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Section	B
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Subject	Irrigation engineering

QNo:-01 :

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

Ans:: Part 01

Delta of water:

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

Generally a crop needs a certain volume of water at fixed intervals through out it's base Period.

Duty of water:

The duty of water is the relationship b/w the volume of water & the area of crop it matures.

• 1 cubic m per sec or 1 ft^3/sec of water for B days matures D hectares or acres of land then the duty of water for that particular crop is D hectares/cumecs or D acres/cusec

Relationship b/w Duty & Delta in FPS system.

let

D = Duty (acres/cusecs)

Δ = Δ feel base period = B days by def.

one cusec of water flowing continously. for "B" days give a depth of water "A" over an "D" acres

volume of water (ft^3/sec) in one day =

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

volume of water (ft^3/sec) in B day =

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

$= 86400\ B\ ft^3$ — (i)

1 Acre = 43560 ft^2

1 ft^2 = 143560 Acre

Putting in eq it becomes

$= 86400\ B \times 43560$ Acre-ft

volume of water (ft^3/sec) in B day = 1.983 B Acre-ft — (ii)

Depth of water required by crop $= \frac{1.983 \times B\ ft}{}$

Relationship b/w Duty & Delta in M.K.S system.

- 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

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

$$= 86,400\, m^3$$

- By definition of duty, $1\, m^3$ of water supplied for B days matures D hectares of land. This quantity of water (V) matures D ha of land $10^4 D\, m^2$ of area.
- Total depth of water applied on this land

$$= \frac{\text{volume}}{\text{Area}} = \frac{86400 B}{10^4 D} = \frac{8.64 B}{D}\, m$$

By Def. this total depth of water is called Delta Δ

Therefore $\Delta = 8.64\, B/D\, m = 864\, B/D\, cm$

where Δ in cm, B is in days

D is duty in hector/cumec

Q No:- 01

Part b):

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

Sol:

$B = 140$ days

$\Delta = ?$

Water required for wheat = 9cm

No of Days = 35 days

By Ratio Method

$9cm = 35$ days.

$\Delta = 140$ days.

$35\Delta = 140 \times 9$

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

$\Delta = 36cm$

Q No:-01
Part c)

Explain Indus water treaty?

The Indus water treaty (IWT) is a water distribution treaty between india and Pakistan signed on sept 19, 1960. The treaty was signed by President Ayub khan and PM J. Nehru. It was brokered by the world Bank.

The indus water treaty deals with river indus and it's five tributaries which are classified into two categories.

Eastern rivers	Western rivers
1) sutlej	1) Jhelum
2) Beas	2) Chenab
3) Ravi	3) indus

- According to the treaty, all the water of eastern rivers shall be available for unrestricted use in india.
- India should let unrestricted flow of water from western rivers to Pakistan.
- The treaty says that india can use the water in western rivers in "non-consumptive" needs.

- The treaty allocates 80% of water from the six-river Indus water system to Pakistan.
- A Permenant Indus commission was set up as a bilateral commission to implement and manage the treaty.

Q:NO:01
Part d)

Write significance of duty of a crop.

- It helps in designing efficient canal irrigation system. knowing the total available water at the head of the main canal and the overall duty of all the crops required to be irrigated in different seasons of the day 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 No:-02

Part:(a) : Explain the factor affating consumptive use.

Ans:

Factors effecting comsumptive use.

- Temperature
- Humidity in air
- velocity of wind
- Soil topography
- sunlight etc

1. Temperatures:

comsumptive use of water is directly affected by the temperature. At high temperature the plant tends to show dormancy while at low temperatures there is a devastated plant growth.

2) Humidity:

Evaporation is inversely proportional to humidity as at low humidity evaporation rate is more while at high humidity evaporation is slowed 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

rate of evaporation is also low.

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 with an accompanying small increase in use of water. However an increase in fertility of the soil causes a decrease in the amount of water consumed Per unit of crop yield

5) Sun light:.

At days in summer there is more sunlight than usual so high evaporation occurs when on winter there is low evaporation rate.

Q:.No:.02

Part: b:.

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

Sol:.

Given:

Usefull Rainfall (cm) = 10

water application Efficiency (η_a) = 80% = 0.8

Cumulative consumptive use (C_u) = 40cm

Required:

Field irrigation Requirement (FIR) = ?

Consumptive irrigation requirement (CIR) = ?

→ $CIR = C_u - R_e$

$= 40 - 10 = 30$ cm

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

Q:No:02

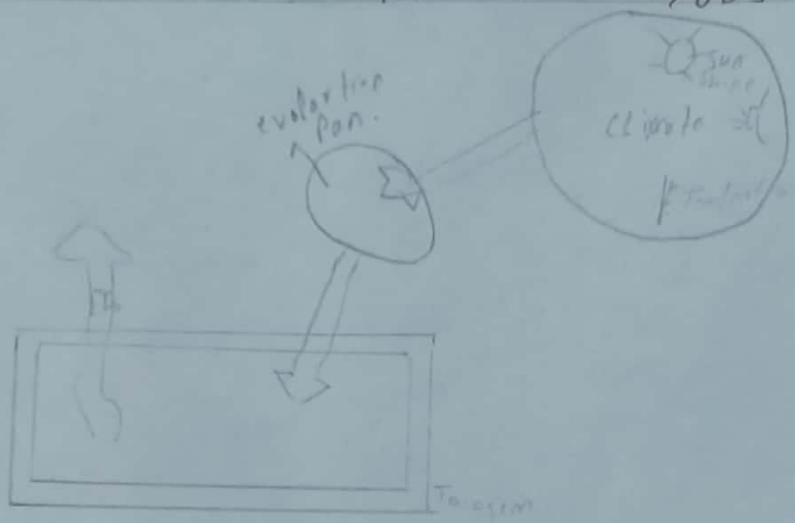
Part:C) Explain class A Pan Evaporation (EP) measurement with the help of a diagram.

Ans:

Class A PAN EVAPotation (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 christionsen formula which states.

$EP = 0.459 R \cdot Ct \cdot Cw \cdot Ch \cdot Cs \cdot Cc$

R = extra-Terrestrial radiation in the same units as EP in cm or mm

Ct = Coefficient for temperature

Cw = Coefficient for wind velocity.

Q: No:- 02

Part d) Explain crop seasons (Rabi and kharif) and kharif Rabi Ratio

Ans:

1) "RABI":-

1st October to 31st March - winter.

"Rabi crops":-

Rabi crops are wheat, Barley Gram Mustard Potatoes.

2) Khorif:

1th April to 30st in summer

" Khorif crops:

Khorif crops are Rice Bajro Jawar maize collon.

" Robi & khorif Ratio:"

The area is irrigated for Robi crops generally more that for khorif crops generally more than that for khorif crops. The ratio of Proposed areas, is to be irrigated in khorif season to that in Robi season is called as Robi & khorif ratio. The ratio is [1:2] that is khorif area is one half of that Robi area.

Q:03

Define and explain the following terms

Ans:.

Part a) Field capacity:

When all gravity water has drained down to water table. a certain amount of water is retained by surface soil. This water which cannot be easily drained. under the action of gravity.

Part b)

Permanent wilting Point:

It is defined as the minimum amount of water in the soil that the plant requires not to will. If the soil water content decrease to this or any lower Point a Plant wilts and no longer recover its turgidity which placed in a saturated atmosphere for 12 hours.

Part c)

Available and readily available moisture contents:

a) Available Moisture content:

The difference in moisture content of the soil between field capacity and Permanent wilting is termed the available moisture. Available moisture can be expresied as Percentage Moisture PW, as

Percentage PV of as depth.

b) "Readily Available Moisture content":

It is the water that a plant can easily extracted from the soil Raw is the soil moisture held between field capacity and a nominated refill point for unrestricted growth. in this range of soil moisture plant are neither waterlogged or water stressed.

Q1. No:-03

Part d)

Optimum utilization of water:

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