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7859

Section "B"

Module "6th"

Irrigation Engineering

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Question No : 1

Part (a) : Define Delta and Duty and derive relation in MKS and FPS Systems.

Delta (Δ) :-

The depth of water in cm and inches required for crop throughout the base Period is called Delt of crop.

⇒ A crop need a certain amount of water at fixed interval through out its base Period. Depth of each watering :

5 cm (2") - 10 cm (4").

Duty (D) :

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 1 cu. ft/sec of water for B-days matures D hectares or acres of land. Then the duty of water for that Particular crop is D-hectare / cumes or Dacres / cuses.

Relationship of Delta and Duty in MKS:

Let D = Duty (hectares / cumecs)

Δ = Delta = A meters Base Period

⇒ one cumec of water flowing continuously 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

$= 1 * 24 * 60 * 60$

$= 86400\ m^3$

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

$= 1 * 24 * 60 * 60$

$= 86400\ B \cdot m^3$

$= 86400\ m^2 \cdot m$ — (i)

As 1 Hectare = $10000 m^2$

$1 m^2 = \frac{1}{10000} H$

Then equation (i) becomes:

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

$= 86400\ B\ m^3$

$= 86400 * \frac{1}{10000} H \cdot m$

Volume of water @ $1m^3$. sec in "B" days = ~~8.64~~

$= 8.64\ B\ |\ H.m \rightarrow (ii)$

Depth of water requried by crop (A)

$= 8.64\ B\ |\ H - m\ D\ H\ A$

Hence $\Delta = \frac{8.64B}{D.m} \Rightarrow \Delta = \frac{8.64B}{D.cm}$

Relation ship of Delta and Duty in FPS system,

Let Duty = D (Acres / cuses)

Delta = A feet Base Period = B days

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

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

$= 86400\ ft^2\ ft \rightarrow (i)$

As 1 acre $= 43560\ ft^2$

$1\ ft^2 = 143560$ Acre Then equation (i) become

Volume of water @ $1ft^2$ sec in "B" days $= 86400\ ft^2$

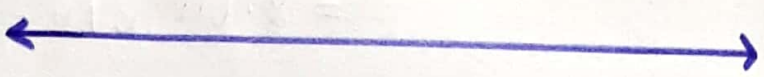
$= 86400B * 143560$ Acre-ft

Volume of water @ $1ft^2$ sec in "B" days.

$= 1.983 * B$ Acre.ft $\rightarrow (ii)$

Depth of water required by a crop. A
= volume Area A = 1.983 Acre/ft.D/Acre

Depth of water required = Δ = 1.983 B/D.ft



Question no : 01

Part (b)

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

Given data:

Base Period = 140 days

no of days = 35 days

Required w = 9 cm

Required Data:

Delta (Δ) = ?

Solution:-

By ratio method

9 cm => 35 days

9 cm => 140 days

$$\Delta = \left(\frac{140}{35}\right) * (35)$$

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

Question : 01

Part "C"

Q: 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 P.M J. Nehru. It was brokered by the world Bank.

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

Eastern rivers	western river
1) Sutlej	1) Jhelum
2) Beas	2) chenab
3) Ravi	3) Indus

⇒ According to the agreement, control over the Eastern rivers (Ravi, ~~Be~~ Beas, Sutlej) with the mean annual flow of 33 million acre-ft (MAF) were given to india.

⇒ while the control of western rivers (Jhelum , Indus , chenab) with the mean annual flow of 80 MAF was given to Pakistan.

⇒ A Permenant indus commission was set up as a bilateral commission to implement and manage the treaty.

Question : 01

Part "d"

Q: write significance of duty of a crop.

It helps in desiging efficient canal irrigation system knowing the total available water at the head of the main canal and the over all duty of all the crops reauried 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.

Question No 2

Part (a)

Q: Explain the factor affecting consumptive use.

Ans: Factors affecting consumptive use.

- Temperature
- Sun light
- velocity of wind
- Humidity in air
- Soil topography

Temperature :-

Consumptive use of water is directly affected by the temperatur.

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

Sun light :-

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

velocity of wind :-

Evaporation rate is more when there is more velocity as air is moving faster so there will be more evaporation. it the velocity of wind is low then rate of evaporation is also low.

Humidity in air:-

Evaporation is universely proportional to humidity as at low humidity evoporation rate is more write at high humidity evoporation is sloved down.

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 cause a decrease in the amount of water consumed per unit of crop yield.

Question : 08

Part "b"

Q: wheat is to be grown at a certain place the useful rainful for the whole season is 10 cm and its cumulative ~~cour~~ consumptive use is 40 cm Determine Consumptive irrigation requirement (CIR) and field irrigation Requirement (FIR), if the water application efficiency is 80 %.

Given data:-

Cumulative consumption use (C_u) = 40 cm

useful Rainfall (cm) = 10

water application Efficiency (na) = 80% = 0.8

Required:-

Field irrigation Requirement (FIR) = ?

consumptive irrigation requirement (CIR) = ?

$\Rightarrow$ CIR = Cu - Re

= 40 - 10 = 30 cm

$\Rightarrow$ FIR = $\frac{CIR}{(na)} = \frac{30}{0.8} = 37.5$ cm

CIR = 30 cm

FIR = 37.5 cm

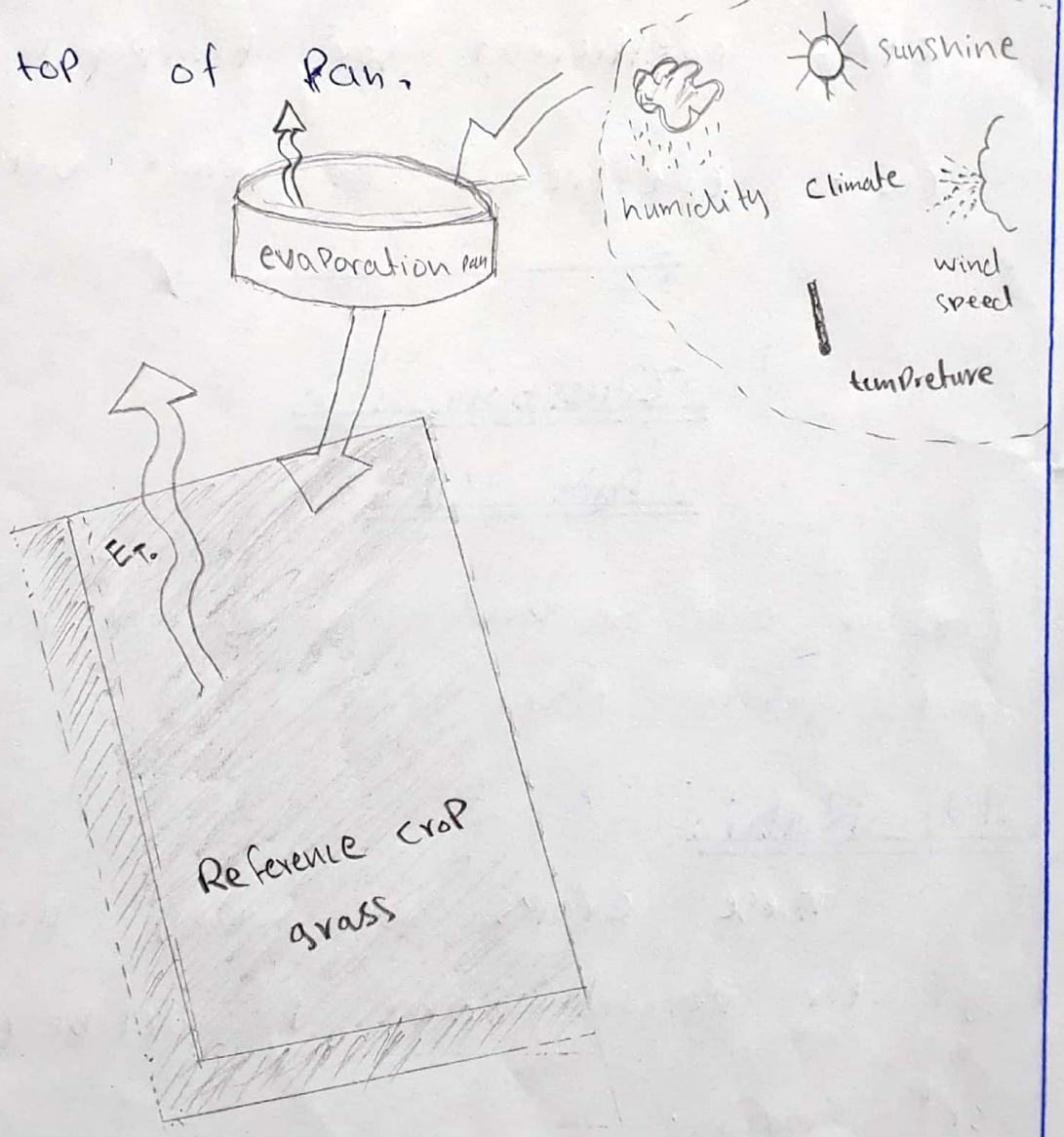
Question : or Part "c"

Explain class A Pan Evaporation (EP) measurment with the help of diagram.

Ans:- Class A Pan Evaporation measurment:-

EP can be experimently determined by directly measuring the quantity of

water evoPorated 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 atleast 5cm. and never more than 7.5cm, below the top of Pan.



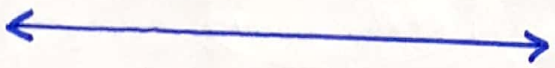
The Pan evaporation EP can also determined by using the Christiansen formula which states.

$$EP = 0.459R \cdot Ct - Cw \cdot Ch \cdot Cs \cdot C_c$$

R extra terrestrial radiation in the same units as EP in CM or MM

Ct = coefficient for temperature

Cw = coefficient for wind velocity



Question :-

Part "d"

Explain crop seasons (Rabi and Kharif) and Kharif Rabi Ratio.

Ans) **Rabi:**

These crops are having there growth period from 1st octobel to 31st March.

=> These are agricultural crops that are sown in winter and harvested

in the spring in Pakistan.
Rabi crops are wheat, Barley, Gram, Mustard.

Kharif :-

Kharif crops are grown after the rabi crops.

=> These crops are having there growth period from 1st april to 30th September.

=> Kharif crops are Rice, Bajra, Jawar, Maize, and cotton.

Question No 3

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 and is called Field capacity.

Period of drainage = 2-5 days

FC is measured after 2 or 5 days.

$$F \cdot C = \frac{\text{weight of water retained in certain volume of soil}}{\text{weight of same volume of soil.}} \times 100$$

Question 3

Part "b"

Permanent welting Point:-

A Point can extract water from soil till a Permanent welting is reached. PwP is that water content at which a Plant can no longer ~~extan~~ extract sufficent water for its growth and wilts up.

Part c

Avaible and readily avaible moisture Contents:-

*** Avaible moisture content:-**

The difference in moisture content of soil between field capacity

and permant wilting is termed the availble moisture Available moisture content is esxpressed as percentage moisture Pw as percentage Pv or as depth

Readily moisture content:-

It is the water that a plant can easily extracted from the soil. It is approximately 75 - 80 % available moisture.

Part (d)

optimum utilization of water:-

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