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MiD Semester Exam

Subject : Irrigation Engineering

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Q1 (a) Define Delta and Duty and derive their relationship in MKS and FPS Systems

Ans Delta:-

Plants or crops need water, it is essential for their growth and development. The water required if measured in terms of depth inches or millimeters for the entire growth period of a crop in its field is called Delta of a crop.
It is denoted by "Δ"
e.g watering depth (4") or (10cm) or (100mm)

Duty:-

Duty is the irrigating capacity of a unit water or it represents a relation between the amount of water required for a crop during its growth period and the area of a crop which is irrigated.

Relation b/w Duty & Delta F.P.S System:-

Let D = Duty (Acres/cusecs)

Delta = A feet base period = B days

As we know

one cusec of water flowing continously for "B" days gives a depth of water "A" over an area of "D" acres.

Now,

Vol of water in $1ft^3$ sec in 1day = $1 \times 24 \times 60 \times 60$

$= 86400 ft^3$

Volume of water in $1ft^3$ sec in B days = $1 \times 24 \times 60 \times 60$

$= 86400 B ft^3$ ①

As we know that

1 Acre = $43560 ft^2$

and

$1 ft^2$ = 143560 Acre then eq ① becomes

=> volume of water in $1ft^3$ sec in "B" days = $86400 B ft^3$

$= 86400B \times 1435600$ Acre-ft

Similarly,

Volume of water in $1ft^3$ sec in "B" days = 1.983B Acre-ft

so,

Depth of water required by crop A = volume / Area =

$= 1.983B$ Acre-ft.D

$$\boxed{\text{Acre } A = 1.983\ B.D \cdot ft}$$

In M.K.S System:-

Let
Duty = D (hectares/cumecs)
Delta = A (meters) Base period = B days

As we know

One cumec of water flowing continously for "B" days gives a depth of water "A" over an area of "D" hectares.

So

=> Volume of water in $1m^3$ Sec in 1day =

$= 1 \times 24 \times 60 \times 60 = 86400 m^3$

=> Volume of water in $1m^3$ sec in "B" days =

$= 1 \times 24 \times 60 \times 60 = 86400 B m^3$ —(1)

As we know

1 Hectare = $10000 m^2$ and $1m^2 = 1104$ Hectare

Then eq (1) becomes

=> Volume of water in $1m^3$ sec in B days

$= 86400B \times 1104$ Hectares-meter

=> Volume of water in $1m^3$ sec in B days

$= 8.64 \times B$. Hectares . meter

$= 8.64 \times B . H . m$

=> Depth of water required by crop

= Volume / Area A

$= 8.64 \times B . \cancel{A} / \cancel{A} . D . m$

$$A = 8.64B / Dm$$

Q1
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.

Given:-

water requirement of wheat = 9cm
Days Interval of watering = 35 days
Crop Period of wheat = 140 days

Required:-

Delta of wheat (D) = ?

According to condition:-

35 days = 9cm
140 days = D

So By cross multiplying

$$D = \frac{\text{water requirement} \times \text{crop period}}{\text{Days Interval}}$$

Put values

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

$$D = \boxed{36\text{cm}}$$

Q1 (C)

Explain Indus Water Treaty

Ans Indus Water Treaty:-

This treaty was signed on September 19th, 1960 between two countries, India and Pakistan by the President of Pakistan Ayub Khan and the prime minister of India Jawahar lal Nehru. It was an arrangement of water sharing between the two countries.

According to this, Eastern rivers (Ravi, Beas, Sutlej) are to be governed by India on Average annual flow 34 MAF

Western Rivers which includes Indus, Chenab Jhelum are controlled by Pakistan.

Since Indus flows from India, only 20% is allowed to the country for irrigation, Power generation and other purposes.

As the river Indus originates from Tibet China can break the flow of water to both the countries, but they have been kept out the treaty.

Q1 (D)
Write Significance of Duty of a crop.

Ans Significance:-
We can design a canal irrigation system the provides us with better efficiency
If we know the total area of crop to be mature, the overall duty of all the crops required to be irrigated can be worked out.

Q2 (A)
Explain the factors affecting consumptive use.

Ans
1) Temperature:-
Temperature has a great effect on the consumptive use of water by crops. Temperature in normal range is effective for the growth of a crop. Abnormally low temperature may break the efficient growth of a crop and high temperature may produce dormancy.

2) Humidity:-
It also has a significant effect on the growth of a plant. High humidity slow down and low humidity on certain days accelerates the evaportranspiration process.

3) Velocity of Wind:-
Under calm conditions, moving air plays a vital role in evaporation of water from land and plant surfaces. Hot dry winds cause more water consumption However, there is a limit of water usage.

4) Soil fertility:-
If the soil is made fertile by some means, the yield may be expected to increase thus causing less water use.

5) Sunlight:-
Sunlight which is a major source of energy also contributes in the evapotranspiration of a crop. If the intensity of the sunlight is high and it remain throughout the day it will help in continuing the process of evatranspiration than the case if weather is cloudy or overcast.

Q2 (B)
Wheat is to grown at a certain place. ..... efficiency is 80%.

Given:-
Useful Rainfall (R_e) = 10cm
Commulative consumptive use (C_u) = 40cm
water Application Efficiency (η_a) = 80% = 0.8

Required:-

Consumptive Irrigation Requirement (CIR) = ?

Field irrigation Requirement (FIR) = ?

As we know that

⇒ Consumptive Irrigation Requirement (CIR) =

$= Cu - Re$

$= 40 - 10$

$\boxed{CIR = 30cm}$

Now

Field Irrigation Requirement (FIR) $= \frac{CIR}{ha}$

$= \frac{30}{0.8}$

$\boxed{FIR = 37.5cm}$

Q2 (c)

Explain class A pan evaporation (Ep) measurment with the help of diagram

Ans Class A Pan evaporation (Ep):-

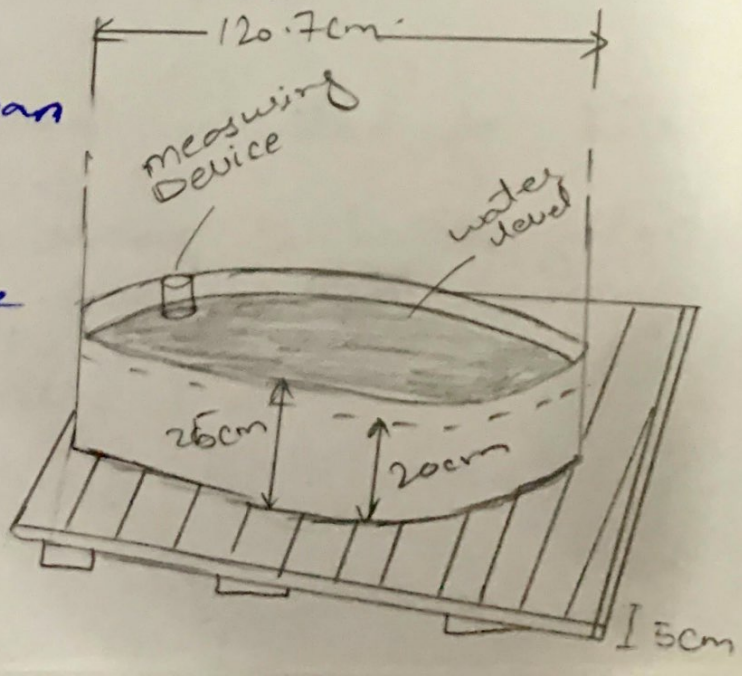
Class A pan evaporation Process of measurement consists of a wide pan

Dimensions:-

Diameter = 1m

Depth = 25cm

Height above ground surface = 15cm



The pan is filled with water such that the water surface is at least 5cm and never more than 7.5 cm below the top of the pan
experimentally the quantity of water evaporated can be measured with the help of measuring device.

Q2 (D)
Explain Crop seasons (Rabi & Kharif) and Rabi and Kharif Ratio

Ans Rabi Crops:-
The crops during the winter season usually 1st Oct to 31st March.
Crops that comes under this season are wheat, Barley, Gram and Mustard.
Harvested in March, April.

Kharif Crops:-
The crops during the summer season (rainy season) dated from 1st April to 30th September.
Crops are Rice, Bajra, Jawar, Maize, cotton.
Harvested in September, October.

Kharif - Rabi Ratio:-
It represents the area irrigated for both the crops.
The ratio of proposed areas to be irrigated in Kharif season to that in Rabi season is called Rabi - Kharif Ratio.
The ratio is generally 1:2
(Kharif is one half of Rabi area)

Q3 (A)

Define the following terms

a) Field Capacity:-

The amount of water that is left on the surface of soil and soil does not allow it to drain against gravity is called field capacity.

$$\text{Field capacity} = \frac{\text{wt. of water retained in certain vol of soil}}{\text{wt. of same vol of soil}} \times 100$$

b) Permanent Wilting Point:-

Permanent wilting point is that point where a plant can no longe extract water from soil for its growth and wilts up

c) Available Moisture Content:-

The amount of water content that a soil can hold between the field capacity and P.W.P is called Available Moisture Content.

Available water = F.C - P.W.P of water

Readily Available Moisture Content:-

The amount of available water that a crop can use without affecting its consumptive use or growth is called Readily available content.

D) Optimum Utilization of Water:-

The crop is sown under different water depths and produced under absolute identical conditions. This causes the yield to increase with water and it reaches a certain value and then falls down.