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Module; 6th

Subject; Irrigation Engineering CE 324

Section; 'B'

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Couace; BE(c)

## Question : 01

Answer: DELTA: A crop needs a certain amount of water at fixed interval through out its base period. Depth of each watering: 5cm (2") - 10cm(4").

Definition: The depth of water in cm or inches required for the crop through

out the base period is called delta of the crop.

Example; 10 cm of water at interval of 10 days. Base period is 120 days.

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

Volume of water is generally expressed by a unit discharge flowing for a time of base period of the crop.

1 cum per sec or 1 cu-ft/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/cusecs.

## Relationship between Duty and delta in MKS system:

★ Let there be a crop of base period B days. Let one cumec ($m^3$/sec) of water by applied to this crop on the field for B days.

★ Now the volume of water applied to this crop during B days = V = (24×60×60×B) $m^3$ = 86,400 $m^3$.

★ By definition of duty, 1 $m^3$ of water supplied for B days matured D hectares of land. This quantity of water (V) matures D ha of land or 10 4D $m^2$ of area.

Total depth of water applied on this land = volume/Area = 86400 B / 10 4D = 8.64 B/D m.

By Def. this total depth of water is called Delta Δ Therefore Δ = 8.64 B/D m = 846 B/D cm where Δ is in cm, B is in days.
D is duty in ha/cumec.
In FPS units Δ = 1.98 B/D ft.

Relationship btw Duty and Delta in FPS system.

Let

D = Duty (Acres)

Δ = Δ Best base period = B days

By definition one cusec of water flowing continously. For "B" days give a depth of water 'A' over an 'D" Acres

volume of water ($ft^3$/sec) in one day

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

volume of water ($ft^3$/sec) in B day =

$1 \times 24 \times 60 \times 60 = 86.400\ B\ ft^3$ — (i)

1 Acre = $43560\ ft^2$

$1\ ft^2 = \frac{1}{43560}$ Acre

Put in eqn it becomes = $86.400\ B \times \frac{1}{43560}$ Acre ft

$= 1.983\ B$ Acre ft (ii)

Depth of water required by crop

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

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Part 'B'

Solution:

No of required watering = $\frac{140}{35} = 4$

Depth of water required = 9cm each time.

Total depth required in = 9×4

= 36 140 days

So

△ for wheat = 36cm

Part 'C'

## Indus water treaty:

The indus water treaty (IWT) is a water distribution treaty between india and pakistan signed on sept 19, 1960. The treaty was signed by president Ayub khan and PM Nehru.

The indus water treaty deals with river indus and its five tributaries which are classified into two categories.

| Eastern Rivers | Western Rivers |
|---|---|
| 1: Sutlej | 1: Jhelum |
| 2: Beas | 2: Chenab |
| 3: Ravi | 3: Indus |

* According to this treaty, all the wate of eastern rivers shall be available.
* India should let unrestricted flow of water from western rivers to pakistan.

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* The treaty says that india can use the water in western rivers in "non-consumptive needs.
* 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

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Part "D"

Significance of Duty of a 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 worked out.

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Inversly if we know the crop area required to be irrigated and their duties. we can work out the discharge required for designing the canal.

$$Q = A/D \qquad A = QD$$

| Crop | Duty in hectares/cumec |
|---|---|
| Sugar can | 730 |
| Rice | 775 |
| other kharip | 1500 |
| Rabi | 1800 |
| Perniale | 1100 |
| Hot bedder | 2200 |

## Question : 02

Part (A)

Explain the factor effecting consumptive use:

Answer: Factor effecting consumptive use are given below:

1: Temperature
2: Humidity
3: Velocity
4: Soil Topography
5: Sunlight

1: Temperature;

consumptive use of water is directly effected by the temperature the plant tends to show while at low temperature there is a devastated plant growth.

2: Humidity; Evaporation is inversly proportional to humidity as at low humidity evaporation rate is more slowed down while at high humidity evaporation is

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: Soil Topography: If a soil is made more fertile through the application of manure or by some other means the yield may be effected to increase with an accumpanying small increase in use of water. However an increase in fertile of the soil causes a decreases in the amount of water consumed per unit of crop yield.

5: Sunlight; In days in summer there is more sunlight than usual so high evaporation occurs, when in winter there is low evaporation rate.

Part B QNO : 02

Given data:

Useful Rainfall (cm) = 10
water application Efficency (ηa) = 80% = 0.8
cumulative consumptive use (Cu) = 40cm.

Required;

Field Irrigation Requirement (FIR) = ?
consumptive Irrigation requirement (CIR) = ?

Solution:

→ CIR = Cu - Re = 40 - 10 = 30cm

→ $FIR = \frac{CIR}{\eta a}$

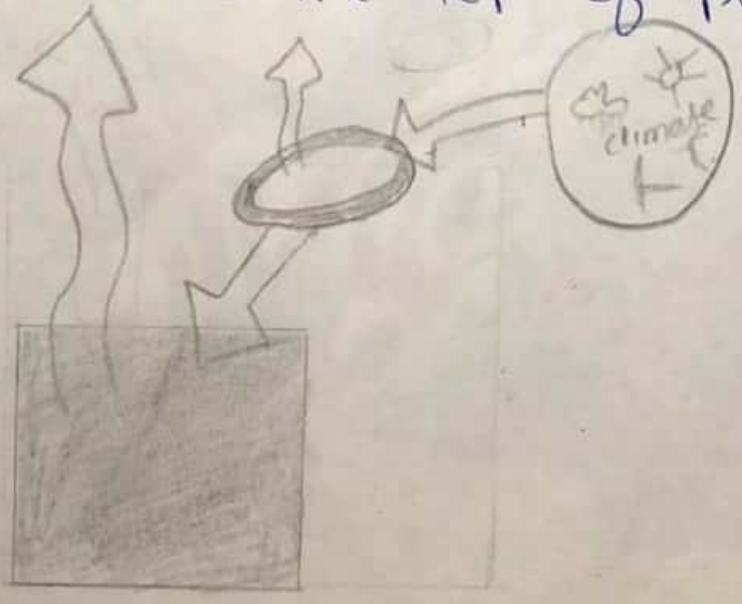
$= \frac{30}{0.8} = 37.5cm$

P.T.O

## Question # 02 part "C"

Answer: "class A pian Evaporation (EP) measurement:

EP can be experimentally 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 bxed range such that the water surface is at least 5cm and never more than 7.5cm, below the top of pan.




A pan evaporation EP can also determined by wing the christanism

formula which states.

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

R = Extra. Terrestrial radiation is the same unit as

EP in cm or mm

Ct = coefficient for temperature

Cw = coefficient for wind velocity.

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Question: 02 part "B" "D"

Answer: RABI: 1st october to 31 March winter.

RABI CROP: Rabi crops are wheat Barley Gram, Mustard potatoes

2 "Kharif": 1st April to 30st september in summer.

"Kharif crops": Kharif crops are Rice, Bajra, Jawar, Maize cotton.

"Rabi & Kharif Ratio:- The area is 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 as Rabi and Kharif Ratio.

The ratio is [1:2] that is Kharif area is one half of that Rabi area.

## Question # 03

Define and explain the following term.

1: Field capacity;

When all gravity water has drained down to water tables by surface soil. This water which can not be easily drained under the action of gravity.

2: Permanent whilting point;

It is defined as the minimum amount of water in the soil that the plant requires not to wilt. If the soil water content decreases to this or any lower point a plant wilts and no longer recover its tragidity which placed in a saturated atmosphere for 12 hours.

3: Available and readily available moisture content:-

Available moisture content: The difference in moisture content of the soil between

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field capacity and permanent wilting is termed the available moisture. Available moisture can be express as percentage moisture PW, as percentage PV or as depth.

4: "Optimum utilization of water":-
Readily available moisture content: It is the water that a plant can easily extract from the soil RAW is the soil moisture held between field capacity and a nominated refil point for unrestricted growth. In this range of soil moisture plant are neither waterlogged or water stressed.

5: Optimum utilization of water: The yield increases with water can reaches a certain maximum values and then fall down the quantity of water at which the yields is maximum is called the optimum water depth. Therefore the optimum utilization of water means getting maximum yield with any amount of water.