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Section B

Subject Irrigation engineering.

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Mid Term exam

QUESTION 01 (a)

Define Delta and Duty and deive their relation ship in MKS and FPS

DELTA :

The depth of water in cm or inches required for the crop through out the base period is called delta of the crop.

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

DUTY :

The duty of water is the relationship b/w 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.

Relation b/w Delta and duty in MKS :

- let there be a crop of base period B days let one cumec (m^3/sec) 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

$$V = (24 \times 60 \times 60 \times B)\ m^3$$

$$V = 86,400\ m^3.$$

- By definition of duty, $1 m^3$ of water supplied for B days matures D hectares of land. This quantity of water (V) matures D ha of land 10^4 D m^2 of area.
- Total depth of water applied on this land.

$$= \frac{\text{Volume}}{\text{Area}} = \frac{86400\,B}{10^4\,D} = \frac{8.64\,B}{D}\ m$$

$$= \frac{864\,B}{D}\ cm$$

where Δ is in cm, B is in days
D is duty in hector / cumec.

Relation b/w Duty and Delta in FPS.

- Volume of water in one day, $V = 1 \times 24 \times 60 \times 60$
  $= 86400\ ft^3/sec$
- Volume of water in B days = $86400\,B\ ft^3$

1 Acre = $43560\ ft^2$

Now $$\frac{86400\,B}{43560}$$

- Volume of water in B days (ft^3/sec) = 1.983 Acre-ft.
- Depth of water required for crop = $\frac{1.983\,B}{D}$ ft

So, $$\Delta = \frac{1.983\,B}{D}\ ft.$$

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 for wheat?

SOLUTION :

- Wheat requires about 9cm of water after every 35 days.
- The base period or crop period of wheat is 140 days

Then delta Δ = 9cm = 35 days

? = 140 days

By cross multiplication

$9 \times 140 = 35$

Divide b/s by 35

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

$$\Delta = 36cm$$

So,

Delta Δ = 36cm delta of wheat.

QUESTION 01 (c)

Explain indus Water Treaty?

ANSWER.

INDUS WATER TREATY:

- The indus water treaty was signed on September 19, 1960 by Prime minister Nehru and Pakistan's President Ayub Khan.
- The treaty administers how rivers indus and its tributaries that flow in both the contries will be utilized.
- According to treaty Beas, Ravi and sutlej are to be governed by india while indus, chenab and Jhelum are to be governed by pakistan.
- It is classified in two categories which are eastern and western rivers
- India should let unrestricted flow of water from western river to Pakistan.
- The treaty says that india can use the water in western rivers in non consumption needs.
- The treaty allocates 80% of water from the six river indus water system to Pakistan.
- A permanent indus commision was set up as a bilateral commission to implement and manage the treaty.

QUESTION 01 (d):

Write Significance of duty of a crop?

ANSWER:

Following are the significance of duty of crops.

- It helps in designing efficient canal irrigation system, knowing that the total available water at the head of the main canal and the overall duty of all the crops required to be irrigated in different seasons of the year the area which can be irrigated can be worked 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.

QUESTION 02 (a)

Explain factor affecting consumption uses?

ANSWER:

Following are the factors that affect consumption uses.

1) Temperature:

Consumptive use of water is directly affected by the temperature. At high temperature the plant tends to show dormancy while at low temperature there is a plant growth

2) Humidity:

Transpiration are accelerated on days of low humidity and slowed during periods of high humidity. During period of low relative humidity greator rate of use of water by vegetation may be expected.

3) Velocity Of Wind:

By wind or air current water vapour given off during transpiration is removed; thus saturation of the surrounding air is avoided which otherwise would retard the rate of transpiration Winds of high however, retard transpiration, because the stomata close up due to high wind. Moreever wind of high velocity bring about a reduction in temperature which undoubtedly affects consumption uses.

4) Soil Topography: The landscape of soil is very important because a smooth surface topography is necessory to yeild a good growth of plant. Rugged landscape topography mut lead to poor yielding.

5) Sun light :

It has marked effect on transpiration The opening and closing of the stomata, through which by far the maximum amount of water is lost, depend on light, Morever, due to absorption of radient energy and its transformation into heat, temperature of the leaf is raised bringing about an increase in ~~tran~~ consumption use

- In general consumption rate is high during daytime particularly when the light is bright than during night time.

QUESTION 02 (b):

Wheat is to be grown at certain place, the usefull rainfall for the whole season is 10 cm and its cumulative consumption use is 40cm. Determine consumption irrigation requirement (CIR) and Field irrigation requirement (FIR) if the water application efficiency is 80 %.

Given Data :

- Usefull rainfall = 10cm
- cumulative consumption use = 40cm
- water application efficiency, η_a = 80%
  = 0.8

Required :

- Field irrigation requirement, FIR = ?
- Consumption irrigation requirement, CIR = ?

Formula :

$$CIR = Cu - Re$$

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

SOLUTION:

- Consumption irrigation requirement, CIR

$$CIR = Cu - Re \Rightarrow = 40 - 10 = 30\,cm$$

- Field irrigation requirement, FIR.

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

$$FIR = 37.5\,cm$$

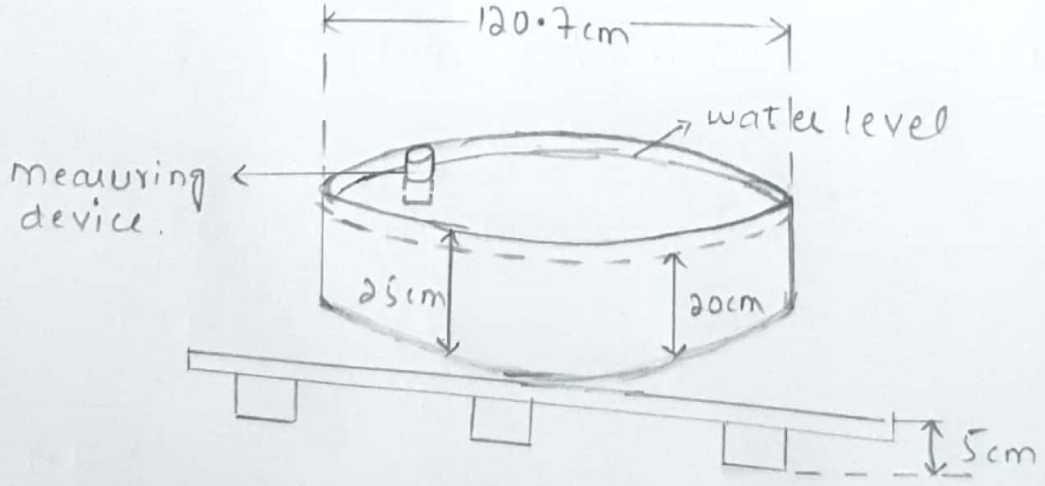
QUESTION 02 (c)

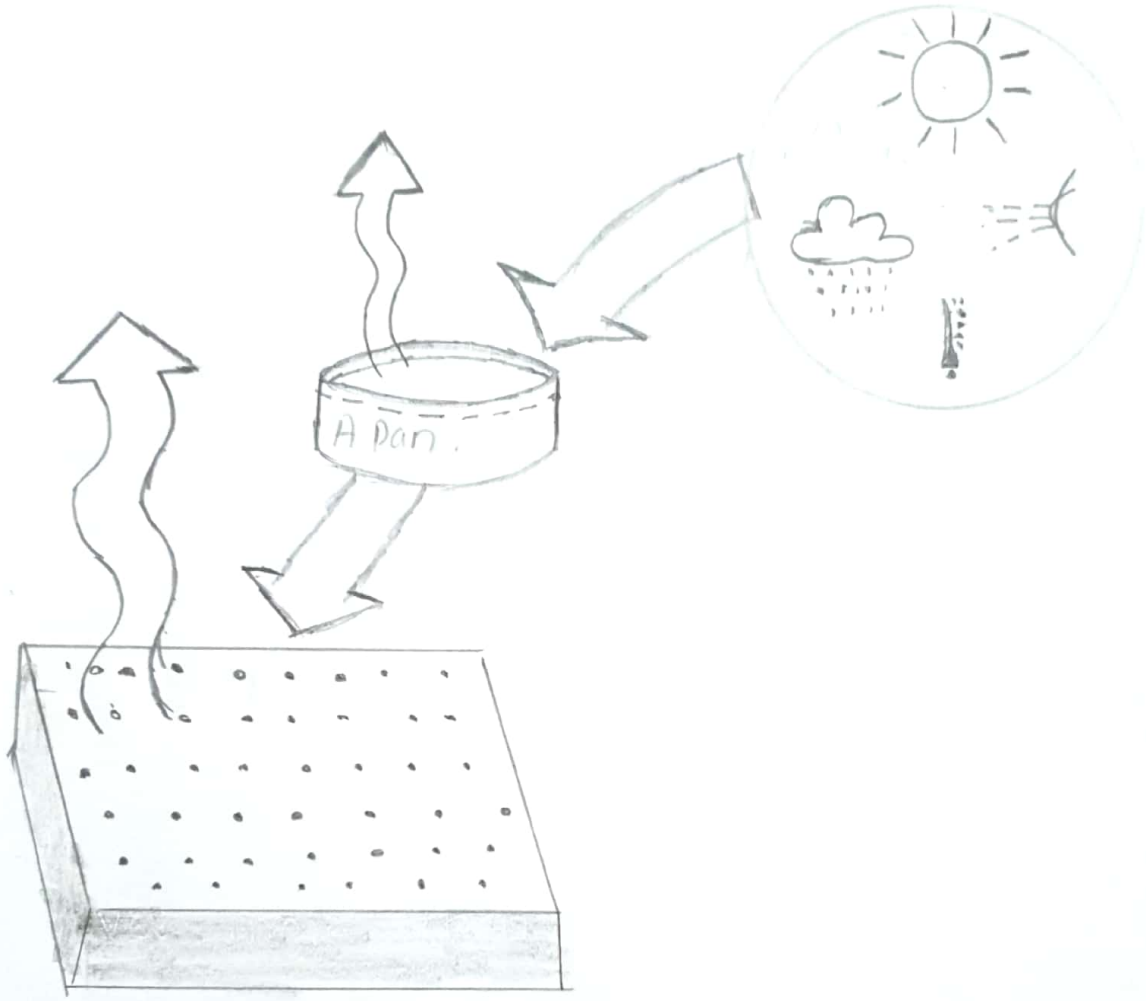
Explain Class A PAN Evaporation (EP) measurement with the help of diagram?

ANSWER

Class A Pan Evaporation ~~Method~~ Measurement:

- Ep can be experimentally determined by directly measuring the quantity of water evaporated from diameter, 25cm deep, and bottom is raised 15cm ~~be kept~~ 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





- The pan evaporation Ep can also determined by using the christiasen formula which states

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

R = extra. Terrestrial radiation in the same units as Ep in cm or mm.

Ct = Co-efficient of temperature

Cw = Co-efficient of wind velocity

Ch = Co-efficient for relative humidity

Cs = Co-efficient for percent of possible sunshine

Ce = Co-efficient for elevation.

QUESTION 02 (d)

Explain crop season (Rabi and Kharif) and Kharif rabi ratio.

ANSWER.

1 Rabi: 1st October to 31st March – Winter.

Rabi Crops: Wheat, Barley, Gram, Mustard. Potatoes.

2 Kharif [illegible]: 1st April to 30 September – Summer.

Kharif Crop: Rice Bajra Jawar Maize cotton.

⇒ 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. The ratio is generally 1:2 i-e kharif area is one half of Rabi area.

QUESTION 03 (a)

FIELD CAPACITY:

Def: When all gravity water has drained down to water table, a certain amount of water is retained by surface soil. This water which can not be easily drained under the action of gravity and is called F.C.

- Period of drainage = 2-5 days.
- FC is measured after 2 or 5 days.

Field capacity:

- Capillary water
- Hygroscopic water.

Capillary water: water attached to soil by surface tension, which can easily be extracted by plants by capillary action.

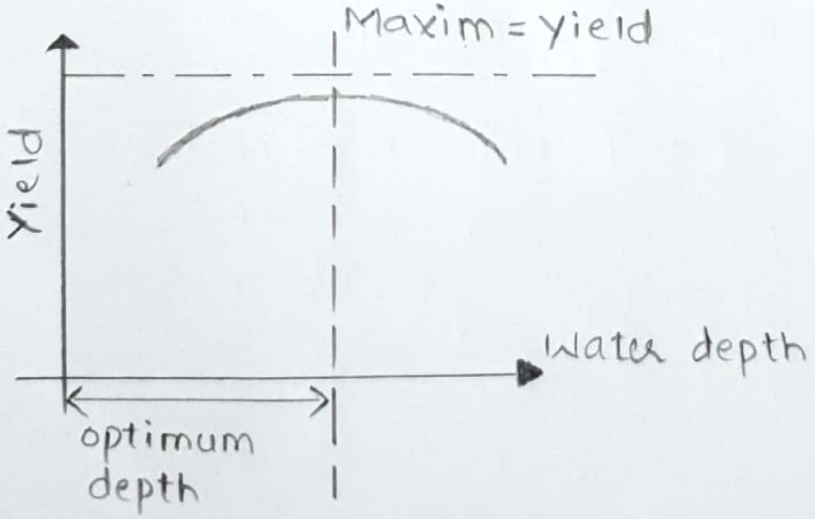
Hygroscope water: water attached to soil by chemical bond, which can not be extracted by plants by capillary action.

b) PERMANENT WILTING POINT:

- A plant can extract water from soil till a permanent wilting is reached. Permanent wilting point 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) OPTIMUM UTILIZATION OF WATER.

If a crop is sown and produced under absolutely identical condition using different amounts of water depth, the yeild is found to vary. The yield increases with water, reaches a certain maximum value and than falls down as shown in fig.



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

c) Available and readily available moisture content

1) Available moisture content:

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

2) Readily Available Moisture Content:

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