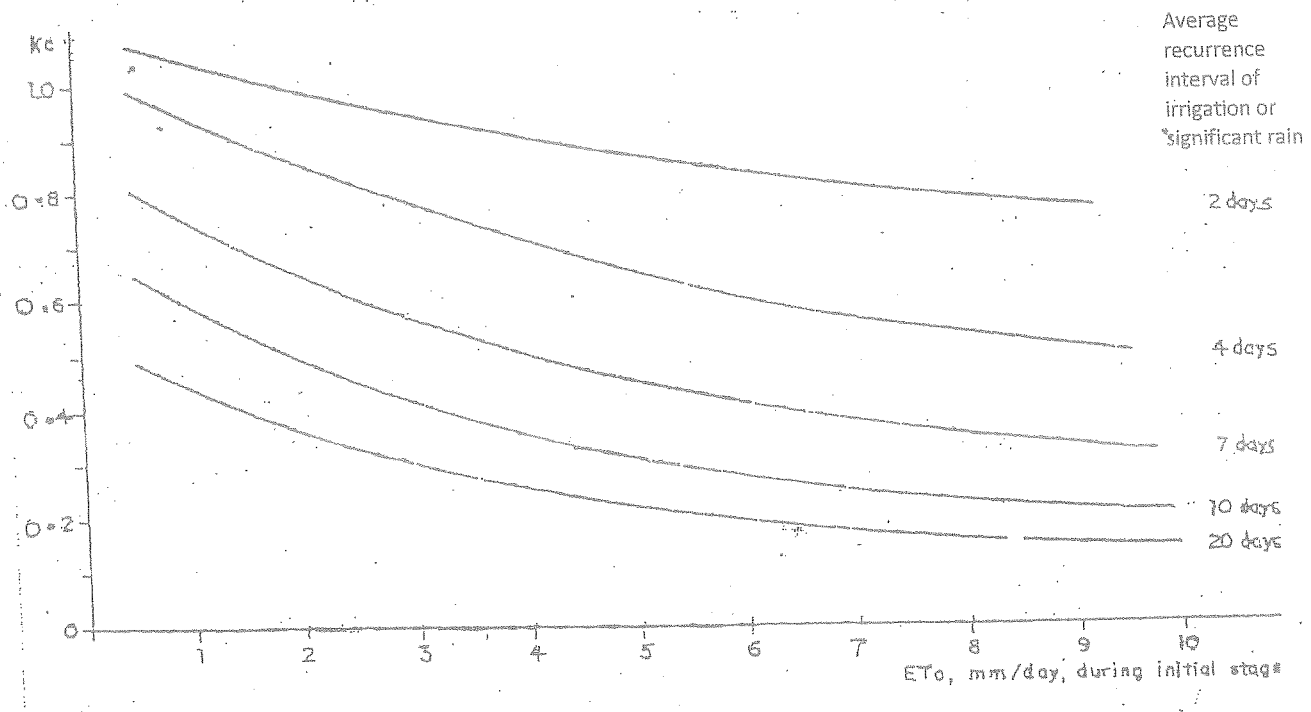

Figure 1: Average Kc value for initial crop development stage as related to level of ETo and frequency of irrigation and/or significant rain

Table 1: Crop Coefficient (Kc) for field and vegetable crops for different stages of crop growth and prevailing climatic conditions

Crop	Humidity		RHmin >70%		RHmin <20%	
	Wind m/sec		0-5	5-8	0-5	5-8
	Crop stage					
All field crops	initial	1				
	crop dev.	2				
Artichokes (perennial-clean cultivated)	mid-season at harvest	3	.95	.95	1.0	1.05
	or maturity	4	.9	.9	.95	1.0
Barley		3	1.05	1.1	1.15	1.2
		4	.25	.25	.2	.2
Beans (green)		3	.95	.95	1.0	1.05
		4	.85	.85	.9	.9
Beans (dry) Pulses		3	1.05	1.1	1.15	1.2
		4	.3	.3	.25	.25
Beets (table)		3	1.0	1.0	1.05	1.1
		4	.9	.9	.95	1.0
Carrots		3	1.0	1.05	1.1	1.15
		4	.7	.75	.8	.85
Castorbeans		3	1.05	1.1	1.15	1.2
		4	.5	.5	.5	.5
Celery		3	1.0	1.05	1.1	1.15
		4	.9	.95	1.0	1.05
Corn (sweet) (maize)		3	1.05	1.1	1.15	1.2
		4	.95	1.0	1.05	1.1
Corn (grain) (maize)		3	1.05	1.1	1.15	1.2
		4	.55	.55	.6	.6
Cotton		3	1.05	1.15	1.2	1.25
		4	.65	.65	.65	.7
Crucifers (cabbage, cauliflower, broccoli, Brussels sprout)		3	.95	1.0	1.05	1.1
		4	.80	.85	.9	.95
Cucumber		3	.9	.9	.95	1.0
Fresh market		4	.7	.7	.75	.8
Machine harvest		4	.85	.85	.95	1.0
Egg plant (aubergine)		3	.95	1.0	1.05	1.1
		4	.8	.85	.85	.9
Flax		3	1.0	1.05	1.1	1.15
		4	.25	.25	.2	.2
Grain		3	1.05	1.1	1.15	1.2
		4	.3	.3	.25	.25
Lentil		3	1.05	1.1	1.15	1.2
		4	.3	.3	.25	.25
Lettuce		3	.95	.95	1.0	1.05
		4	.9	.9	.9	1.0
Melons		3	.95	.95	1.0	1.05
		4	.65	.65	.75	.75
Millet		3	1.0	1.05	1.1	1.15
		4	.3	.3	.25	.25