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SECTION :

qB

SEMESTER :

6th

SUBJECT :

IRRIGATION ENGINEERING

INSTRUCTOR :-

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# QUISTION- 1 (a)

## Define "Delta" and Duty and derive their relationship in MSK and FPS System

## DELTA :-

A crop needs a certain amount of water at fixed interval through out it's base period depth of each watering 5cm – 10cm.

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

The summation of all the individual water depths that had been supplied during the entire base period of a crop is called delta.

Its units are

Acre ft , Hecter meter

Million cubic meter, million cubic feet.

## DUTY :-

The duty of water is the relation between the volueme of water and the area of crops it's matures

It's defined as the number of hecters of land irrigated for full growth of a crop by supply of 1 cumec of water

Continuosly supplied the during the entire base period of crop

volueme of water generally expressed by a unit discharge flowing for a time of base period of the crop.

Duty of certian crops:-

| | | |
|---|---|---|
| 1 | Sugar cane | 730 ha/cumec |
| 2 | Rice | 775 ha/cumec |
| 3 | Rabi | 1800 ha/cumec. |

## RELATION BETWEEN DUTY AND DELTA

Let there be a crop of base period B-days. Let one cumec ($m^3$/sec) of water be supplied to this crop on the field to B days.

Now the volueme of water applied to this crop on the field for B- days

$V = (24 \times 60 \times 60 \times B)\ m^3 \Rightarrow 86,400\ m^3$

By definition of duty $1\ m^3$ of water supplied for B- days matures D- hecters of land. This quantity of water (V) matures D hectares of land of 10 4 D m2 of area.

Total depth of water on this land
Vol/area = 86400 B/10 D = 8.64 B/D m
This total depth of water is called delta
Therefore Δ = 8.64 B/D m = 864 B/D cm
where delta is in cm, B is in days.
D is duty in ha/cumec
in FPS units Δ = 1.98 B/D ft
where Δ is in ft, B in days
and D is in Acres/cusec

Q1-<b>

If wheat requires about 9cm of water after every 35 days and base period of crop is 140 days. Find delta for wheat?

GIVEN DATA:

Depth of water = 9cm

Base period = 140 days.

REQUIRED:

Delta of wheat, $\Delta$ = ?

SOLUTION:

No of watering required = $\frac{140}{35} \Rightarrow 4$

Total depth of water required =

$\Rightarrow$ No of watering x depth of watering

$\Rightarrow 4 \times 9 \Rightarrow 36$ cm.

DELTA = 36 cm.

Q-1 (C)

## EXPLAIN INDUS WATER TREATY:-

The Indus water treaty is a water distribution treaty between Pakistan and India signed on Sep 19th, 1960. This treaty was signed by the president of Pakistan Ayub Khan and PM of India Jawher Lal Nehru.

**PURPOSE:-** The purpose of this agreement was to chalk out the control over the rivers that flows across both the countries into the Indus Basin.

**RIVERS:**

- Ravi
- Sutluj
- Beas
- Jehlum
- Chenab
- Indus

## RIVER GIVEN TO COUNTRIES:

| PAKISTAN | INDIA. |
|---|---|
| 1- Indus | 1- Ravi |
| 2- chenab | 2- Sutwj |
| 3- Jehlum | 3- Beas. |

According to the treaty:-

Water of Sutlej, Beas and Ravi should be used by India.

India show allow Indus, chenab, and Jehlum to flow to Pakistan

This treaty allocated 80% of water from the Six Rivers Indus water system to Pakistan

A permanent Indus commission was set up as bilateral commision to implement the treaty.

Q-1 <d>

## Write significance of Duty

It helps in designing efficient canal irrigation system. Knowing the total available water at the head of the main canal and the overall duty for all the crop required to be irrigated in different seasons of the year the area which can be irrigated can be worked out.

Inversely if we know the crop area required to be irrigated and their duties. we can work out the discharge required for designing the canal.

$$Q = A/D$$
$$A = QD$$

| Crop | duty in hectares / cumec. |
|---|---|
| Sugar cane | 730 |
| Rice | 775 |
| Other Kharif | 1500 |
| Rabi | 1800 |
| Perennials | 1100 |
| Hot fodder | 2200 |

QUESTION- 2 <a>

## Explain factors affecting consumptive use.

Following are the factors that affects consumptive use.

1- Temperature
2- Humidity
3- Wind
4- Soil topography
5- Sunlight

### 1- TEMPERATURE:-

Consumptive use of water is directly affected by the temperature. at high temperature the plants tends to show dormancy while at low temperature there is a devastated plant growth. consumptive use may vary widely even in years of equal accumulated temperature because because of deviation from normal seasonal distribution.

## 2- HUMIDITY:-

Evoporation is inversely proportional to humadity as at low humidity evoporation rate is move while at high humidity evoporation is slow. in other words humidity and evoporation are in versely proportional.

## 3- WIND:-

Velocity or speed of water can effect. consumptive use as when the speed of wind is move the evoporation rate will be higher and water from crops will be reduced while ~~as~~ slower the speed of wind low will be the rate of evoporation and crops will be watered.

## 4- Soil Topography:

If a soil is made more fertile through the application of manure or by some other means the yields may be expected to increase (i.e use of water) with in accompanying small increase in use of water. However an increase in fertile of the soil causes a decreases in the amount of water consumed per unit of crop yield.

## 5- Sunlight:

At day time and Summer There is more sun light and the rate of evopouration is higher which extracts water from crops.

Q-2 <b>

Wheat is to be grown at a certian place the usefull rainfall for whole season is 10 cm its comulative consumption use is 40 cm. Determine consumptive irrigation requirement (CIR) and field irrigation requirement (FIR) if the water application efficiency is 80%.

## GIVEN DATA:-

usefull rainfall = 10 cm

water application efficiancy = 80% ⇒ 0.8

Cumulative consumption use cu = 40cm

## REQUIRED :-

Field irrigation Requirement (FIR) = ?

consumptive irrigation requirement (CIR) = ?

## SOLUTION:-

$$CIR = Cu - Re$$

$$\Rightarrow 40 - 10 \Rightarrow \boxed{30 \text{ cm}}$$

$$FIR = \frac{CIR}{na} \Rightarrow \frac{30}{0.8} \Rightarrow \boxed{37.5 \text{ cm}}$$

Q-2 <C>

## Explain class A pan evoporation measurment.

Ep can be experimently determined by directly measuring the quantity of water evoporated from this standard class a pan. This pan is 1.0 m 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 not more than 7.5cm below the top of pan.

The pan evoporation can also be determined by using the christiansen formula which states

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

R = extra, terestrial rediation in the same units as ep in cm or mm

Ct = Coefficient for temperature

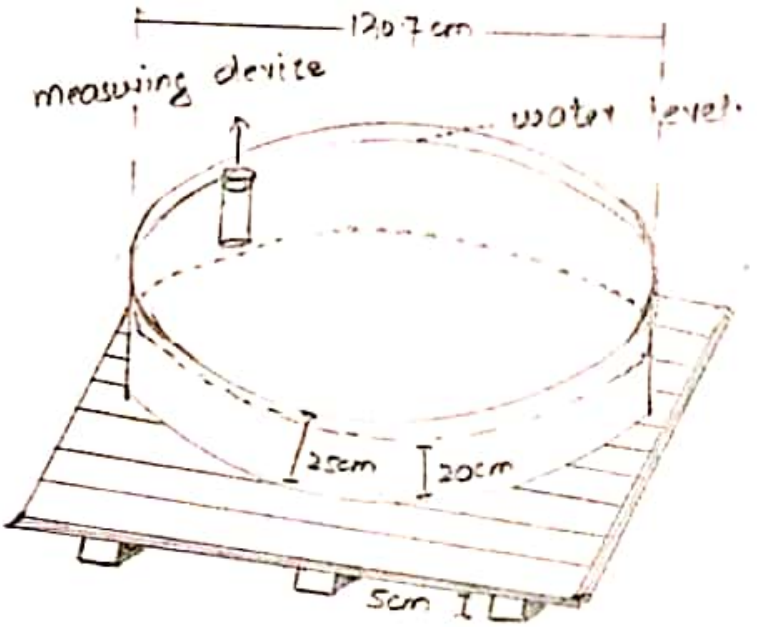
Cw = Co efficient for wind velocity

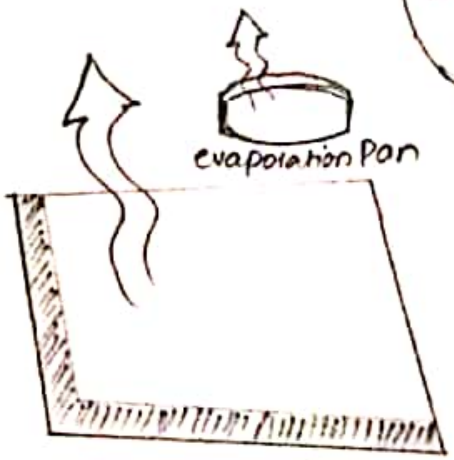
Ch = co-efficient for relative humidity

Cs = coefficient for percent of possible sunshine

Ce = Coefficient for elevation.

A pan evaporation measurement



Q-2 <d>

## Explain Crop Seasons:

## RABI AND KHARIF CROPS:-

### RABI CROP:-

1st October – 31st March.

Wheat, Barley, Gram
Linseed, Mustured, potatos.

### KHARIF CROPS:-

1st April to 30th Sep.

Rice, Bajra, Jowar, Maize
cotton, tobacco, Ground nut.

## KHARIF RABI RATIO:-

The area to be irrigated for Rabi crop is generally more than that of kharif crop. This ratio of proposed area to be irrigated in kharif season so 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.

# QUISTION - 3 (a)

## FIELD CAPACITY :-

When rainfall occurs on field or irrigation water is applied, it percolates down because of gravity. some of the water is retained against gravity it's called field capacity.

$$\text{Field capacity} = \frac{\text{wt of water retained in a certain volume of soil}}{\text{wt of the same vol of dried soil}} \times 100$$

Period of drainage = 2-5 days

FC is measured after 2 or 5 days

Q-3 <b>

## PERMANENT WILTING POINT :-

A plant can extract water from soil till a permanent wilting is reached. PWP is that water content at which a plant can no longer extracts sufficient water for its growth and wilts up.

Water available to plant = Field Capacity − PWP water

↳ Its the lower end of the availble moisture range

↳ For soil of high silt content 2·4 should be used.

↳ PWP can be estimated by dividing (FC) by factor (2·4) depending upon amount of silt in soil

Q3 <c>

## AVAILABLE MOISTURE CONTENT:

The difference in moisture content of the soil between field capacity and permanent wilting is termed as available moisture. It can be expressed as percentage moisture pw, as percentage Pv or as depth d.

## READILY AVIALABLE MOISTURE CONTENT:

Soil moisture content near the wilting point is not readily available to the plant. Hence Hence the term readily available moisture that is most easy extracted by plants. aproximatly 75% of the availble moisture.

Q3 <d>

## OPTIMUM UTILIZATION OF WATER:

If a crop is sown and produced under absolutly identical conditions using different amount of water depths the yield is found to vary. The yied 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 water depth.