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Q1) **Duty:-**
It is the total area irrigated by a unit discharge running continously during the base period and and its unit is area/cumec

Delta:-
It is the total depth of water required by a crop during the entire period the crop is the field and it is denoted by symbol Δ

Relation between Delta and Duty:-
let there be a crop of base period B day
let one cumec (m^3) 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 x 60 x 60)
$\times B\ m^3 = 86.400\ m^3$

(*) By definition of duty $1\ m^3$ of water supplied for B days matures D ha of land or $10^4\ Dm^2$ of Area

total depth of water applied on this land

volume / area = $8640 B / 10^4$ $D = 8.64 B / D$ m.

this total depth of water is called Delta Δ

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

where Δ is in cm B is in days

D is duty in hA / cumec

in fps unit $\Delta = 1.98 B / D$ ft

MKS System :-

D = duty in hectares / cumec

Δ = total depth of water supplied in meters

B = Base period in days

if we take a field of area D hectares water supplied to the field corresponding to the water depth Δ meters will be

$\Delta \times D$ hectares - meter $= D \times \Delta \times 10^4$ cubic meter ... (1)

Again for the same field of D hectares one cumec of water is required to flow during the entire base period Hence water supplied to this field is

$= (1) \times (B \times 24 \times 60 \times 60) m^3$ ... (2)

Equation (1) and (2) we get

$$D \times \Delta \times 10^4 = B \times 24 \times 60 \times 60$$

$$\Delta = \frac{B \times 24 \times 60 \times 60}{D \times 10^4} = 8.64 B/D \text{ meter}$$

1 hectare = 10^4 sq meter.

cumec day = hectare-meter.

In FPS System:-

let Duty = D = (Acres / cusecs)

Delta = A feet Base period = B days by definition one cusec of water flowing continously for B days gives a depth of water A over an area of D acres

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

$= 86400 ft^3$

volume of water $1 ft^3$ sec in B days =

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

As 1 acre = $43560 ft^2$ $1 ft^2 = \frac{1}{43560}$ acre.

then equation 1 becomes

volume of water $1 ft^3$ sec in B days. $86400 ft^3$

$= 86400 \times \frac{1}{43560}$ Acre ft volume

of water $1 ft^3$ sec in B days. $1.983 B$ Acre ft

Depth of water required by crop A = Volume / Area A

$= 1.983 B$ Acre.ft / D Acres A

$= 1.983 \times B/D$ ft

$\Rightarrow \Delta = 1.983 B/D$ ft

where Δ is in feet B in days

D in Acres / cusec.

(b) Given data:-

water requirement of wheat = 9cm

Day interval = 35 days

Base period = 140 days

Required:-

Delta of wheat (Δ) = ?

Solution:-

As we know that

35 days = 9cm

140 days = Δ

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

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

(c) Indus water treaty:-

History:-

It was signed on 19 September 1960 by Prime minister of india Pondit Jawaharlal Nehru and President of Pakistan Ayub Khan.

Statement:-

It is water distribution treaty between Pakistan and India for the usage of water

available in the rivers of india According to this treaty india was given control of eastern india was given control of eastern india. river Beyane Ravi and Sutlej while the control of western rivers indus Chenab and Jehlum was given to Pakistan.

(D) Significance Duty of a crop

(i) Kharif crop:-

The kharif crops include rice, maize, Sorghum, Pearl millet / bajra finger millet / raji, Soyd bean, ground nut cotton.

(ii) cotton:-

cotton is a soft, fluffy staple fiber that grows in a boll, or protective case, around the seeds of the cotton plants of the genus Gossypium in the mallow family Malvaceae. The fiber is almost pure cellulose

(3) **Tobacco:-** Tobacco contain the highly addicitive Stimulant alkaloid nicotine as well as harmala alkaloids Dried tobacco leaves are mainly used for smoking in cigarettes and cigars, as well as Pipes and Shishas.

(4) **Mustard:-** Mustard any of several herbs belonging to the mustard family of plants, Brassicacee, or the condiment made from these plant pungent seeds. The leaves and swollen leaf stem of mustard plants are also used, as greens or potherbs.

(5) **Wheat:-** Wheat (Species of triticum) is a cereal grain people eat it most often in the form of bread. it is a kind of grass whose fruit is a head of wheat with edible seeds. It was first grown in the levant a region of the Near East. world trade in wheat is greater than for all other crops combined.

Q2(a) **factor affecting consumptive use:-**

consumptive use:-

It is the quantity of water used by the vegetation growth of a given area. It is the amount of water required by a crop for its vegetated growth to evapotranspiration and building of plant tissues plus evaporation from soil and intercepted precipitation.

factor affective the consumptive use of water:

consumptive use of water varies with

1. Evaporation which depends on humidity
2. Mean Monthly temperature
3. Growing season of crops and cropping pattern
4. Monthly precipitation in area
5. wind velocity in locality
6. Soil and topography
7. Irrigation practices and method of irrigation
8. Sunlight hours.

(b) **Given data:-**

useful rainfall (cm) = 10

water application efficiency (na) = 80% = 0.8

comulative consumptive use cu = 40cm

Required:-

field irrigation Required FIR = ?

consumptive irrigation requirement CIR = ?

Solution:-

As we know that

By formula

consumptive irrigation Requirement

$$CIR = cu - Re$$

$$= 40 - 10$$

$$CIR = 30 \text{ cm}$$

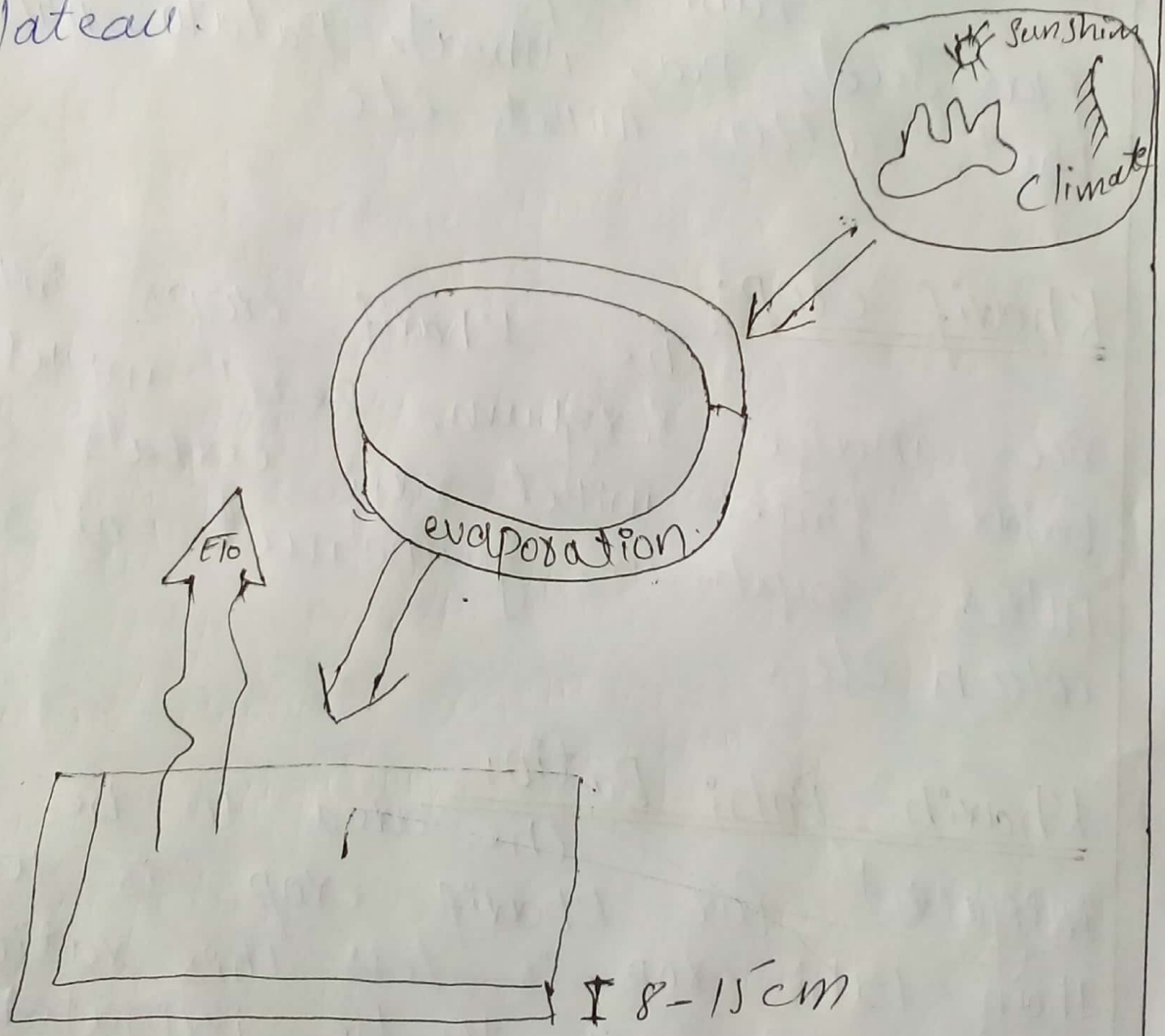
field irrigation Requirement FIR

$$= \frac{CIR}{na}$$

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

(c) **Class A Evaporation measurement:-**

The class A Evaporation pan is a standard device for manual measurement of evaporation. The pan represents an open body of water. it is filled with water and exposed on a flat plateau.



(D) Rabi crop:-

Rabi crops which are sown in july and harvested in october are called rabi crops

For example:-

Rabi crops chickpea, Barley flax seed, Pea, Wheat, Potato, Mustard Plant, cotton, millet etc.

Kharif crop:-

The Kharif crops include rice, maize, Sorghum, pearl millet bajar, finger millet ragi cereals arhar pulses Soyabean, groundnut oil seeds cotton etc.

Kharib Rabi Ratio:-

The area to be irrigated for kharif crop is less than Rabi crop is ~~less~~ This ratio of Proposal area to be irrigated in kharif season to that in the Rabi season is called kharif Rabi ration

This ratio is generally 1:2 Kharif area is one half-ed of the Rabi area.

Ans (3)

(a) **Field capacity:-**

The maximum amount of water that a soil or rock can hold as by capillary action before the water is drawn away by gravity is called field capacity

(b) **Permament wilting point:-**

Permanent wilting Point or wilting point is define as the minimum amount of water in the soil that the plant require not to wilt. if the soil water content decreases to this or any lower point a plant wilts and can no longer recover its turgidity when placed in a saturated atmosphere for 12 hour.

(c) **Readily Available moisture content:-**

Readily available is the water that a plant can easily extract 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 plants are neither waterlogged nor water-stressed.

(d) optimum utilization of irrigation water:-

if a crop is sown and produced under absolutely identical conditions using different amount of water depth the yield is found to vary if a crop is sown and produced under absolutely identical condition using different amount of water depth the yield is found to vary.