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Exam	Mid term
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Question#01

a) Define "Delta" and "Duty" and derive their relationship in MKS and FPS System.

Answer:

Delta of a Crop: (Δ)

Delta of a crop is defined as "The total quantity of water, required for the crop to get matured, during its base period"

↳ Delta of crop of irrigated area can simply be obtained by dividing the total quantity of water by the total irrigated area.

↳ Delta of a crop is expressed in "cm" or in "inches.

↳ Delta of a crop can also be defined as "The depth of water in cm or inches required for a specific crop through out its base period (B) for its full fledged nourishment".

↳ **Base period:-**

Base period of a crop is the perid between the first time watering and its last watering before harvesting of the crop.

Examples of Delta of a Crop:-

↳ Delta of Sugar cane is 120 cm or 48 inches, which is same as the delta of the Rice.

↳ Delta of the wheat crop is 30 cm or 12 inches.

↳ Delta of Fodder crop is 22.5cm or 9 inches.

Duty of a Crop:- (D)

Duty of water for a crop is the area in hectares (ha) irrigated by one cubic meter per second of water flowing continously for its base period.

↳ Duty of water for a crop is actually the relationship between the volume of water and the area of crop or land it matures.

↳ The duty of water can be expressed by the number of hectares or acres.

↳ Duty of water (D) is its capacity to irrigate land

↳ it is commonly expressed in $\frac{\text{hectares}}{\text{cumecs}}$ or acres/cusecs.

↳ Example of Duty of water:

↳ Let Suppose a crop is sown in an area of 1000 hectares and the water required for this area to be irrigated is 2 cumecs, then the Duty of water for the crop can be calculated as.

$$D = \frac{1000}{2} = 500 \text{ ha/cumecs.}$$

Relationship between Delta and Duty in MKS System:-

Let Suppose we have a crop having Base period of B days. Let Suppose the Duty of the crop is D hectares/cumecs

As we can say that volume of water applied to this crop for 1 day is equal to, V,

(Hours in day) (min in hour) (Seconds in 1 min)

$$V = 1 \times 24 \times 60 \times 60$$

$$\Rightarrow V = 86400 \text{ m}^3$$

Also we can say for B days that,

$$\text{Volume} = V = B \times 24 \times 60 \times 60 \text{ m}^3$$

$$V = 86400\,B \text{ m}^3$$

$$\because \quad 1 \text{ ha} = 10000 \text{ m}^2$$

$$\Rightarrow \quad 1 \text{ m}^2 = 10^4 \text{ ha}$$

As we know that by definition of the duty, $1\ m^3$ of water is supplied for B days to matures or irrigate D hectares of land.

then this volume of water (V) matures D hectares of land which is also equal to $10^4\ D\ m^2$ of area.

So, the depth of water applied on this land is equal to $\frac{\text{Volume}}{\text{area}}$

$$\Delta = \frac{86400\ B\ m^3}{10^4\ D\ m^2}$$

$$\boxed{\Delta = 8.64\ B/D\ m}$$

Relationship between Delta and Duty in FPS System:-

Let Suppose, we have a crop which have Base period of B days and the Duty of the crop is D Acrs/cusec and Delta for the crop is Δ feet.

then we can say that volume of water in B days, applied to the crop is equal to

$$V = B \times 24 \times 60 \times 60 \ ft^3$$

$$V = 86400 \ B \ ft^3$$

As we know that

$$1 \text{ acre} = 43560 \ ft^2$$

$$\Rightarrow 1 \ ft^2 = 1/43560 \text{ acre}$$

As

$$V = 86400 \ B \ ft^3$$

$$= 86400 \ B \ ft^2 . ft$$

$$\Rightarrow V = 86400 \ B \times \frac{1}{43560 \text{ acre}} \cdot ft$$

$$\Rightarrow V = \boxed{\Delta = 1.983 \ B/D \ ft}$$

where Δ is in ft

B is in days (Sec)

D is in Acres / Cusec

$\because 1 \text{ cusec} = 1 \ ft^3/sec$

Question#01

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 of wheat?

Solution:

Required depth = 9cm

Required water interval = after 35 days

Base period = B = 140 days

then

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

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

The delta for wheat is 36 cm.

Question#01

c) Explain Indus water treaty?

Ans: Indus water Treaty:-

It is an agreement that was made to chalk out the control over the 6 ~~years~~ rivers that run across india and then Pakistan into the indus basin.

↳ Indus waters Treaty was signed on September 19, 1960 between India and Pakistan and was brokered by the world Bank.

↳ The treaty fixed the rights and obligations of both cöntries concerning the use of water of the indus river system.

↳ The IWT was signed in Karachi by the first Prime minister of india, Pandit Jawaharlal Nehru and then by the President of Pakistan Ayub Khan.

↳ According to this agreement, control over the water flowing in three "eastern rivers" of india i) the Beas ii) the Ravi and iii) the Sutlej with the mean annual flow of 33 million acre-feet (MAF) and was given that to india, while the control over the water flowing in three

"western rivers" of india, i) the indus, ii) the chenab and iii) the jhelum with the mean annual flow of 80 MAF was given to Pakistan.

↳ Both countries agreed in the Treaty to exchange data and co-operate in the optimum use of water from indus system of Rivers.

Question#01:

D) Write Significance of Duty of a Crop.

Answer:

Significance of Duty of a Crop:-

↳ Duty of a crop shows us the relation between area of a crop irrigated and the quantity of water required.

↳ Duty represents the irrigating capacity of a unit.

↳ It also helps us in designing the efficient canal irrigation system.

↳ If we know the area to be irregated for the crop and their duties, it can also help us to workout the discharge required for designing the canal.

Questions#02:

a) Explain the factors affecting consumptive use

Answer:-

Factors affecting consumptive use:

The factors affecting consumptive use of water for a crop are the followings:

1) Temperature:-

The rate of consumptive use of water by crops in any particular locality is probably affecting more by temperature.

↳ Low temperature slow down the growth of a crop while High temperatures may produce dormancy.

2) Humidity:-

The process of Evaporation and transpiration are accelarated when there is low humidity while these processes are Slowed down in high humidity.

3) Wind movement:-

Evaporation of water takes place more rapidly and fast when there is moving air or wind movement. while in calm air condition, this process is slow enough.

4) Latitude and Sun light :

Latitude have considerable influence on the rate of consumptive use of water. The hours of daylight during the summer are much greater in northern latitudes than that at the Equator. This longer days may allow plant transpiration to continue for a longer period each day.

5) Quality of water:-

The quality of water supply may also effect on consumptive use. If the water is more salty the crop or land will want more water to leach the salts down through the soil.

6) Soil Fertility:-

If a soil is more fertile, then the yield may increase with small increase in water. However, an increase in fertility of the soil causes a decrease in the amount of water consumed per unit of crop yield.

Question#02:

b) Wheat is to be grown at a certain place, the useful rainfall for the whole season is 10cm and its comulative consumptive use is 40cm. Determine consumptive irrigation requirement (CIR) and Field irrigation Requirement (FIR) if the water application efficiency is 80%.

Given data:

Usefull Rainfall = 10cm = R_e

Comulative consumptive use = 40cm = C_u

Water irrigation Efficiency = η_a = 80%.

= 0.8

Required data:

Field irrigation requirement (FIR) = ?

Consumptive irrigation requirement (CIR) = ?

Solution:

As we know by formula of consumptive irrigation requirement,

$$CIR = C_u - R_e = 40 - 10$$

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

Also we know that,

$$FIR = \frac{CIR}{\eta_a} = \frac{30}{0.8}$$

$$\boxed{FIR = 37.5 \text{ cm}}$$

Question#02:

c) Explain class A Pan evaporation (Ep) measurement with the help of a diagram.

Answer:

Pan Evaporation:-

It is a weather measure-ment system that distinguishes the rate of evaporation based on weather factors.

↳ Pans occur for pan evaporation in different sizes and shapes, the most commonly used pans are circular and square.

"Class A" Pan Evaporation:-

It is the most commonly used in North America. This pan consists of a cylinder that is 46.5 inches in diameter and 10 inches in depth.

↳ The pan is placed on a leveled wooden base and is enclosed by a chain-link

fence to avoid interference by animals and insects.

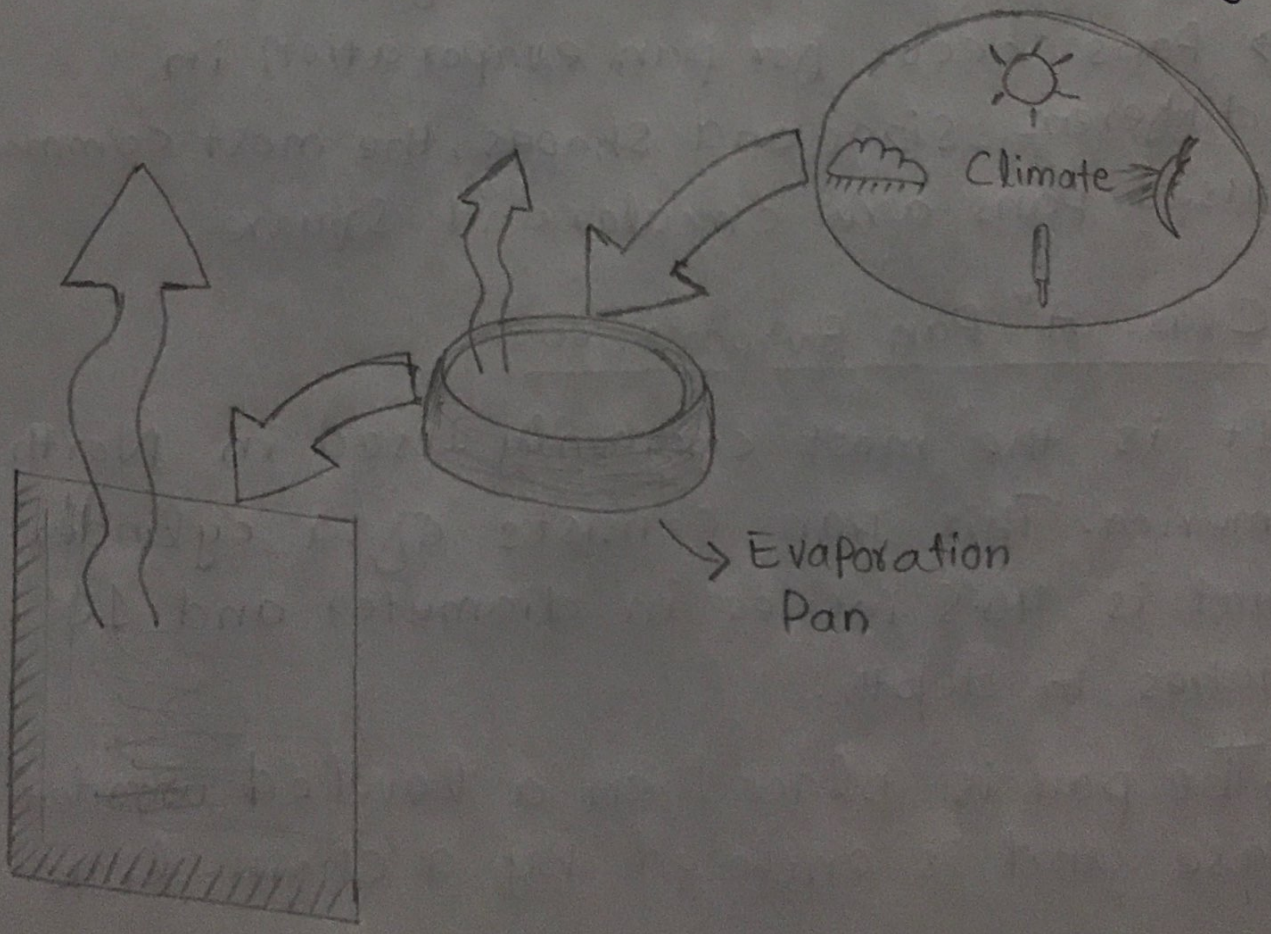
↳ The rate of evaporation is determined daily by recording the depth of water.

↳ The initial quantity of water is set at exactly two inches; at the end of the day, the water is then refilled.

↳ The amount of water it takes to fill the pan is the rate of evaporation.

↳ The class A Evaporation pan is ineffective when the level of rainfall is beyond 30mm.

↳ When rainfall is is more than 55mm recorded, the pan is likely to overflow.



Question#02

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

Answer:

Rabi Crops:

The word "Rabi" is from Arabic language which means Spring.

↳ The harvesting of this type of crop happens in the spring time.

↳ The Rabi Season usually starts in November and lasts up or ends in March or April.

↳ Rabi crops are mainly cultivated using irrigation since monsoons are already over by November.

↳ In fact, unusually showers or rains in November or December can ruin the crops.

↳ The seeds of Rabi crops are sown at the beginning of autumn due to which its harvesting happens in spring.

Examples:

The most common examples of Rabi Season crops are wheat, barley, mustard and grean peas.

Kharif Crops:

The word Kharif is from Arabic language and it means autumn

↳ Kharif Season starts with the beginning of autumn or ~~water~~winter.

↳ Kharif Season's Crops are also known as monsoon crops.

↳ These are the crops that are cultivated in the monsoon season.

↳ This Season differs in every state or country but is generally from june to September.

↳ Kharif Crops are usually sown at the Start of the monsoon season around june and is harvested in September or October.

Examples:

The most Common Crops of Kharif Season are Rice, maize, ragi, bajra, cotton, Soybean and groundnutt etc.

Kharif-Rabi Ratio:-

The ratio of proposed area, to be irrigated in kharif Season to that in the Rabi Season is known as kharif-Rabi Ratio.

↳ Kharif rabi ratio is also called Crop ratio.

↳ The area to be irrigated in Rabi Season is generally more than that of the kharif Season.

↳ The Ratio is generally 1:2

↳ Kharif crop area is one half of the Rabi area.

Question# 03:

Define and Explain the following terms.

a) Field Capacity:-

Field capacity is the amount of Soil moistur or water content remain in the Soil after excess water has drained away and the rate of downward movement has decreased.

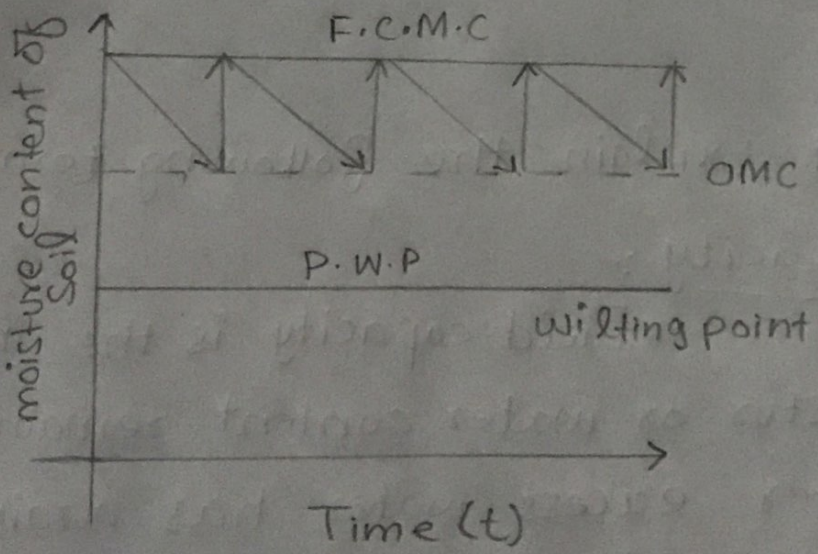
↳ Field capacity is a measurement that has to do with the ability of Soil in a given area to absorb water, once when all excess and Surface water has been drained from the area.

↳ Field Capacity is a process that normally takes a couple of days.

b) Permanent wilting point:- (PWP)

Permanent wilting point is that water content at which a plant can no longer extract Sufficient water for its growth and thus wilts up.

↳ A plant can extract water from Soil till a permanent wilting is reached.



c) Available and readily available moisture content:-

This is actually that part or portion of available moisture which is most likely extracted by plants.

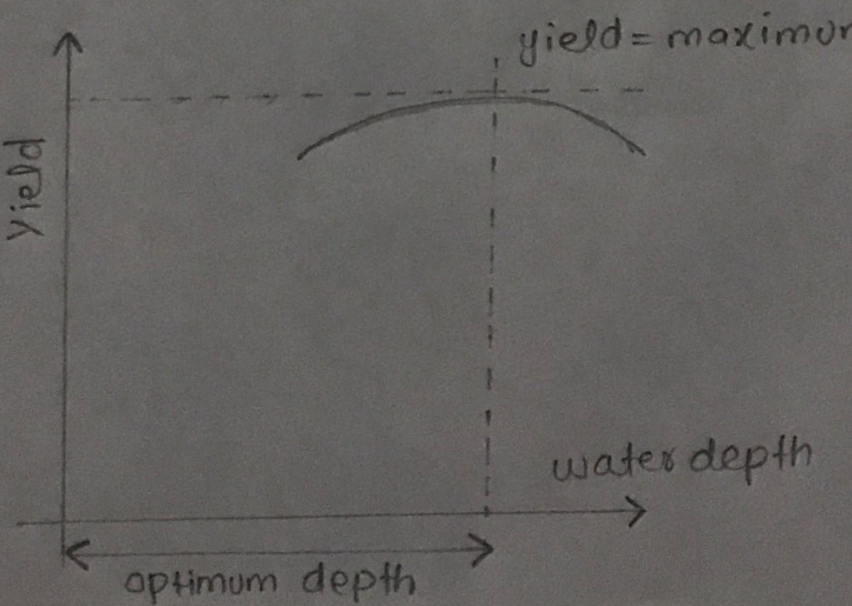
↳ This is approximately 75% to 80% of available moisture.

d) Optimum utilization of water:-

Optimum utilization generally 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 utilization.

↳ The quantity of water at which the yield is maximum is called the optimum water depth.



Thank You

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