



**UNIVERSITY OF RUHUNA**

**Faculty of Engineering**

End-Semester 8 Examination in Engineering: December 2016

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

**[Three Hours]**

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

- 
- Q1 a) Discuss the significance of following soil moisture levels for crop growth.  
i) Field capacity.  
ii) Permanent wilting point. [2.0 Marks]
- b) What are the influences of following factors on the field capacity?  
i) Texture of soil.  
ii) Structure of soil.  
iii) Organic matter content of the soil. [2.0 Marks]
- c) In an irrigation scheme where the border method of irrigation is being practiced, several farmers complain that enough amount of water is not reaching the far end of the borders.  
i) State possible reasons for the above situation.  
ii) Give suggestions to overcome the above problem. [4.0 Marks]
- d) 'The design of tertiary canals requires consideration of number of factors that ensure proper functioning of whole irrigation system'. Explain the key factors stated in the above statement. [4.0 Marks]
- Q2 a) Explain the difference between the 'net irrigation requirement' and the 'actual irrigation requirement'. [4.0 Marks]
- b) Continuous supply, rotational supply and supply on demand are the three main methods of supplying water to farm lands.  
i) Describe these three methods emphasizing the conditions at which each method is suitable.  
ii) State the advantages and limitations of employing each method. [4.0 Marks]
- c) Explain how the leaching requirement affects the irrigation requirement. [4.0 Marks]
- Q3 a) What is meant by watershed management? [2.0 Marks]
- b) Explain the benefits of watershed management. [2.0 Marks]

c) Explain the difference between 'demand' for water and 'use' of water at watershed level.

[2.0 Marks]

d) 'If watersheds are not managed properly then the natural resources are degraded rapidly and in due course cannot be used for betterment of human beings and animals'. Explain the validity of the above statement giving examples.

[3.0 Marks]

e) Strategies used to manage a watershed depend on the characteristics of the watershed. Technical investments have been identified as one of the effective strategies used to manage watersheds in sustainable manner. Describe such technical investments giving examples.

[3.0 Marks]

Q4 a) Integrated water resources management (IWRM) incorporates a systematic process for allocation and monitoring of water resources to ensure sustainable development. Discuss how surface and groundwater resources in a particular catchment could be effectively utilized under the IWRM concept.

[2.0 Marks]

b) Explain how soil erosion influences watershed development and management:

[2.0 Marks]

c) Salinity control is one of the core elements in sustainable irrigated agriculture. Discuss the importance of controlling salinity in an irrigation scheme, highlighting its impacts on agricultural productivity and the environment.

[4.0 Marks]

d) Gin river's catchment having an area of 900 km<sup>2</sup> received 2,500 mm of precipitation, during a water year. The average discharge at the catchment outlet was 65 m<sup>3</sup>/s. Estimate the amount of water lost due to the combined effects of evaporation, transpiration and percolation to groundwater.

[4.0 Marks]

Q5 a) Define 'reference crop evapotranspiration'.

[2.0 Marks]

b) Food and Agricultural Organization of the United Nations (FAO) has recommended several methods to determine the reference crop evapotranspiration. Explain the factors that determine the choice of a suitable method.

[2.0 Marks]

c) Actual crop water requirement depends on several local factors. Describe how the local factors given below affect the crop water requirement.

i) Method of irrigation.

ii) Cultural practices.

[4.0 Marks]

d) The following empirical equation can be used to calculate the mean value of ET<sub>0</sub> using the Blaney-Criddle method.

$$ET_0 = c [ p (0.46 T + 8) ] \text{ mm/day}$$

Where;

ET<sub>0</sub> - reference crop evaporation in mm/day

- T - mean daily temperature in  $^{\circ}\text{C}$
- p - mean daily percentage of annual daytime hours
- c - adjustment factor which depends on minimum relative humidity, sunshine hours and daytime wind estimates

Following data belong to an irrigated farmland for the month of October:

Latitude is  $8^{\circ}\text{N}$

Altitude is 1200 m

Mean daily temperature is  $25.8^{\circ}\text{C}$

Minimum relative humidity is around 75%

Average day time wind speed at 2m height is approximately 3.5 m/s

Average actual sunshine hours and the maximum possible sunshine hours are 11.5 hrs and 12.5 hrs, respectively

Using the Blaney-Criddle method, determine the mean  $\text{ET}_0$  at the farmland for the month of October.

You may use the data in the attached Data Sheets for your calculations.

[4.0 Marks]

# Data Sheet 1

Table 1: Mean Daily Percentage (p) of Annual Daytime Hours  
for Different Latitudes

Latitude	North	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
	South <sup>1/</sup>	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
60°		.15	.20	.26	.32	.38	.41	.40	.34	.28	.22	.17	.13
58		.16	.21	.26	.32	.37	.40	.39	.34	.25	.23	.18	.15
56		.17	.21	.26	.32	.36	.39	.38	.33	.28	.23	.18	.16
54		.18	.22	.26	.31	.36	.38	.37	.33	.28	.23	.19	.17
52		.19	.22	.27	.31	.35	.37	.36	.33	.28	.24	.20	.17
50		.19	.23	.27	.31	.34	.36	.35	.32	.28	.24	.20	.18
48		.20	.23	.27	.31	.34	.36	.35	.32	.28	.24	.21	.19
46		.20	.23	.27	.30	.34	.35	.34	.32	.28	.24	.21	.20
44		.21	.24	.27	.30	.33	.35	.34	.31	.28	.25	.22	.20
42		.21	.24	.27	.30	.33	.34	.33	.31	.28	.25	.22	.21
40		.22	.24	.27	.30	.32	.34	.33	.31	.28	.25	.22	.21
35		.23	.25	.27	.29	.31	.32	.32	.30	.28	.25	.23	.22
30		.24	.25	.27	.29	.31	.32	.31*	.30	.28	.26	.24	.23
25		.24	.26	.27	.29	.30	.31	.31	.29	.28	.26	.25	.24
20		.25	.26	.27	.28	.29	.30	.30	.29	.28	.26	.25	.25
15		.26	.26	.27	.28	.29	.29	.29	.28	.28	.27	.26	.25
10		.26	.27	.27	.28	.28	.29	.29	.28	.28	.27	.26	.26
5		.27	.27	.27	.28	.28	.28	.28	.28	.28	.27	.27	.27
0		.27	.27	.27	.27	.27	.27	.27	.27	.27	.27	.27	.27

<sup>1/</sup> Southern latitudes: apply 6 month difference as shown.

# Data Sheet 2

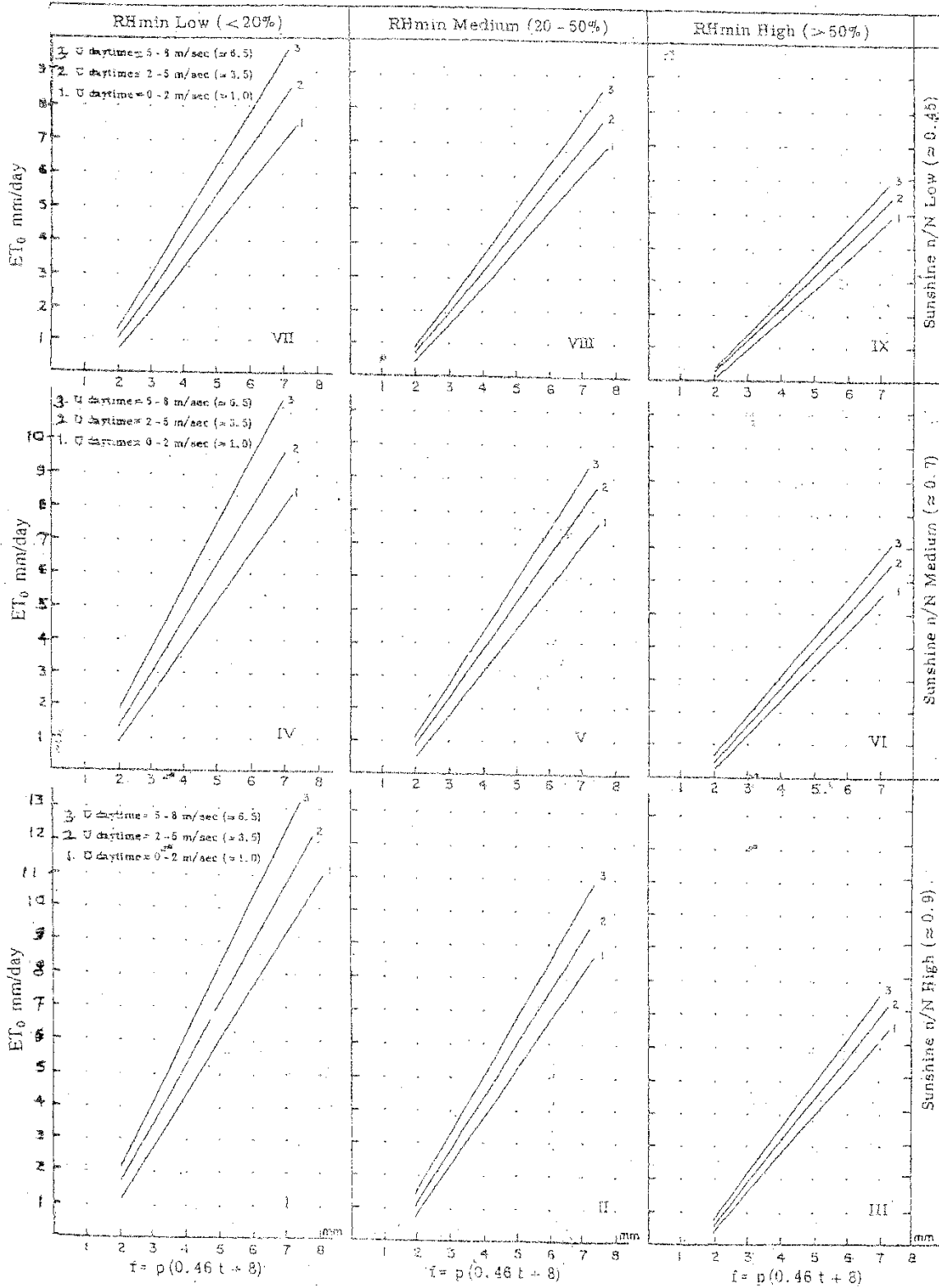


Figure 1: Prediction of  $ET_0$  from Blaney-Criddle  $f$  factor for different conditions of minimum relative humidity, sunshine duration and day time wind.