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Mid Term Paper / summar 2020

Irrigation Engineering

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Q 1(a) Define "Delta" and Duty and derive their relationship in MKS and FPS systems.

Ans: **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").

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

- Ex. Rice: 10cm of water at interval of 10 day. Base period is 120 days.

Duty:

The term duty means the area of land that can be irrigated with unit volume of irrigation water. Duty refers the irrigation capacity of a unit.

Relation between Duty and Delta:

- 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 = $V = (24 \times 60 \times 60 \times B)\ m^3 = 86,400 m^3$.

- 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 or $10^4 D m^2$ of area.

  Total depth of water applied on this land = volume/area =

  $86400B/10^4D = 8.64B/D$ m.

By Def. this total depth of water is called Delta Δ.
Therefore $\Delta = 8.64B/D$ m $= 864\ B/D$ cm

Where Δ is in cm, B is in days, D is duty in ha/cumec.
In FPS units $\Delta = 1.98\ B/D$ ft

where Δ is in ft, B in days and D is in Acres/cusec.

e ~~Exam~~

(b) 9f wheat - for wheat?

Sol:-

Assuming the base period to be representing the crop Period as per usual practice. we can easily infer that water is required at an average interval of 35 days up to a total Period of 140 days.

=> This means that $5\left(\frac{40}{35}\right)$ no. of watering are required 35 days

=> The depth of water required each time = 9cm.

Total depth of water required in 140 days
= 5 × 9 = 45cm.

hence Δ (delta) for wheat = **45cm**

(c) Explain Indus water treaty.

Ans: The indus water treaty is a water distribution treaty between India and Pakistan, brokered by the world bank, to use the water available in the Indus river and its tributaries. The Indus water treaty (IWT) was signed in Karachi on 19 Sep 1960 by Ayub Khan.

The treaty gives control over the waters of the three "eastern river" — the Beas, Ravi and Sutlej.

In 1948, the water rights of the river system was the focus of an Indo-Pakistani water dispute.

(d) Write significane of duty of a crop.

Ans:- Importance of duty:

- It helps us in desigining an efficient canal irrigation system.

- Knowing the total available water at the head of a 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.

- If we know the crops area required to be irrigated and their duties, we can work out the discharge required for designing the channel.

Q2:-

(a) Explain the factors affecting consumptive use:

1) Temperature
2) Humidity in air
3) Velocity of wind
4) Soil Topography
5) Sun light.

Temperature:-

The rate of consumptive use of water by crops in any particular locality is probably affected more by temp. which for ~~more~~ long time periods is a good measure of solar radiation.

Humidity.

Evaporation and transpiration are accelerated on days of low humidity and slowed during periods of high humidity.

~~Sun light~~

(b) wheat is to be ---
--- 80%.

Given data:

- Rainfall for whole season is 10cm
- Comulative consumptive use is 40cm.
- Water application efficiency is 80%.

Required

$CIR = ?$

$FIR = ?$

Sol-

$$Cu = \Sigma\, k \cdot f = k \sum_{t=1}^{4} P/40\,(1.8t_i + 32)$$

where

$Cu = 40\,cm$

So

$C.I.R = Cu - Re$

where Re = Rainfall of whole season = 10cm.

$C.I.R = 40 - 10 = \boxed{30cm}$

$$F.I.R = \frac{C.I.R}{Ea} \Rightarrow \frac{30}{0.8}$$

$$= \boxed{F.I.R = 37.5\,cm}$$

(c) Explain Class A Pan Evaporation (EP) measurement with the help of a diagram.

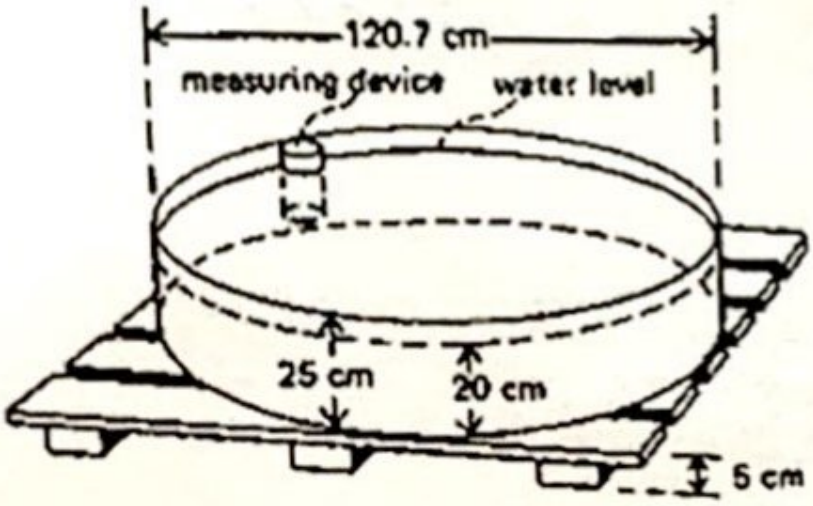
Ans EP can be experimentally determined by directly measuring the quantity of water evaporated from this standard class a pan. This pan is 1.0 m in diameter, 25 cm deep, and bottom is raised 15cm above the ground surface. The depth of water is to be kept in a fixed range, such that the water surface is at least 5 cm, and never more than 7.5cm, below the top of plan.

- ~~The pan evapor~~. E.P also determined by using Christiansen formula which states.

$EP = 0.459 \cdot R \cdot Ct \cdot Cw \cdot Ch \cdot Cs \cdot Ce$

R = extra-Terrestrial radiation in the same units as EP in cm or mm

(10)



(d) Explain Crop Seasons (Rabi and Kharif) and Kharif Rabi Ratio.

1) Rabi : 1st October to 31st March — winter.

2) Kharif : 1st April to 30st Sep Summer.

Kharif crops : Rice Bajra jawar Maize cotton.

Rabi crops : Wheat, Barley, Gram, Mustard Potatoes. ~~Kharif~~

Kharif Rabi Ratio :-

The area to be irrigated for rabi crops generally more than that for kharif crops. This 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.

Q3.

a) **Field capacity:**

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 Field capacity. (F.C).

Period of drainage = 2-5 days

F.C is measured after 2 or 5 days.

1) Capillary water
2) Hygroscopic water

Capillary water:

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

Hygroscopic water:

Water attached to soil by chemical bonds, which can not be extracted by plants by capillary action.

Field capacity = (weight of water retained in a certain volume of soil) / wt. of same volume of soil) x 100.

(b) Permanent wilting Point. (P.W.P)

Ans. 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) Available and readily available moisture contents.

Available

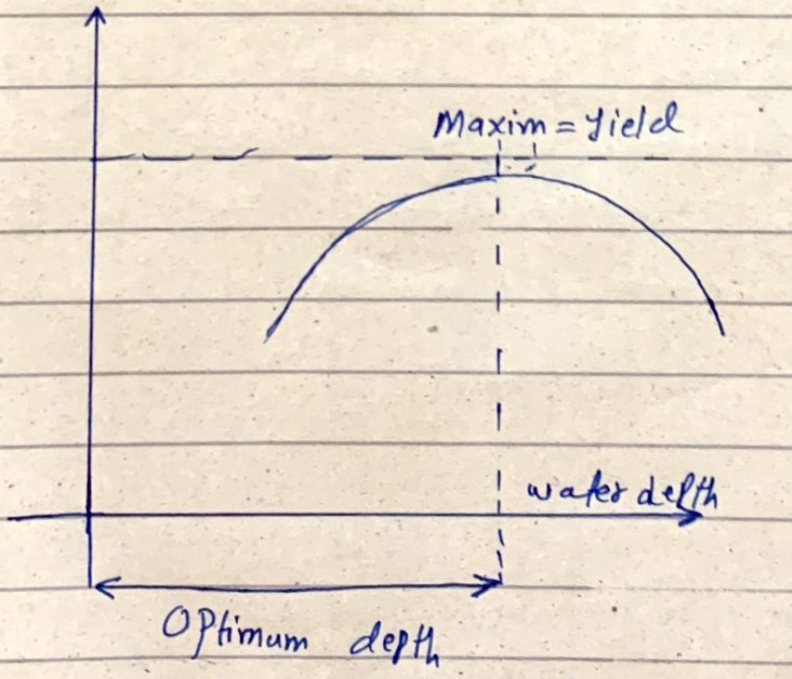
- Water is consumed by plants through roots.
- Sufficient moisture should be available in root zone.
- Soil M.C is not allowed to deplete up to W.P

Readily available moisture:

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

(d) Optimum utilization of water.

Ans. If a crop is sown and produced under absolutely identical conditions using different amounts of water depths, the yield is found to vary. The yield increases with water, reaches a certain maximum value and then falls down as shown in following fig.



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