



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 8 Examination in Engineering: November 2017

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

[Three Hours]

[Answer all questions, each question carries twelve marks]

- Q1 a) i) Explain watershed management process with respect to the 'integrated' concept.
ii) What are the major objectives of Integrated Watershed Management?
[4.0 Marks]
- b) i) Explain the difference between 'demand' for water and 'use' of water, at the watershed level.
ii) 'Upstream area of a watershed is socially and economically well linked with the downstream area'. Explain the validity of the above statement giving examples.
[4.0 Marks]
- c) Community based approach has been identified as one of the effective strategies used in sustainable watershed management. Describe the role of community based groups and organizations to manage watersheds in sustainable manner.
[4.0 Marks]
- Q2 a) Explain the difference between the 'net irrigation requirement' and the 'actual irrigation requirement'.
[2.0 Marks]
- b) Explain the impact of following factors on the irrigation requirement.
i) Stored soil water.
ii) Leaching requirement.
[3.0 Marks]
- c) Before selecting a particular irrigation method, irrigation engineer must consider several factors, and choose a method which is best suited to local conditions. What are the factors to be considered in selecting an irrigation method?
[3.0 Marks]
- d) A farmland having sandy loam soil is required to irrigate using the basin irrigation method. How would you adjust 'size' and 'shape' of the basin in order to ensure high water application efficiency and high cultivation efficiency?
[4.0 Marks]

- Q3 a) 'The design of primary, secondary and tertiary canals requires consideration of number of factors that ensure proper functioning of whole irrigation system'. Explain the factors stated in the above statement. [4.0 Marks]
- b) In irrigated agriculture, maintaining the soil fertility by natural means has become popular in the recent past. In this context, discuss the importance of practicing 'crop rotation' and 'intercropping'. [4.0 Marks]
- c) Sri Lanka's dry zone is the main crop cultivating area in the country and several studies have shown that some parts of the dry zone will face scarcity of water by the year 2025. Describe possible water saving techniques and strategies that could be practiced by irrigation schemes in water scarce dry zone in order to minimize the water losses. [4.0 Marks]
- Q4 a) Key objective of establishing an irrigation scheme is to improve the socio-economic conditions of the people living in the area. However it can have variety of negative impacts on downstream of the irrigation scheme.
- i) Describe potential negative impacts giving examples.
- ii) State the techniques that could be used to minimize the major environmental impacts. [6.0 Marks]
- b) Drainage management and salinity control are important elements in sustainable irrigated agriculture. Discuss the importance of following, highlighting their impacts on agricultural productivity and the environment.
- i) Having a proper drainage system in an irrigation scheme.
- ii) Controlling salinity in an irrigation scheme. [6.0 Marks]
- Q5 a) i) 'Crop coefficient is used to account for the effect of crop characteristics on the crop water requirements'. In this statement, what do you understand by the term 'crop coefficient'? [4.0 Marks]
- ii) Discuss the accuracy of irrigation requirement estimates based on the concept of crop coefficient. [4.0 Marks]

- b) To calculate the mean value of ET_0 using the Blaney-Criddle method, following empirical equation can be used.

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

Where;

ET_0 - reference crop evaporation in mm/day

T - mean daily temperature in $^{\circ}C$

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 at Latitude of $10^{\circ}N$ and Altitude of 1200 m, for the month of July:

Mean daily temperature is $28^{\circ}C$

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 ET_0 at the farmland for the month of July.

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 ^{1/}	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
60 ^o		.15	.20	.26	.32	.38	.41	.40	.34	.28	.22	.17	.13
58		.16	.21	.26	.32	.37	.40	.39	.34	.28	.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	.29	.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

^{1/} Southern latitudes: apply 6 month difference as shown.

Data Sheet 2

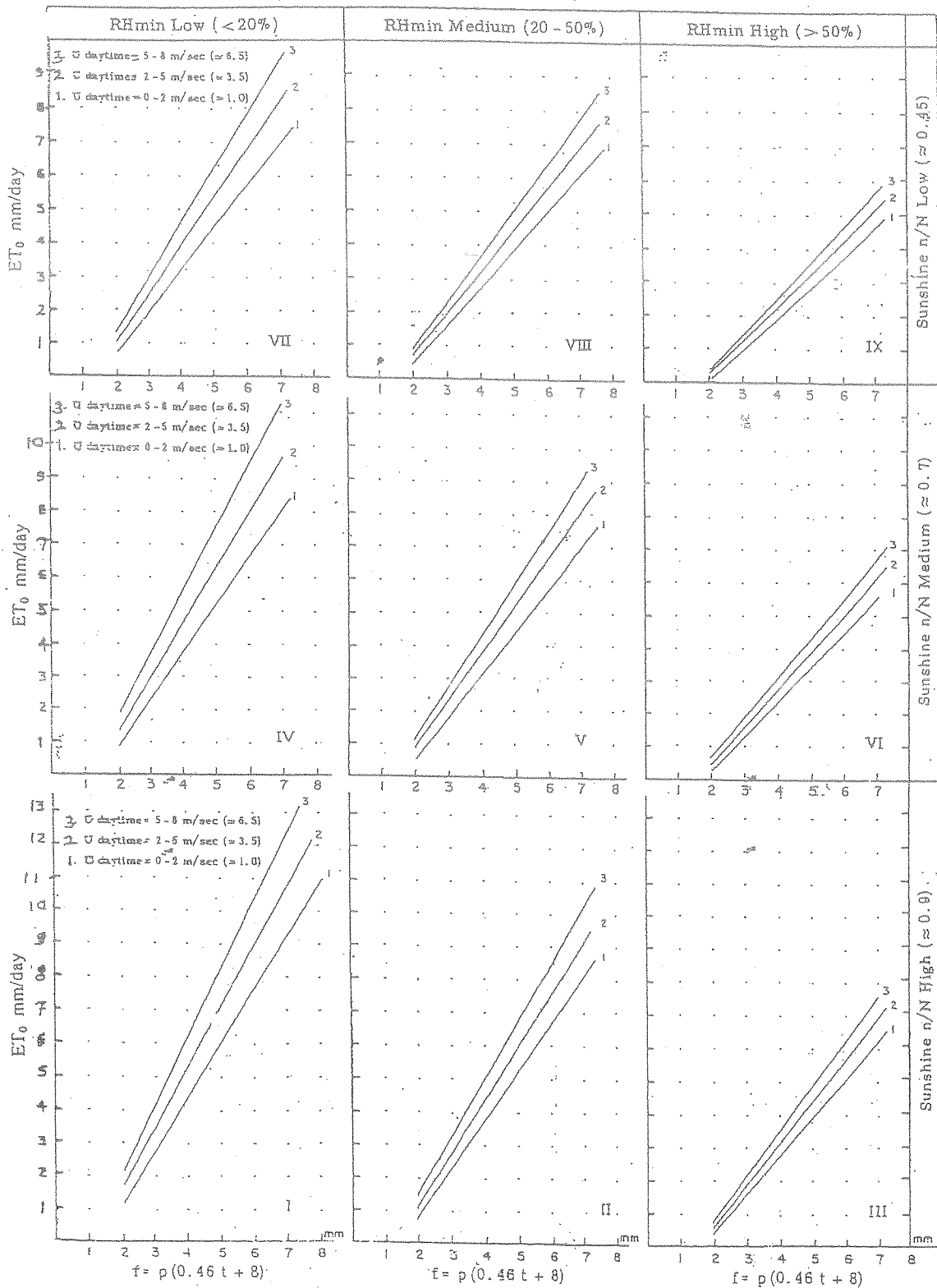


Figure 1: Prediction of ET_0 from Blaney-Criddle f factor for different conditions of minimum relative humidity, sunshine duration and day time wind.