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Section A

Paper Irrigation Engg

Q NO.1):

a) Define "Delta" and Duty and derive their relationship in MKS and FPS systems.

Ans: Delta:

→ A crop needs a certain amount of water at fixed interval throughout its base period is know as Delta. → Depth of watering is 5cm(2") - 10cm(4").

→ The total quantity of water is divided by total irrigated place is know as Delta.

→ The base period of delta means the time period between the first watering of the crop during its sowing to last watering before its harvesting.

Delta of Crop:

The depth of water in cm or inches required to crop through out the base period is called delta of crop.

Duty of Water:

The duty of water is the relationship between the volume of water and the area of crop it matures.

→ It is the relation between the area of crop irrigated and quantity of irrigated water required during the entire period of the growth of that crop.

→ Duty represent the irrigating capacity

of a unit.

Relationship of "Delta" and "Duty" In MKS:

Let,

Duty = D (hectares/cumecs)

Delta = A meters Base period = B days By defin

one cumec of water flowing continuous for "B" days given a depth of wate "A" over an area of "D" hectares.

Volume of water @ $1 m^3$ sec in one day = $1 \times 24 \times 60 \times 6$
$= 86400 m^3$

volume of water @ $1 m^3$ sec in "B" days = $1 \times 24 \times 60 \times 60$
$= 86400 B m^3$
$= 86400 m^2 m$ -(i)

AS 1 Hectare = $10000 m^2$

$1 m^2 = 1104 H$

Then eq-(i) becomes,

volume of Water @ $1 m^3$ sec in "B" days = $86400 B m^3$
$= 86400 B * 1104$ H-m

volume of water @ $1 m^3$ sec in "B" days = $8.64 \times B$ H-m

(ii)

Depth of Water required by crop, A =

volume of Area $A = 8.64 \times B$ H-mD HA
$= 8.64 * B$ Dm

Relationship of "Delta" and "Duty" In FPS:

Let

Duty = D (Acres/cusecs)

Delta = A feet

Base period = B days By definition

one cusec of water flowing continuously for "B" days gives a depth of water "A" over an area of "D" acres

Volume of water @ 1 ft^3 sec in one day = $1 \times 24 * 60 * 60 = 86400\ ft^3$

volume of water @ 1 ft^3 sec in "B" days

$= 1 \times 24 * 60 * 60$

$= 86400\ B\ ft^3 = 86400\ ft^3$ (1)

As 1 Acre = 43560 ft^2, 1 ft^2 = 143560 Acr

Then equation (1) becomes,

Volume of water @ 1 ft^3 sec in "B" days = 86400 B ft

$= 86400B * 143560$ Acre-ft

Volume of water @ 1 ft^3 sec in "B" days = 1.983 * B Acre-ft (1)

Depth of water required by crop A = Volume

Area A = 1.983 B Acre-ft D Acre A = 1.983 × B/D ft

QNO.1):

(b):

Solution:

Water required of Wheat = 9cm

Days Interval = 35 days

Base period = 140 days

Delta of Wheat (Δ) = ?

35 days = 9 cm

140 days = Δ

$$\Rightarrow \Delta = \frac{9\text{cm} \times 140 \text{ days}}{35 \text{ days}}$$

$$\boxed{\Delta = 36\text{cm}}$$

QNO.1):

(c):

Ans: Indus Water Treaty:

- Pakistan is an agricultural country.
- Eighty percent of its agricultural output comes from the Indus Basin
- Pakistan has one of the World largest canal systems built much before Independence by the British.
- After Independence, problem between the two countries arose over the distribution of Water.
- Rivers flow into Pakistan territory

from across india. In 1947, when Pubjab was divided between the two countries, many of the canal head-works remained with india.

- The division of punjab thus created major problems for irrigation in Pakistan.
- on April 1, 1948, india stopped the supply of water to pakistan from every canal flowing from india to pakistan.
- pakistan protested and india finally agreed on an interim agreement on May 4, 1948.
- This agreement was not a permanent solution; therefore pakistan approched the World Bank in 1952 to help settle the problem permanently
- Negotiations were carried out between the two countries through the offices of World Bank. It was finally in Ayub Khan's regime that an agreement was signed between India and pakistan in september 1960. This agreement is known as the Indus Water Treaty.
- This treaty divided the use of rivers and canals between the two countries.

QNO.1):

D):

Ans: Significance of Duty of crops: It helps is designing efficient canal irrigation system. Knowing the entire available Water at the top of most canal and therefore the overall duty for all the crops required to be irrigated in Several season of the Year. The World which may irrigated in several season of the

University if we all Know the crop area required to be irrigated and their duties we will compute the discharge required for designing the canal.

Q 2):

(a):

Ans: Factor Affecting Consumptive Use:

Following are the factor affecting consumptive use of Water are;

1- Temperature: The rate of consumptive use is effected more by temperature. Low temperature retard plant growth Where high temperatures may produce dormancy. Consumptive use may vary widely even in years of equal accumulated temperature because of devition from the normal seasonal distribution.

2-Humidity: Evaporation and transportion are accelerated on days of low humidity and slowed during periods of high humidity on low humid day great use of water by vegetation may be expected.

3-Wind velocity: Evaporation of water from land and plant Surfaces. takes place more rapidly when there is moving air than under calm or hot, dry winds and other unusual condition during the growing period will affect the amount of water.

4-Soil Topography: If a soil is made more fertile through the application of manure or by some other means the yields may expected to increase with an accompanying small increase in use of water.

5-Sunlight: The Sun is the source of all energy used in crop growth and evaporation of water. This longe day may allow plant transpiratio to continue for long period each day.

QNO.2):

(b):

Solution: Given:

Useful Rainfall (cm) = 10

Water application Efficency (n_a) = 80% = 0.8

cummulative consumptive use (CU) = 40cm

Required:

Field Irrigation Requirement (FIR) = ?

consumptive Irrigation Requirement (CIR) = ?

Solution:

By formula;

consumptive Irrigation Requirement

$$(CIR) = Cu - Rc$$

$$= 40 - 10$$

$$\boxed{CIR = 30\,cm}$$

Field Irrigation Requirement

$$(FIR) = \frac{CIR}{n_a}$$

$$= \frac{30}{0.8}$$

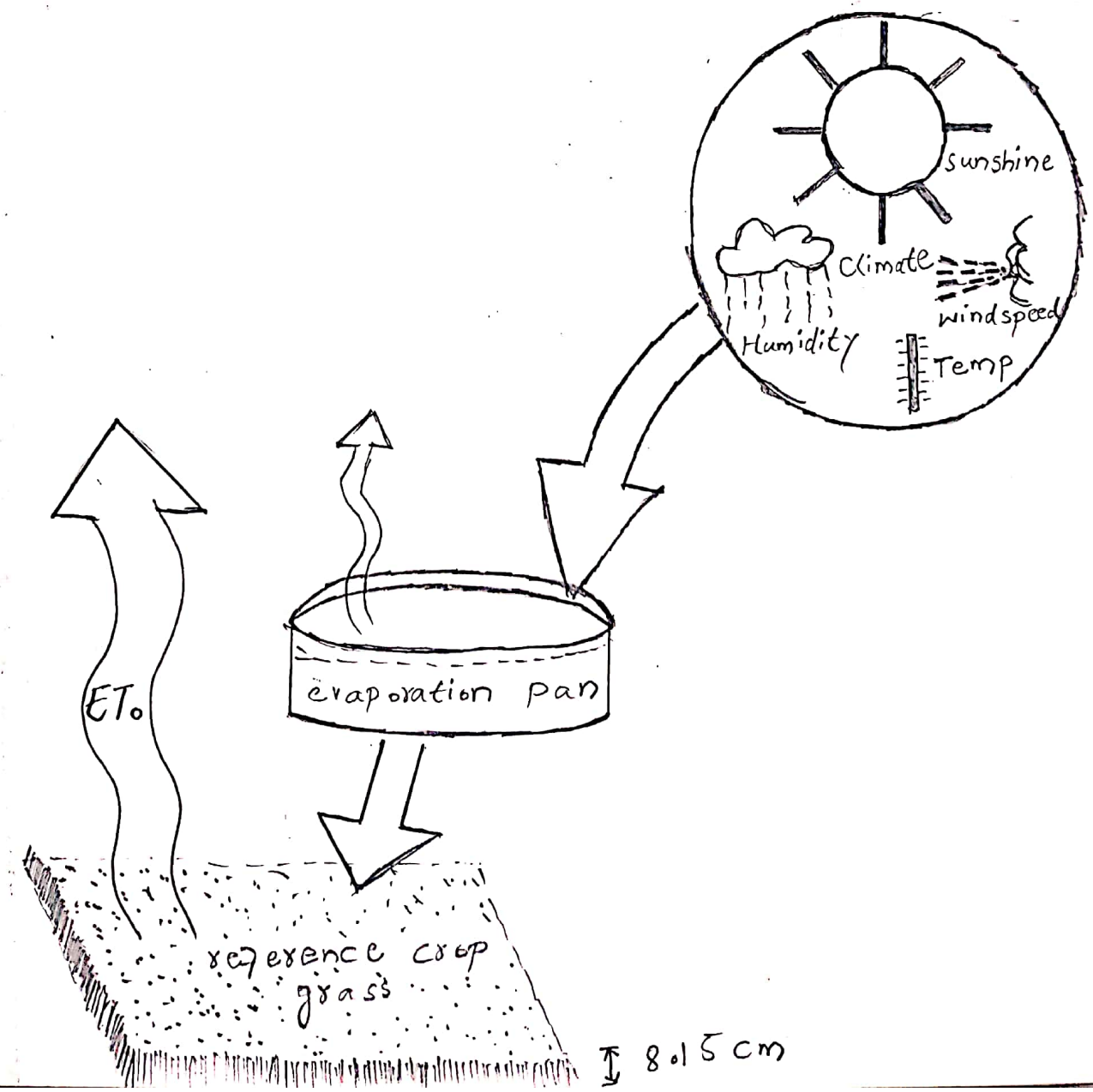
$$\boxed{FIR = 37.5\,cm}$$

QNO.2):

(C):

Ans: Class A Pan Evaporation (EP) Measurement:

.Ep can be experimentally determined by directly measuring the quantity of water evaporated from this standard Class a pan. This pan is 1.0m in diameter, 25cm deep, and bottom is raised 15cm above the ground surface. The depth of water is to be kept in a fixed range such that the water surface is at least 5cm, and never more than 7.5cm, below the top of pan.



• The pan evaporation Ep can also determined by using the Christiansen formula which states.

$Ep = 0.459\ R \cdot Ct \cdot CW \cdot Ch \cdot Cs \cdot Ce$

R = extra. Terrestrial radiation in the same units as Ep in cm or mm.

Ct = Coefficient for temperature.

CW = Coefficient for wind velocity.

Ch = Coefficient for relative humidity.

Cs = Coefficient for percent of possible Sunshine

Ce = Coefficient for elevation.

QNO.2):

d):

ANS: RABI: 1st October to 31st March - Winter.

KHARIF: 1st April to 30th september - Summer.

Kharif Crops: Rice, Bajra, Jawar, Maize and Cotton.

Rabi Crops: Wheat, Barley, Gram, Mustard and potatoes.

Kharif Rabi Ratio: The area to be irrigated for rabi crops generally more than that for Kharif crops. This ratio of proposed areas, to be irrigated in Kharif season to that in Rabi season is called Kharif rabi ratio.

→ This ratio is generally 1:2 i-e Kharif area is one half of Rabi area.

Q-3):

Ans:

Field Capacity: In many soil after a rain or irrigation, the soil immediatly starts draining to the deeper depth after one or two days the water content in the soil will reach with time. For many soil, a nearly constant value for a particular depth in question. This same what arbitary value of water content expressed as percent is called field capacity.

Permanent Wilting point: permanent wilting point is define as the minimum amount of water in the soil that the plant requires not to wilt. If the soil water content decreases to this or any lower point a plant wilts and can no longer recover its torgidity when placed in a saturated atmosphere to 12 hours.

Available Moisture Content: The difference in soil moisture content of soil between field capacity and permanent wilting is termed the available moisture.

Available moisture can be expressed as percentage moisture.

Readily Moisture Contents:

Soil moisture content near the wilting point is not readily available to the plant. Hence, the term readily available moisture has been used to refer to the portion of available moisture that is most easily extracted by plants, approximately 75% of the available moisture.

Optimum Utilization of Water:

If a crop is sown and produced under absolutely identical conditions, using different amount of water depths, the yield is found to vary. The yield increases with water, reaches a certain maximum value and then falls down.

The quantity of water at which the yield is maximum, is called optimum utilization of water.