UNIVERSITY OF RUHUNA

THIRD EXAMINATION IN B.Sc AGRICULTURAL RESOURCE MANAGEMENT AND TECHNOLOGY (PART I)

July/August – 2022

EN3101-Irrigation and Water Resources Engineering

Structured and Essay Type **Time: 2 ½ hours**

Index Number

Answer ALL questions in PART A and THREE question in PART B.
Answer to the structured questions in Part A must be supplied in the spaces provided.
Answers to essay type questions in Part B must be supplied on the answer books.
All questions carry equal marks.
Only non-programmable calculators are permitted.
Mobile phones are not allowed

PART A – Structured - Answer All Questions

1. (a). Determination of evapotranspiration is very important in irrigation scheduling. How do you define followings with respect to the irrigation scheduling?

i. Evapotranspiration

.....

.....

.....

ii. Crop Evapotranspiration

.....

.....

.....

iii. Reference Evapotranspiration.

.....

.....

.....

.....

iv. Potential Evapotranspiration.

.....

.....

.....

.....*(20 Marks)*

(b). List the major factors that affect for evapotranspiration.

.....

.....

.....

.....

.....

.....*(10 Marks)*

(c). Lysimeter is one of the direct methods that can be used for the determination of evapotranspiration.

i. Draw a sketch that shows the major components of a Lysimeter?

..... (15 Marks)

ii. How do you use working principle of Lysimeter for the determination of evapotranspiration?

..... (10 Marks)

iii. List the major factors that should be considered when construction and operation of a Lysimeter.

..... (10 Marks)

(d). Evapotranspiration of an annual crop varies with its growth stages.

i. List the different growth stages of an annual crop.

..... (10 Marks)

ii. Which growth stages are the most and least water sensitive stages of an annual crop?

..... (10 Marks)

iii. Sketch a diagram showing the changes of evapotranspiration with different growth stages of an annual crop.

..... (15 Marks)

2. (a). Using suitable equations and illustrations explain how do you determine when it is time to irrigate?

(10 Marks)

(b). Explain the parameters that you consider to decide how much water to apply in irrigation?

(10 Marks)

(c). List-the environmental factors that may influence the frequency or duration of irrigation?

(10 Marks)

(d). Enlist different methods of irrigation with examples.

(10 Marks)

(e). Enlist factors that should be considered when selecting a proper irrigation system.

.....

.....

.....

.....

.....

.....

..... *(10 Marks)*

(f). Using a suitable graph explain four phases of Surface Irrigation Systems.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... *(10 Marks)*

(g). Enlist dominant variables in border irrigation system.

.....

.....

.....

.....

.....

.....

..... *(10 Marks)*

(h). Wheat is to be grown in sandy loam soil under border irrigation. Border length and stream size are 120 m and 2 l/s, respectively. Determine the infiltration opportunity time, if irrigation need is 400 m^3/ha.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... (30 Marks)

PART B – Essay - Answer THREE Questions ONLY

1. (a). Enlist the design specifications of furrow irrigation . *(20 Marks)*

   (b). Explain briefly different furrow evaluation procedures. *(20 Marks)*

   (c). Using a suitable equations and graphs explain the basic infiltration rate and the accumulated infiltration rates. *(20 Marks)*

   (d). Furrows 90 m long and spaced 80 cm apart are irrigated by an initial furrow stream of 3 l/s. The initial furrow stream reached the lower end of the field in 50 minutes. The size of the stream was then reduced to 1.5 l/s. The cut back stream continued for 1 hr. Estimate the average depth of irrigation. *(40 Marks)*

2. (a). Define Followings.

   i. Drainage co-efficient

   ii. Shape index

   iii. Compactness co-efficient *(30 Marks)*

   (b). Briefly describe effect of water logging. *(20 Marks)*

   (c). i. A drainage system at 40 ha field flows for 5 days. If the system is designed using drainage coefficient of 3.0 cm, how much water is drained during this period? *(20 Marks)*

   ii. If amount of rainfall received during these 5 days mentioned above, is 25 cm, calculate the % of rainwater drained during this period. *(10 Marks)*

   (d). A surface drainage channel has to be designed for an area of 100 ha. If the drainage coefficient is 5 cm, what is the capacity of the channel? *(20 Marks)*

3. (a). What are the benefits that you expect by the proper irrigation scheduling? *(10 Marks)*

   (b). How do you increase the water conveyance efficiency? *(20 Marks)*

   (c). Briefly explain the important of followings with respect to irrigation.

   i. Field Capacity

   ii. Critical Moisture Content

   iii. Saturation Capacity

   iv. Permanent Wilting Point

   v. Management Allowed Depletion (MAD) *(25 Marks)*

   (d). Briefly explain the difference between Crop Water Requirements and Irrigation Water Requirement. *(10 Marks)*

   (e). The upper limit of available plant moisture (moisture holding capacity) of a loam soil is 41% (by volume) and the lower limit of plant available moisture is 19% (by vol.). The present moisture content is 36% (by vol.) and the root zone depth of the existing field crop is 40 cm. For effective use of soil moisture, irrigation is planned to apply when 75% of the plant available moisture is depleted. The average ET rate of the crop is 7 mm/day. Determine:

   i. When to irrigate (Time of irrigation based on present moisture level)? *(10 Marks)*

   ii. How much to irrigate (Amount to be irrigated)? *(10 Marks)*

   iii. If the application efficiency is 80% and the conveyance efficiency is 95%, determine the gross

4. (a). Derive an equation which could be used to calculate the discharge rate of a large reservoir through a small orifice using Bernoulli equation. *(20 Marks)*

(b). The figure below illustrates a hydropower system which the electric power is generated through a turbine. The length of the penstock (only in the 45° angle section) is 50m.

i. Calculate the actual flow rate of water through the turbine *(40 Marks)*

ii. Calculate the useful power (net power) can be generated by the scheme. *(20 Marks)*

iii. Write down any assumption made during your calculation *(20 Marks)*

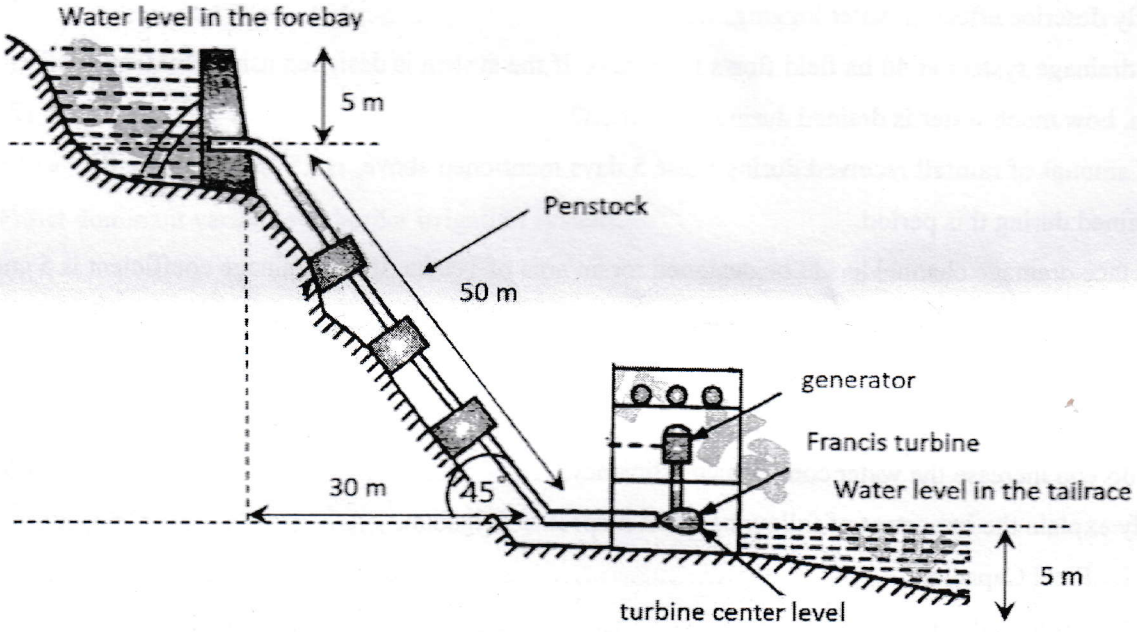
The area of the water jet = 5×10^{-3} m^2

Coefficient of discharge of water jet at the turbine entry = 0.65

Total MHP efficiency = 0.5

The equation for net power of MHP is = $\alpha\ Q\ \sigma\ g\ h$

(α= total efficiency, Q= flow rate, σ = density of water)



@@@@@@@@@@@@@@