Q#1 (a)

Define "Delta" and duty and derive Their Relation ship in MKS and FPS System.

ANS:

⇒ **DUTY:-**

The term Duty means the area of land that can be irrigated with unit volume of irrigation water. Duty represents the irrigation capacity of a unit. It is the relation between the area of a crop irrigated and and the quantity of irrigation water required during the entire period of the growth of that crop.

Ex:

If 3 Cumec of water supply is required for a crop shown in the area of 5100 hectares, the duty of irrigation water will be 5100/3 = 1700 hectares/cumecs, and the discharge of 3 cumecs will be required throughout the base period.

(P.t.o)

⇒ DELTA:

It is the total depth of water required by a crop during the entire period the crop is in the field and is denoted by the Symbol Δ, for ex: If a crop requires about 12 watering at an interval of 10 days and a water depth of 10cm. If the area under the crop is A hectares, the total quantity will be $1.20 \times A = 1.2A$ hectare-meter in a period of 120 days.

RELATION BETWEEN DUTY, DELTA IN MKS AND FPS SYSTEM:

⇒ MKS SYSTEM:

Let Suppose,

Duty = D (hectares/Cumec)

Delta = A (Meters)

Base period = B (days by definition)

one Cumec of water flowing continously for "B" days gives a depth of water "A" over an area of "D" (hectares)

Volume of water at $1 m^3/sec$ in "B" days $= 1 \times 24 \times 60 \times 60 = 86400 m^3$.

Volume of water at $1 m^3/sec$ in "B" days $= 1 \times 24 \times 60 \times 60 = 86400\ B\ m^3 = 86400\ m^3 m$ → (1)

As 1 Hectare $= 10000 m^2$

$1 m^2 = 1104\ H$

Then equation (1) becomes.

(Pto)

Volume of water at $1 m^3$ Sec in "B" days = $86400 B m^3$ = $86400 B \times 1104$ H-m

Volume of water at $1 m^3$ Sec in "B" days = $8.64 \times B$ H-m → (ii)

Depth of water required by Crop, A = Volume Area A =

$8.64 \times B$ H/m D HA = $8.64 \times BD$ m.

⇒ **IN FPS SYSTEM:**

Let Suppose,

Duty = D (Acres/Cusec)

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 at $1 ft^3$ Sec in one day = $1 \times 24 \times 60 \times 60$ = 86400^3.

Volume of water at $1 ft^3$ Sec in "B" days = $1 \times 24 \times 60 \times 60$ = $86400 B ft^3$ = $86400 B ft^2 ft$ → (i).

As 1 Acre = 43560 ft^2 $1 ft^2 = \frac{1}{43560}$ Acre then, equation i becomes,

Volume of water at $1 ft^3$ Sec in "B" days = $86400 B ft^3$ = $86400 B \times 143560$ Acre-ft

Volume of water at $1 ft^3$ Sec in "B" days = $1.983 \times B$ Acre-ft → (ii)

Depth of water required by Crop,

A = Volume of Area A = $1.983B$ Acre-ft D Acre A = $1.983 \times BD$ ft.

ID#7879

Q1(b). If wheat requires about 9cm of water after every 35 days and the base period or crop period of wheat is 140 days. Find out the delta for wheat?

Ans: Given data:

Water requirement of wheat = 9cm

Days interval = 35 days.

Base period = 140 days.

Required:-

Delta of wheat (Δ) = ?

Sol:-

35 days = 9cm

140 days = Δ

As we have.

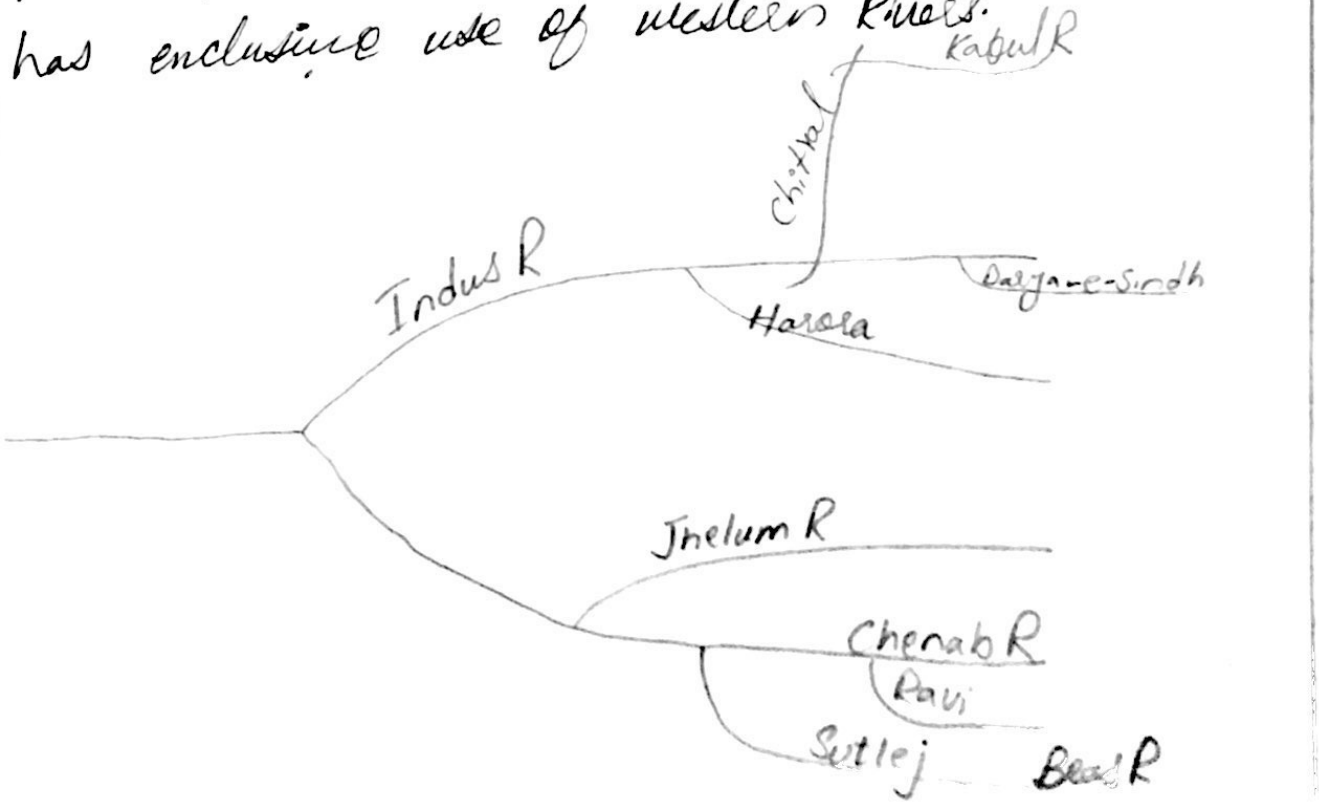
$$\Delta = \frac{9\text{cm} \times 140 \text{ days}}{35 \text{ days}}$$

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

C) INDUS WATER TREATY:

The indus water treaty is a water-sharing treaty between the Republic of India and Islamic Republic of Pakistan The Treaty was signed in Karachi on September 19, 1960 by the then indian Prime minister "Jawaharlal Nehru" and the then president of pakistan Field Marshal Mohammad Ayub Khan.

The indus system of River comprises three western Rivers - the indus, the Jhelum and chenab and three Eastern Rivers, the Sutlej and the Beas and the Ravi and with minor exceptions, the treaty gives india exclusive use of all the waters of the Eastern Rivers and their tributaries before the point where the rivers enter Pakistan. Similarly pakistan has exclusive use of western Rivers.



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Q1(d): write Significance of Duty of crop

ANS: SIGNIFICANCE OF DUTY OF 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 for all the crops required to be irrigated in different seasons of the year, the area which can be irrigated can be work 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#2 (a)

Explain the factors affecting Consumptive use.

ANS:

FACTORS AFFECTING CONSUMPTIVE USE:

Following are factors affecting Consumptive use:

1) Soil fertality.
2) Quality of water.
3) Temperature.
4) Humidity in Air.
5) velocity of wind.
6 Sunlight.

1. **Soil Fertality:**
increase in fertility of the soil caused or causes a decrease in the amount of water consumed per unit of crop yield.

2. **Quality of water:**
Quality of the water supply may have an appreciable effect on Consumptive use. whether or not plants actually transpire more or less if water is highly saline may be debatable.

2. **Temperature:-**
The rate of consumptive use of water by crops in any particular locality is probably affected more by temperature, which for long time period is a good measures of solar radiation, then by any other factor.

4- **Humidity In Air:-**
Evaporation and transpiration are accelerated on days of low humidity and slow during period of high ~~temperature~~ humidity. During period of low relative humidity, greater rate of use of water by vegitation may be expected.

5- **Velocity Of Wind:-**
Evaporation of water from land and plant surfaces take place more rapidly when there is moving air then under calm air conditions. Hot dry winds ~~are~~ and other unusual winds condition during the growing period will affect the amount of water consumptively used.

6- **Sunlight:**
Sun is the source of all energy used in crop growth and evaporation of water, This longer day may allow plants transpiration to continue for a longer period each day and to produce an effect similar to that [redacted] of lengthening the growing season.

Q#2: (b)

wheat is to be grown at certain place, The usefull rainfall for the whole season is 10cm and its comulative consumptive use is 40cm. Determine consamptive irrigation requirement (CIR) and field irrigation requirement (FIR) If the water application efficency is 80%.

Given data:

usefull Rainfall (cm) = 10.

water application efficiency (η_a) = 80% = 0.8.

Commulative consamptive use (Cu) = 40cm.

REQUIRED:

CIR = ?

FIR = ?

Solution:

As in formula:

⇒ Consumptive Irrigation Requirement (CIR) = Cu - Re

= 40 - 10

CIR = 30cm.

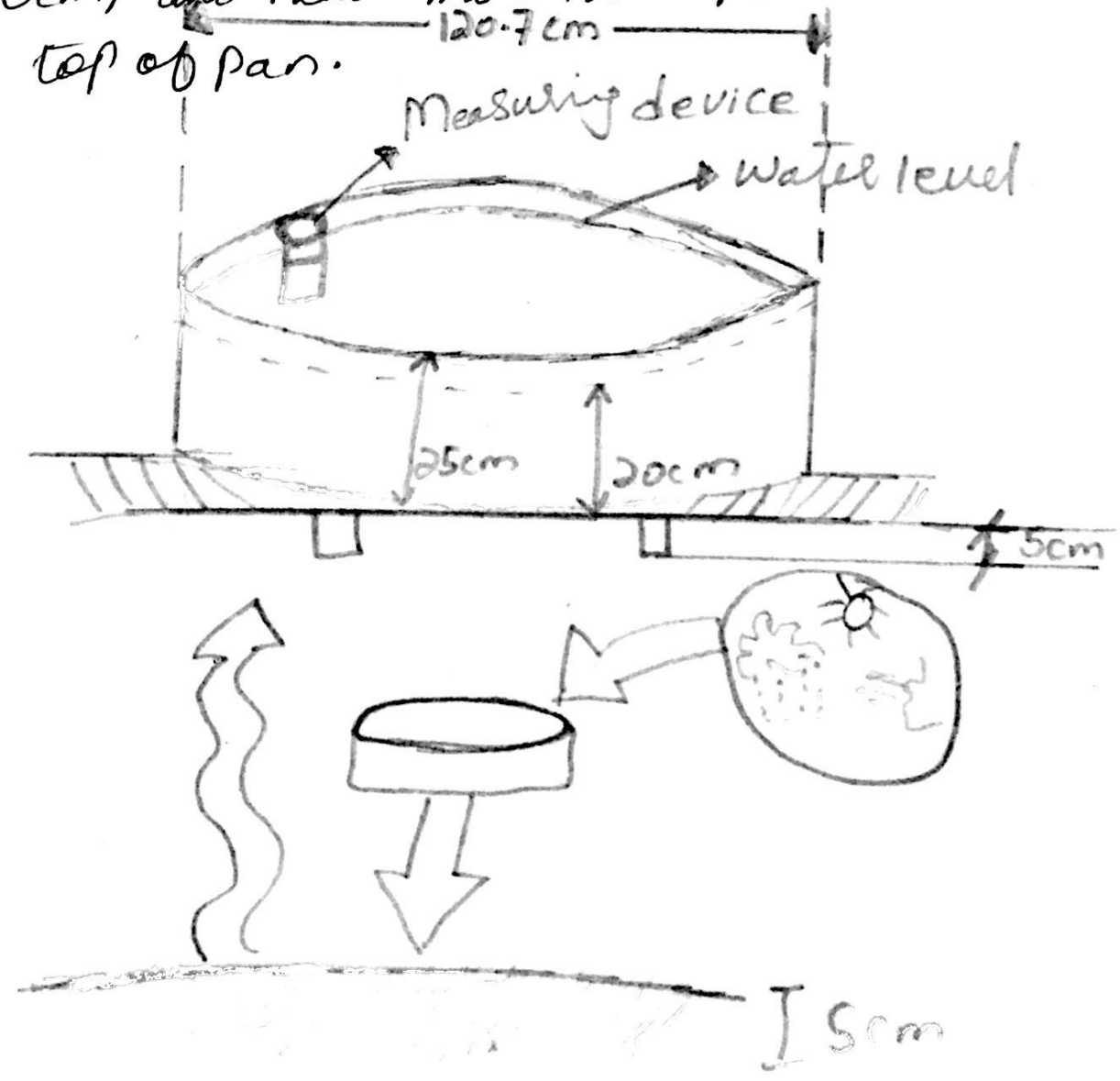
⇒ Field irrigation requirement (FIR) = $\frac{CIR}{\eta_a}$

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

Q#2 (c)

CLASS A PAN EVAPORATION (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.



Q#2 (d)

⇒ **CROP SEASON:**

1- RABI ⇒ 1st octobar to 31st March — winter
2- KHARIF ⇒ 1st April to 30th September — Summer.

KHARIF CROPS ⇒ Rice, Bajra, Jawar, Maize, Cotton

RABI CROPS ⇒ wheat, Barly, Gram, Mustard. Potatoes.

KHARIF RABI RATIO:

The area to be irrigated for rabi crops generally more than that for kharif crops. The ratio of proposed areas, to be irrigated in kharif season to that in Rabi season is called kharif Rabi ratio. This ratio is generally 1:2. i.e kharif area is one half of Rabi area.

ID # 7879 (12)

Q#3 Define & Explain the following terms

A- **Field Capacity:**

Field capacity is the amount of soil moisture or water content held in soil after excess water has drained away and the rate of downward movement has materially decreased, which usually takes place within 2-3 days after a rain or irrigation in pervious soils of uniform structure and texture.

b- **PERMANENT WILTING POINT:-**

The permanent wilting point is the point when there is no water available to the plant. The permanent wilting point depends on plant variety, but it is usually around 1500 kPa (15 bars). At this stage, the soil still contains some water, but it is difficult for the roots to extract from the soil. Nearly 15 bars of tension is required to extract water by the plants. At this limit, if no additional water is supplied to the soil, most of the plants die.

The moisture content at the permanent wilting point varied with soil texture. Fine-textured soils retain higher amount of water (~26%-32% v/v) then the coarse textured soils (10%-15% v/v) at the permanent wilting point.

c. Available and readily Available Moisture Content.

⇒ **Available Moisture Content:-**

The difference in moisture content of the soil between field capacity (F.C) and permanent wilting point is termed the available moisture. Available moisture can be expressed as percentage moisture P_w, as percentage P_v or as depth d.

⇒ **Readily Available Moisture (Raw):**

Soil Moisture content near the wilting point is not readily available to the plant. Hence, the term readily Available moisture has been used to refer to the portion of available moisture that is most easily extracted by plants, approximately 75% of the available moisture.

d- Optimum utilization of water.

optimum utilization of water means getting maximum yield with any amount of water. The supplies of water to the various crops should be adjusted in such a fashion, to get optimum benefit ratio, not only for the efficient use.