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Section: A

Semester: 6th

## Q.No. 1

**Partial Delta:**

Delta represents the total depth of the water which is required by the crop during its period as long as the crop is in the field and the symbol used for delta is Δ.

**Duty:-**

Duty is the area of land which is irrigated by the unit volume of water especially the irrigat water. Duty basically represents the relation between the area of the crop that is irrigated and the amou quantity of the water that the crop will require during its entire period of growth. The unit of duty is area/cum.

## Relationship between Duty & Delta

* In MKS System

Let,

Duty = D (hectares/cumecs)

Delta = A meter Base period = B days by definition

One cumec of water flowing continously for 'B' days gives a depth of water 'A' over an area of 'D' hectares.

Volume of water @ $1 m^3$ sec in one day =

$1 \times 24 \times 60 \times 60 = 86400\ m^3$

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, equation (i) becomes,

Volume of water @ $1 m^3$ sec in "B" days =

$86400\ B\ m^3 = 86400\ B \times 1104$ H-m Volume of water in "B" days = $8.64 \times B$ H-m —(ii)

Depth of water required by Crop, A, = Volume

Area $A = 8.64 \times B$ H-mD HA $= 8.64 \times B\ D$ m

In FPS System..

let,

Duty = D [Acres/cusecs)

Delta = A feet Base period = B days by definition,

One cusec of water flowing continously 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

$= 1 \times 24 \times 60 \times 60 = 86400\ ft^3$

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

$1 \times 24 \times 60 \times 60 = 86400\ B\ ft^3 = 86400 = ft^2 ft$ —(i)

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

Then eqn i becomes,

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

$= 86400\ B \times 143560$ Acre-ft Volume of water @ 1 f

in "B" days = $1.983 \times B$ Acre-ft —iii

Depth of water required by crop A = Volume

Area A = 1.983 B Acre-ft D Acre A = $1.983 \times B$ D

D.T.D

Q1.

Part (b).

Given Data:

Water requirement of wheat = 9 cm

Days Interval = 35 days

Base Period = 140 days

Required Data:-

Delta of wheat ($\Delta$) = ?

Solution:-

35 days = 9 cm

140 days = $\Delta$

Thus,

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

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

Q.No. 1

Part (c). Indus Water Treaty:-

The Indus Water Treaty is a treaty blw the Pakistan and India for the water distribution which was signed on Sep 19, 1960. The Indus Water Treaty was signed by the Indian Prime Minister Jawaharlal Nehro and Pakistan president Ayub Khan.

Main Points:-

The Indus Water Treaty deals with the River Indus and its five tributaries which are then classified into 2 categories.

Western Rivers:-

Jhelum
Chenab
Indus

Eastern Rivers:-

Sutlej
Beas
Ravi

i) According to this treaty, all the water of the eastern rivers shall be available for the unrestricted use of India.

, The unrestricted flow of water from the western rivers should be let by India to Pakistan. But this doesn't mean that India couldn't use the water of the western rivers. India can use western river water in non consumptive needs. Here the

non consumptive needs means (6) that they can use it for irrigation, storage (y also for the electricity production.

iv) The treaty also allocates 80% of water from the six rivers water system to Pakistan.

iv) To manage and implement the treaty, a permanent indus commission was set up as a bilateral comission.

vi) As the Indus river originated from the tibet, so due to this the China was kept out of the treaty.

**Q.No.1**

**Part (d).** Significance of Duty:-

i) It helps us to design efficient canal irrigation system which we know the total water at head of the main canal (available) and the crop that is ~~to~~ ~~be~~ required to be irrigated, when we know their overall duty in different seasons of the year, the area that can be irrigated can also be worked out.

ii) We can workout the discharge which is required while designing the canal, only if we know the crop area which is required to be irrigated and also their duty.

Q.No. 2

Part (a) Factors affecting consumptive use:

Following are the factors which affect the consumptive use.

1- Wind velocity.
2- Temperature.
3- Relative humidity of the air.
4- Evaporation from the soil.
5. Precipitation.
6- The intensity of sunlight.
7- Plant Pests and Disease.
8- Soil fertility.

Plant Pests and Disease:

Plants Pests and Diseases severely affects the rate of consumptive use. Due to this, the rate of transpiration will decrease.

Temperature:

The rate of consumptive use of water is also affected by the temperature and the changes in the temperature.

Precipitation:

During summer season, the amount of the precipitation may have little effect on consumptive use of water.

Q.No. 2

Part (b).

Given Data:-

Useful Rainfall (cm) = 10

Water application Efficiency ($\eta_a$) = 80 % = 0.8

Commulative Consumptive use (Cu) = 40 cm

Required Data:-

Field Irrigation Requirement (FIR) = ?

Consumptive Irrigation Requirement (CIR) = ?

Solution:-

As,

Consumptive Irrigation Requirement (CIR) = Cu - Rc

= 40 - 10

**CIR = 30 cm**

→ Field Irrigation Requirement (FIR) = $\frac{CIR}{\eta_a}$

= $\frac{30}{0.8}$

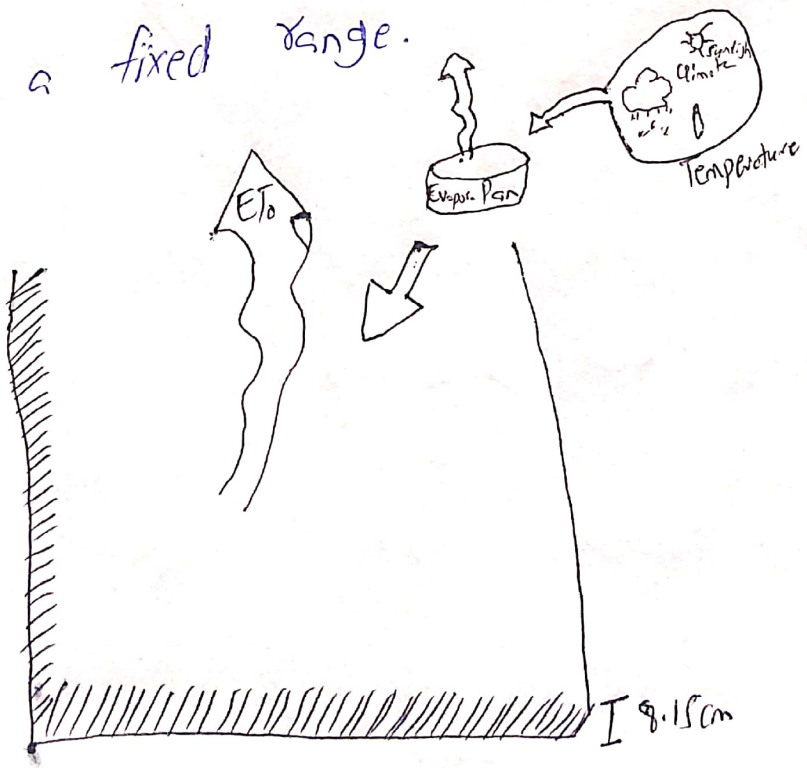
**FIR = 37.5 cm**

Q.No.2

Part (i).

Class A Pan Evaporation ($E_p$) Measurement.

The $E_p$ can be experimentally determined by measuring the quantity of the water that evaporated from the standard size class A pan. This pan is 1m in diameter, it is 25 cm deep and its bottom is also raised 15 cm above the ground. The water surface is atleast 5 cm, and not more than 7.5 cm, below the top of pan, So for this the depth of water is to be kept in a fixed range.



Q.No.2

Part (d).

Kharif Crops:

The word 'Kharif' is Arabic for Autumn and this season deals/coincides with the besinning of winter/late autumn. These crops are usually cultivated in the monsoon season. These crops are also known as the monsoon crops as these crops are cultivated in the monsoon season The Kharif season starts in June and ends in September.

Examples. Maize, sugarcane, rice etc.

Rabi Crops:

The word "Rabi" is an Arabic word which means Spring. These crops are harvested in the spring as the name indicates. This season starts in November and ends in March or April.

Examples:

Gram, wheat, banana etc are the examples of the Rabi crop.

Q. No. 3

Part (a). Field Capacity:-

Field Capacity is that amount of water content which is held in the soil after the extra/excess water has drained away and the rate of downward movement has decreased.

(b). Permanent Wilting Point:-

Permanent wilting point is defined as the minimum amount of water present in the soil that the plant requires not to wilt. When the water content of the soil decreases to this or any lower point than this, then the plant wilts and then they can no longer recover their turgidity when they are placed in a saturated atmosphere for 12 hours.

(c) Available Moisture Content:-

The difference in the moisture content of the soil b/w field capacity and permanent wilting point is termed as the available moisture content.

Readily Available Moisture Content:-

It is that portion of available moisture content that can be easily extracted by the plants.

(d) Optimum Utilization of Water:-

If a crop is sown by Produced using almost identical condition using the different amount of water depth, the yield is found to vary. The yield increases with water, reaches a certain maximum value by then falls down.