

: INU :

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Q No: 01

①

Part: (a)

Delta :-

It is the Total depth of water need by a crop during the whole base period.

- It is expressed in term of Depth (D).
- Delta is denoted by " $\Delta$ "
- It is calculated in "cm" or "m"

Duty :-

It is defined as the number of hectares that can be irrigated by a constant supply of water at the rate of one cumec throughout the base period

- It is denoted by " $D$ "
- It is expressed in cumec/hectares.

## Relationship in MKS and FPS Systems.

① Relationship between Delta and Duty in MKS System:

Let:

$\Delta$  = Total depth of water supplied in "m"

$D$  = Duty of Crop in hectares/cumec

$B$  = Base period of the Crop per-day

→ As per definition of "Duty" volume of water supply to irrigate  $D$  hectares of Land for 1 sec =  $1m^3$

Then

volume of water for one day

$$= 1 \times 24 \times 60 \times 60 m^3$$

$$= 86400 m^3$$

→ Similarly the volume of water for  $B$  days ( $V$ ) =  $86400 \times B m^3$

Area of Land irrigated ( $A$ )

$$= D \text{ hectares} \Rightarrow D \times 10^4 m^2$$

(3)

Now,

The 'Depth of water Supplied on  
This Land ( $\Delta$ ) =  $\frac{V}{A}$

$$= \frac{86400B}{10^4 D}$$

$$\Delta = \frac{8.64B}{D}$$

where B in days

$\Delta$  = meter

D = hectars/Cumec

F'Ps :-

Let,

Duty = D (Acres/Cusec)

Delta = A feet Base period = B days  
(As per Def.)

Thus 
$$\Delta = \frac{1.98}{D} \text{ ft}$$

where,

B in days

$\Delta$  is in (feet)

⑥ part :

Given Data :

Water requirement of wheat = 9cm

Base period of wheat = 140 days

Days interval = 35 days

Required

Delta for wheat ( $\Delta$ ) = ?

Solution -

Water as required at an average interval of "35" days upto a total period of "140" days =  $\frac{140}{35}$

$$\Rightarrow 4$$

Total depth of water in 140 days

$$= 4 \times 9$$

$$= 36\text{cm}$$

Hence

$$\Delta \text{ of wheat} = \boxed{36\text{cm}} \text{ Ans}$$

© part:

### Indus Water Treaty:

It is water distribution treaty between Pakistan and India Brokered by the world Bank to use the available water in the Indus System of Rivers Located in India. The Indus water treaty was signed in Karachi on 19<sup>th</sup> September 1960 between the two countries.

According to this the flow of rivers the Beas, the Ravi, and the Sutlej with the mean annual flow of 34 million acre-feet was given to India while control over the water flowing in three western rivers of India, the Indus, the "Chenab" and the "Jhelum" with the mean annual flow 80 (MAF) was given to Pakistan.

④ part:

### Significance of Duty of a Crop:

It helps in the designing of an efficient canal irrigation system knowing the total available water at the head of a main canal and the overall duty for all the crop required to be irrigated in various seasons of the year.

And if we know the crop area which required to be irrigated and also their duties. We can able to calculate the required discharge for proper designing the channel.

Q.No : 02

Part (a)

Factors Affecting Consumptive use:

Following are the factors affecting Consumptive use.

- ① Temperature
- ② Solar radiation
- ③ Precipitation
- ④ Humidity
- ⑤ Wind movement
- ⑥ Length of growing Season
- ⑦ Latitude
- ⑧ Sunlight
- ⑨ Available Irrigation water Supply
- ⑩ Soil fertility

① Temperature:

Abnormally Low temperature retard plant growth and unusually high temperature may be produced dormancy.

② Precipitation:— The rate of precipitation may have some minor effect on the amount of water consumptively used during any summer.

③ Humidity:— Evaporation and transpiration are accelerated on days of Low humidity and slowed during periods of high humidity.



(b) part:

Given Data:

Useful Rainfall for the entire Season  
( $R_e$ ) = 10cm

Cumulative Consumptive use ( $C_u$ ) = 40cm

Efficiency of water ( $E_a$ ) = 80%

Solution:

According to Blaney & Criddle  
Formula:

$$C_u = \sum K \cdot f = 40 \text{ cm}$$

From Consumptive Irrigation Requirement (C.I.R)

Formula

(i)  $C.I.R = C_u - R_e$   
 $= 40 - 10$

$C.I.R = 30 \text{ cm}$  Ans

(ii) Field Irrigation Requirement (F.I.R)

$$F.I.R = \frac{C.I.R}{\text{efficiency}}$$

$$= \frac{30}{80\%}$$

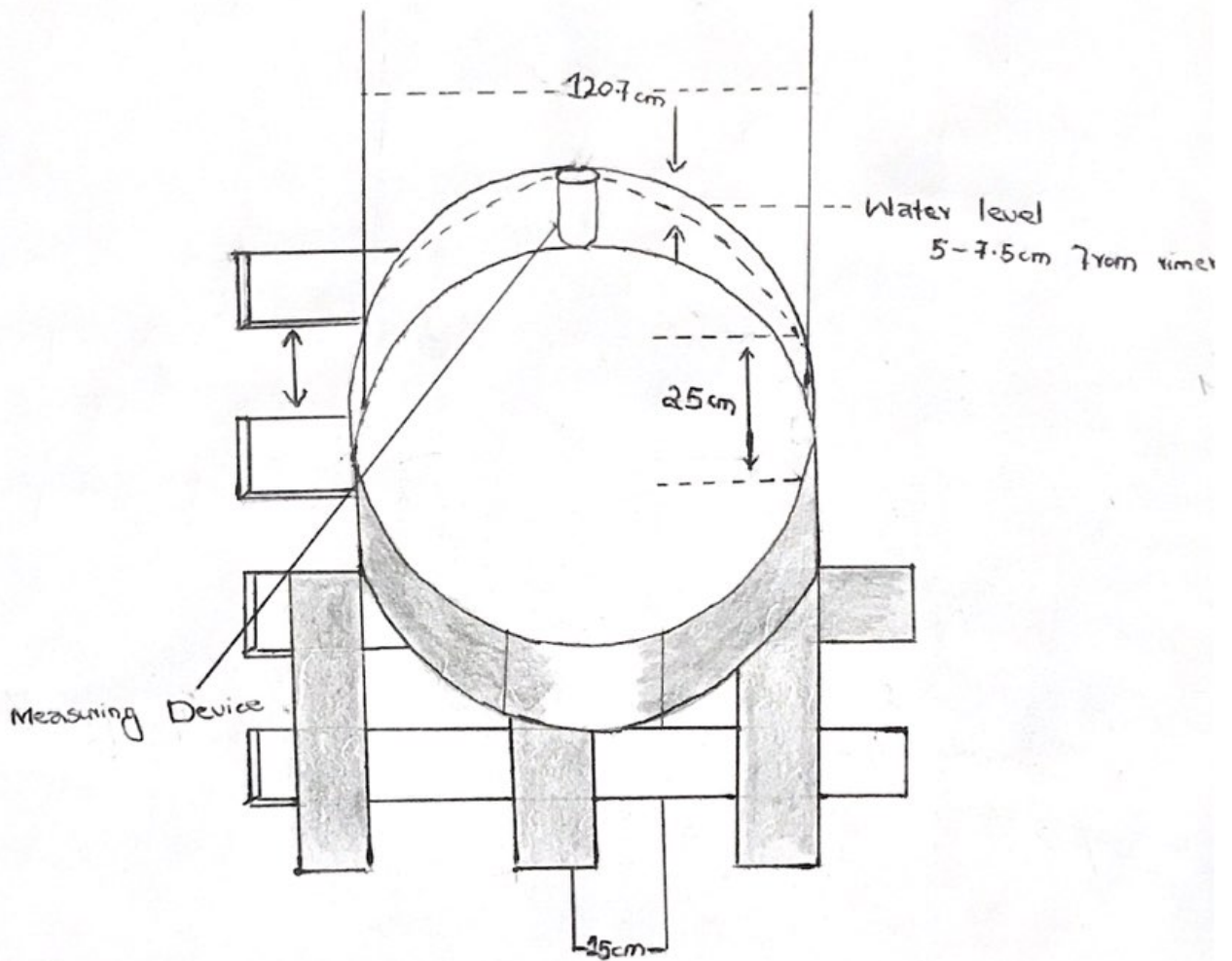
$$= \frac{30}{0.8}$$

$\Rightarrow F.I.R = 37.5 \text{ cm}$  Ans.

© part:

Class A Pan Evaporation (EP) measurement:

Def: It is a standard device manual measurement of evaporation



## Explanation:

(10)

Evaporation can be experimentally calculated by directly measuring the quantity of water which evaporated from this standard class A pan.

→ The pan is 1.0m in diameter 25cm depth of pan and bottom is raised/kept 15cm above the ground level.

→ 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 ( $E_p$ ) can also be determined by using the Christiansen formula which states.

$$E_p = 0.459 R_s \cdot c_t \cdot c_w \cdot c_h \cdot c_s \cdot c_e$$

where  $R_s$  extra. Terrestrial radiation in the same units as  $E_p$  in cm or mm

$c_t$  = Coefficient for temperature.

$c_w$  = Coefficient for relative humidity

$c_s$  = Coefficient for percent of possible sunshine

$c_e$  = Coefficient for elevation.

(d) part:

Rabi Crops Seasons: It is also called winter Crops

⇒ They are the Crops that are Sown at the end of monsoon or at the starting/beginning of winter Season

For example: In between September and October, Major Rabi Crops are wheat, peas, gram etc.

Kharif Crops Seasons: The Crops which are Sown at the beginning/starting of the Rainy Season, eg in between 'April' and 'May'. These Crops are called monsoon Crops.

Main Kharif Crops are rice, Cotton, Maize, bajra, Jowar etc.

Kharif Rabi Ratio: The ratio of irrigation area under Kharif and Rabi is called Crop Ratio. Kharif Crops are those Crops which are Sown in the Summer months and are harvested in the autumn months.

On the other hand Rabi Crops are those which are Sown in the winter months and are harvested during the Spring months. Crops like wheat fall under Kharif Crops whereas Crops like rice and maize fall under Rabi Crops.

Q No: 03

(a) part:

Field Capacity :- (F.C)

Def:

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

(b) part:

Permanent wilting point : (P.W.P)

A plant can extract water from soil till a permanent wilting is reached. P.W.P is that water content at which a plant can no longer extract sufficient water for its growth and wilts up.

water available to plant = Field Capacity  
- P.W.P water.

(c) part:

Available and readily available moisture content:

It is that portion of available moisture which is most easily extracted by plants and is approximately 75 to 80% available moisture.

② part :

### Optimum Utilization of Water:

If a Crop is Sown and produced under absolutely identical Condition using different amounts of water depth, the yield is found to vary. The yield increases with water, reaches a Certain maximum value & then falls down as shown in following fig.

