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Subject :- Irrigation Eng.

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to

Define "Delta" and "Duty" and derive their relationship in MKS & FPS system.

Duty of water:- The duty of water is the relationship b/w the volume of water and the area of crop it matures.

Volume of water is generally expressed by: a unit discharge flowing for a time of base period of the crop. 1 cu.m per sec or 1 cu.ft/sec of water for B days mature D hectares or acre of land. The duty of water for the particular crop is D hectare/cumecs or D acre/cusecs

: Delta of water:- The depth of water in cm or inches required for the crop through out the base period is known as delta of the crops.

Generally a crop need a certain volume of water at fixed interval through out its base period.

Relation b/w Duty and Delta:-

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

Now the volume of water applied to this crop during B days = $V = (24 \times 60 \times 60 \times B)$

By definition of duty $1m^3$ of water supplied for B days matures D hectares of land. This quantity of water (V) mature D ha of land or Dm^2 of area.

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Total depth of water applied on this land =

$$\begin{aligned}\frac{\text{Volume}}{\text{Area}} &= \frac{86400 B}{10^4 D} \\ &= 8.64 \frac{B}{D} \text{ m.}\end{aligned}$$

This total depth of water is called Delta Δ

$$\Delta = 8.64 \frac{B}{D} \text{ m} = 864 \frac{B}{D} \text{ cm.}$$

Where A in cm B in days.

D is duty in ha/cumec.

In FPS unit $\Delta = 1.98 \frac{B}{D} \text{ ft.}$

A is ft B in days and D is Area/cusec

Q) If wheat required about 9 cm of water every 35 days and the base period or crop period of wheat is 140 days. Find out the delta for wheat?

$$B = 140 \text{ days}$$

$$D = ?$$

Water required for wheat = 9 cm

No of days = 35 days.

By Ratio Method.

$$9 \text{ cm} = 35 \text{ days}$$

$$\Delta = 140 \text{ days}$$

$$35 \Delta = 140 \times 9$$

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

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

Q1c

5) Explain Indus water treaty?

Indus Water Treaty: The IWT is a water distribution treaty b/w India & Pakistan signed on Sep 19, 1960. The treaty was signed by president Ayub Khan and P.M J. Nehru. It was brokered by the W.Bank. In Indus water treaty deals with river Indus and its five tributaries which are classified into two categories.

- | Eastern River | Western River. |
|---------------|----------------|
| 1) Sutlej | 1) Jhelum |
| 2) Beas | 2) Chenab |
| 3) Ravi | 3) Indus |

According to the treaty at the water of eastern river shall be available for unrestricted use in India.

India should let unrestricted flows of water from western river to Pakistan.

The treaty allocated 80% of water from the six-river Indus water system to Pakistan.

Q. Write significance of Duty of crops.

Significance of Duty of crops:-

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

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

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Q2a

Explain Factor effecting ³ consumptive use.

Ans

Factor effecting consumptive use are given.

- 1) Temperature
- 2) Humidity in air
- 3) velocity of wind
- 4) Soil topography.
- 5) Sun light etc.

1) Temperature:- consumptive of water is directly effected by the temperature.

At high temp the plant tends to show dormancy while at low temp there is a devastated plant growth.

2) Humidity:- Evaporation is Inversly proportional to humidity as at low humidity evaporation rate is more while at high humidity evaporation is slow down.

3) Velocity:- evaporation rate is more when there is more velocity as air is moving faster. So there will be more evaporation. If the velocity of wind is low then the rate of evaporation is also low.

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Soil * topography:- If a soil is made more fertile through the applications of manure or by some other mean. The yield may be expected to increase with an accompanying small increase in fertility of the soil causes a decrease in the amount of water consumed per unit of crop yield.

Sunlight:- At days in summer there is more sunlight than usual so high evaporation occurs when in winter there is low evaporation.

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

Given data:-
useful rainfall (com) = 10
Water application Efficiency (η_a) = 80% = 0.8
Cumulative consumptive use C_u = 40cm

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Required:-

Cumulative irrigation Requirement = CIR = ?

Field irrigation Requirement = FIR = ?

Soln.

$$CIR = C_u - R_e = 40 - 10 = 30 \text{ cm}$$

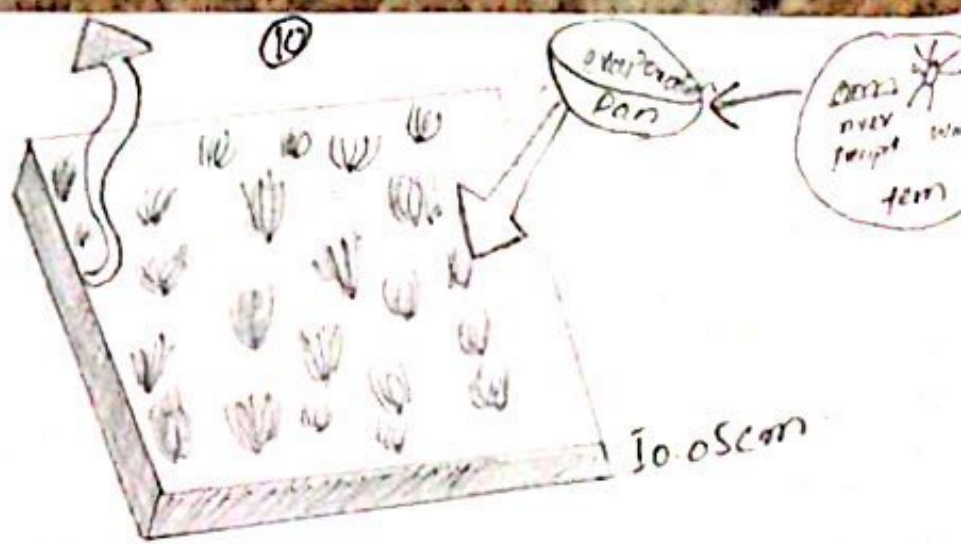
$$FIR = \frac{CIR}{\eta_a} = \frac{30}{0.8} = 37.5 \text{ cm.}$$

Q Explain class A pan Evaporation (Ep) measurement with the help of Diagram.

Ans) class A pan Evaporation (Ep) measurement:-

Ep can be experimentally determined directly measuring the quantity of water evaporated from this standard class A pan. This pan is 1.0m in dia 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.



A pan evaporated E_p can also determined by using the christiansen formula which states

$$E_p = 0.459 R \cdot c_t \cdot c_w \cdot c_h \cdot c_s \cdot c_e$$

R = extra-Terrestrial radiation is the same unit as

E_p = cm or mm

c_t = coefficient for temp.

c_w = " " wind velocity.

d) Explain crop season (Rabi & Kharif) & Kharif Rabi ratio.

1) RABI:- 1st october to 31st March - winter

"Rabi Crops":- Rabi crop are wheat, Barley, Grams, Musturd, potatoes.

2) Kharif:- 1st april to 30th september in summer.

Kharif crops:- Kharif crops ^① are Rice, Bajra
Jawar, Maize Cotton.

Rabi & Kharif Ratio:- The area is irrigated for Rabi crops generally more than for Kharif crops. The ratio of proposed areas to be irrigated in Kharif season to that in Rabi season is called as Rabi and Kharif Ratio.

The Ratio is [1:2] that is Kharif area is one half of that Rabi area.

Q3:- Define and explain the following terms.

- a) Field Capacity:- When all gravity water has drained down to water table by a surface soil. This water which can not be easily drained under the action of gravity.

Permanent ⁽¹²⁾ Wiltting point:- It is defined as the minimum amount of water in the soil that the plant required not to wilt. At the soil water content decrease to this or any other lower point a plant wilt and no longer recover its turgidity which place in a saturated atmosphere for 12 hrs. Available & readily available moisture content

Available Moisture content:-

The difference in moisture content of the soil b/w field capacity and permanent wilting is termed the Available moisture. Available moisture can be expressed as percentage moisture PW as percentage PV or as depth d .
Optimum utilization of water"

Readily Available moisture content:-
It is a water that plant can easily extract from the soil. RAW is the soil moisture held b/w field capacity and

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a maximised refill point for unrestricted growth - In this range of soil moisture plants are neither water logged or water stressed

Optimum utilization of water:-

The yield increase with water can reach a certain maximum value and then fall down. The quantity of water at which the yield is maximum is called optimum water depth. Therefore the optimum utilization of water means getting maximum yield with any amount of water.

