Name :- Hamza Ejaj

Submitted by :- "7835"

Submitted to :- Jehangir Durrani

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Section :- "B"

Q No 1

(a) DELTA OF Water :-

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

Generally a crop needs a certain volume of water at fixed intervals through out its base period.

Duty of water:-

The duty of water is the relationship between the volume of water and the area of crop it matures.

1 cubic meter 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 hectare / cumecs or D acres / cusec.

Relation Between Duty and Delta in FPS System:-

Let

D = Duty (acres / cusec)

Δ = Δfeet base period = B days by def

one cusec of water flowing continously for 'B' days gives a depth of water 'Δ' over 'D' acres.

Volume of water (ft^3/sec) in one day:

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

Vol of water (ft^3/sec) in B day:

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

$= 86400 \ B ft^3 \rightarrow (i)$

1 Acre = 43560 ft^2

1 ft^2 = 143560 Acre

Putting in eq it becomes

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

vol of water (ft^3/sec) in B day $= 1.983 \ B$ Acre-ft - (ii)

Depth of water required by crop

$$\frac{1.983 \times B \ ft}{D}$$

Relation b/w Duty and Delta in MKS:

Let there be a crop of base period B days. Let one cumec (m^3/ka) 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

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

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

By definition of duty, $1\ m^3$ of water supplied for B days matures D hectares of land. this quantity of water matures D ha of land $104\ D\ m^2$ of area.

Total depth of water applied in this land

$$= \frac{\text{volume}}{\text{Area}} = \frac{86400\ B}{104\ D} = \frac{8.64 B}{D}\ m$$

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 hactor / cumec.

Q.No 1

(B) Soln. B = 140 days

Δ = ?

water required for wheat = 9cm

No of days = 35days

By Ratio Method

9cm : 35days

Δ : 140 days

$35\Delta = 140 \times 9$

$\Delta = \frac{140 \times 9}{35}$

$\Delta = 36cm$

Part (c)

INDUS WATER TREATY:-

The Indus water treaty (IWT) is a water discription 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
1. Ravi
2. Sutlej
3. Beas

Western Rivers
1. Jehlum
2. Chenab

⇒ 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 allocates 80% of water from the Six-river indus water system to Pakistan

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

D Importance of Duty:-

It helps 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 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 workout the discharge required for designing the canal.

Q3 (A) Factors affecting Consumptive use

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

1. Temperature:-
Consumptive use of water is directly affected by the temperature. At high temperature the plants tend to show dormancy while at low temperature there is a devasted 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. Sunlight :- At days in summer high evaporation occurs as there is more sunlight. while in winter evaporation rate is low.

5. Soil Fertility :- If a soil is made more fertile through the application of manure or by some other means, the yield may be expected to increase with an accompanying small increase in use of water. Increase in fertility of soil decreases the amount of water consumed per unit of crop yield.

"B"

Given Data:-

useful Rainfall (cm) = 10

water application Efficiency (η_a) = 80% = 0.8

Cumulative Consumptive use (Cu) = 40cm

Required:-

Field Irrigation Requirement (FIR) = ?

Consumptive Irrigation requirement (CIR) = ?

Sol:-

1) $CIR = Cu - Re = 40 - 10 = 30cm$

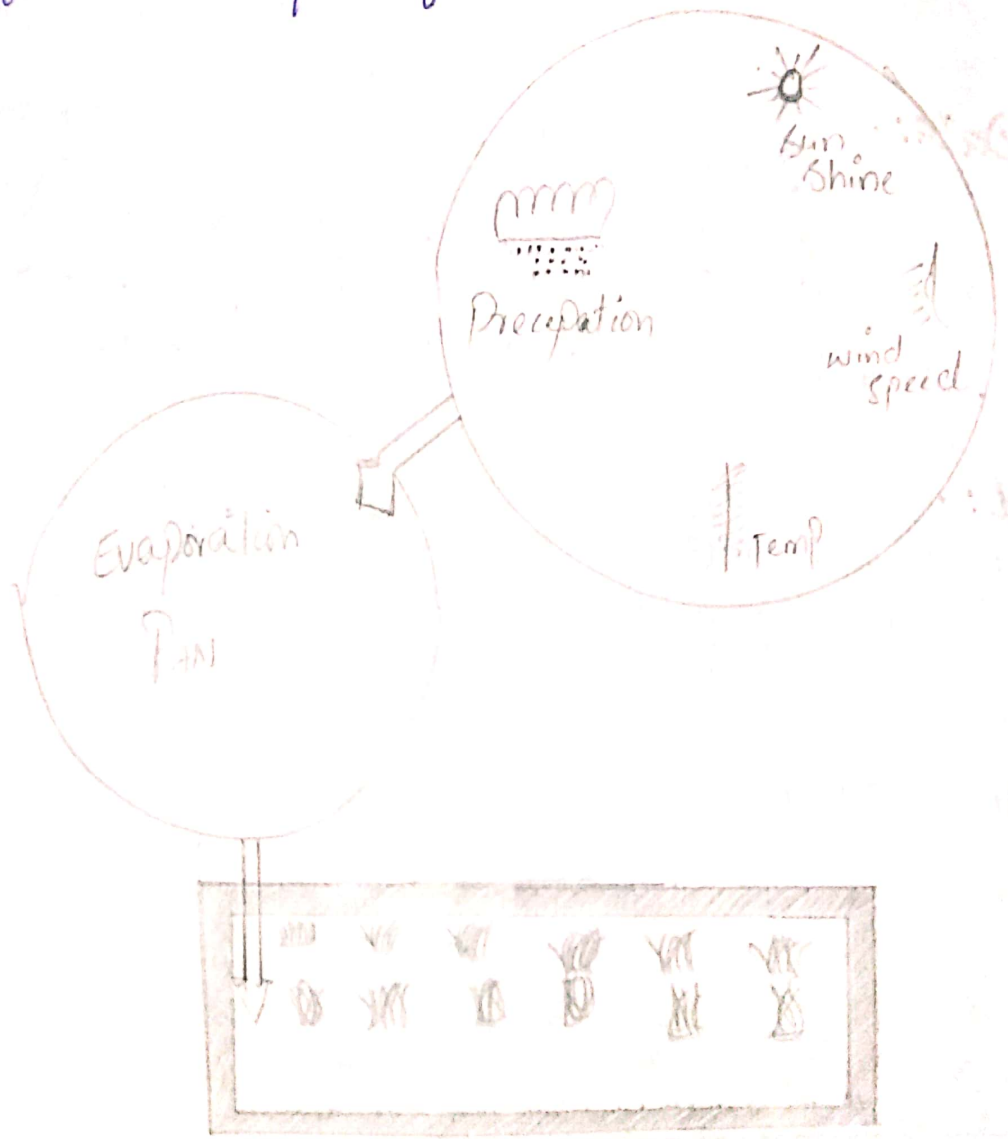
2) $FIR = \frac{CIR}{\eta a}$

$= \frac{30}{0.8} = 37.5cm$

C Part "C"

CLASS A PAN EVAPORATION (EP) MEASUREMENT

EP can be experimently 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.



d) A pan evaporation EP can also determined by using the christiansen formula which states

EP = 0.459 R.Cl.Cw.Ch.Cs.Ce

R = extra terrestrial radiation is the same unit as

EP in cm or mm

Cl = Coefficient for temperature

Cw = Coefficient for wind velocity

Part "D":-

1) "RABI":- 1st October to 31st March - winter

"RABI Crops":- Rabi crops are wheat, Barley, Gram, Mustard Potatoes.

2) "KHARIF":- [redacted]

1st April to 30th September in Summer

"KHARIF CROPS":-

Kharif crops are Rice, Bajra, Jowar, Maize, cotton.

"Rabi and Khariff Ratio:-

The area is irrigated for Rabi crops generally more than that for Kharif crops The Ratio of proposed areas is 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

Q No 3

(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.

Part "B"

Pavement wilting Point:-

It is defined as the minimum amount of water in the soil that the plant require not to wilt. If the soil water decrease to this lower point a plants wilt and no longer recover it's 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. It can be expressed as percentage moisture Pw as percentage P or a depth D

Readily available moisture content:-

It is the water that a plant can easily extract from the soil Now is the soil moisture held between field capacity and a nominated refill point for unrestricted growth in the range of soil moisture

Q No3

Part (d) :- Optimum Utilization Of Water :-

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