Mid - Term Examination

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Subject : Irrigation Engineering

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Q#1a Define delta and duty and derive thier relationship in MKS and FPS system.

→ Answer **Delta :-** Amount of water required (volume) to the crop to get mature during its base period.

Simply means total volume of water divided by total irrigated area gives us "Delta" of crop of irrigated area.

Duty :- The terminology duty means the area of land that can be irrigated with unit volume irrigation water.

Duty represents the irrigation capacity of a unit. It is the relation between the area of crop irrigated and quantity of irrigation water required during the entire period of the growth of that crop.

- Relation of Delta and Duty in MKS.

Let
Duty = D (hectres/cumecs)
Delta = A meters Base period
= B days by defination. One cumec of water flowing continously for "B" days gives a depth of water "A" over an area of "D" hectares.

Volume of water that is $1m^3$ sec in one day = $1 \times 24 \times 60 \times 60$
= $86400\ m^3$.

Volume of water that is $1m^3$ sec in B days = $1 \times 24 \times 60 \times 60$
= $86400\ Bm^3$
= $86400\ m^2 m$ (i).

As 1 Hectare = $10000\ m^2$
$1m^2$ = $\frac{1}{10000}$ H
Then equation becomes

Volume of water that is $1 m^3/sec$ in B days = $86400\ B m^3$

= $86400\ B \times 1104$ H.m Vol of water that is $1 m^3/sec$ in B days = $8.64 \times B$ H.m

Depth of water required by crop A = Vol of Area A

= $8.64\ BDm$.

- **Relation of Delta and duty in FPS.**

Let

Duty = D (Acres / cusecs).

Delta = A feet base period = B days

by definition, one cusec of water flowing continously for B days gives a depth of water A over an area of D acres

Volume of water $1 ft^3/sec$ in one day

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

= $86400\ ft^3$ = $86400\ ft^2 \cdot ft$ (i)

As 1 Acre = 43560 ft^2

eq (i)

Vol of water 1 ft^3 sec in B days

= 86400 ft^3

= 86400 B x 43560 Acre-ft

Vol of water in B days = 1.983 x B. Acre-ft -(ii)

Depth of water required by crop A =

Vol Area A = 1.983 B Acre ft D Acre A_2

1.983 x BD ft

D is duty in H/cumec.

Q#1b If wheat requires about 9cm of water after every 35 days and base period of crop is 140 days Find delta for wheat.

Answer **Given data :**

Depth of water = 9cm

Base period = 140 days

Required :

Delta for wheat, Δ = ?

Solution :

As no. of watering required = 140/35 = 4.

Total depth of water required =

No. of watering x Depth of water

4 x 9 = 36 cm

Delta (Δ) for wheat is 36 cm.

Q#1 c Explain indus water treaty.

Introduction : Signed in the year 1960 by former Prime minister Jawahar lal Nehru and President of Pakistan Ayub khan.

Purpose :- An arrangement that was made to chalk out the control over the 6 rivers that run across India and Pakistan into the indus Basin.

Rivers given to Pakistan : Control of water flowing in 3 western river of India (Indus, chenab and Jehlum) with mean annual flow of 80 MAF were given to Pakistan.

River given to India : Eastern river of India Beas and sutlej with mean annual flow of 33 MAF were given to india.

Q #1d Write significance of duty of crop?

Answer **Significance of duty of crop:-**

It helps us in designing an efficent canal system.
knowing the total available water at the head of the 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.
Inversly if we know the crop area required to be irrigated and thier duties, we can workout the discharge required for designing the channel.

Q#2 a Explain the factor affecting consumptive use?

Answer Following are the factors affecting consumptive use.

Temprature
Humidity in air
Velocity of wind
Soil topography
Sunlight.

Temperature: The rate of consumtive use of water by crops in any particular locality is probable affected more by temperature, which for long time period is good measure of solar radiation then by any other factor. Abnormally low temperature retard plant growth and usually high temperature may produce dormancy.

Q#2(b) Wheat is to be grown at a certain place, the useful rainfall for the season is 10cm and its cumulative consumptive use is 40cm. Determine consumptive irrigation environment requirement (CIR) and Field Irrigation Requirement (FIR) if the water application efficiency is 80%?

Ans: **Given data:**

Useful rainfall (cm) = 10

Water application Efficiency (η_a) = 80% = 0.8

Commulative consumptive use (Cu) = 40cm

required:

Field Irrigation Requirement (FIR) = ?

Consumptive Irrigation Requirement (CIR) = ?

By formula:

→ consumptive Irrigation Requirement (CIR) = Cu - Re

= 40 - 10

CIR = 30cm.

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

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

(10)

Sol: First Problem

Water requirement of wheat = 9cm

Days Interval = 35 days.

Base period = 140 days.

Delta of wheat (Δ) = ?

$\Rightarrow$ 35 days = 9cm

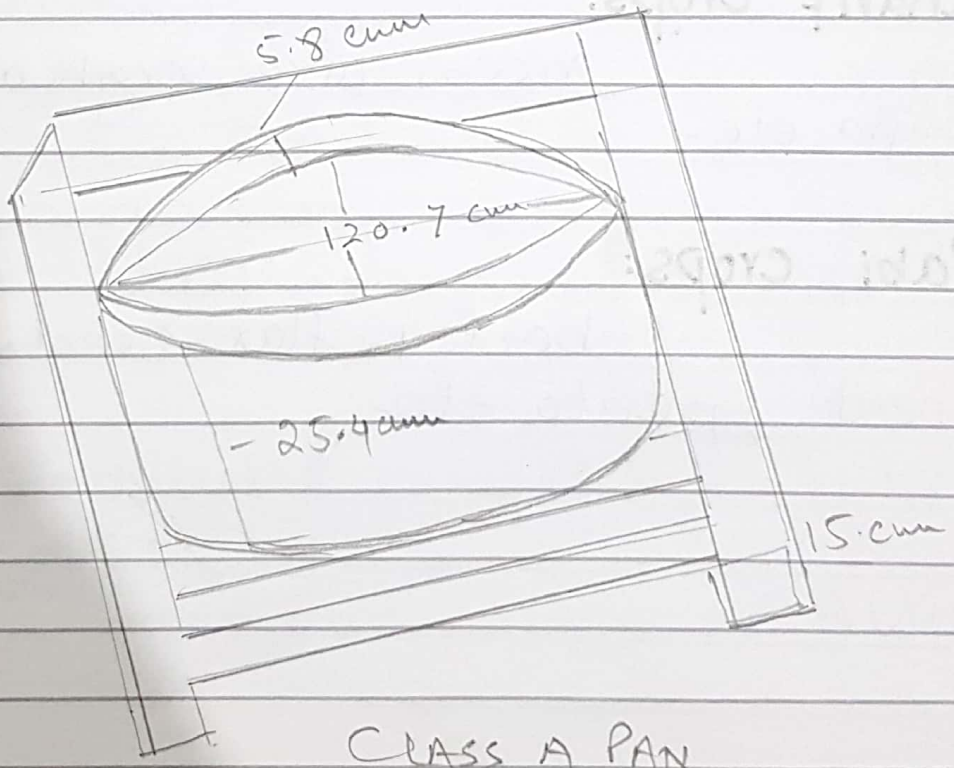
140 days = Δ

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

$\Delta = 36\text{cm}.$

Q #2(c) Explain class A pan Evaporation (Ep) measurment with help of diagram.

ANSWER: Evaporation can be experimentally determined by directly measuring the quantity of water evaporated from this standard class A pan.
The pan is 1.0m in diameter, 25cm 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 least 5cm, and never more than 7.5cm below the top of pan.



CLASS A PAN

Q#1(d) Explain crop season (Rabi and Kharif) and Kharif Rabi

ANSWER **Crop Season:** The growing season is the part of year during which local weather condition i.e (rainfall and temperature) permit normal plant growth.

Kharif:

1st April to 30th September - Summer.

Rabi:

1st october to 31st March - winter.

Kharif crops:

rice, maize, sorghum, pearl, bajra etc.

Rabi crops:

barley, flax seed, Pea, wheat, potato etc.

Q#3a Define and explain the following terms :-

(a) → **Field Capacity** :- When all gravity water has drained down to water table, a certain amount is retained by surface soil. This water which cannot be easily drained under the action of gravity and is called field capacity.

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

(b) → **Permanent wilting point** :- 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 it's growth and wilts up

water available to point = Field capacity − P.W.P water

c → **Available and Readily available moisture content :-**

The difference in moisture content of the soil between field capacity (F.C) and permanent wilting is termed as the available moisture. Can also be expressed as percentage moisture.

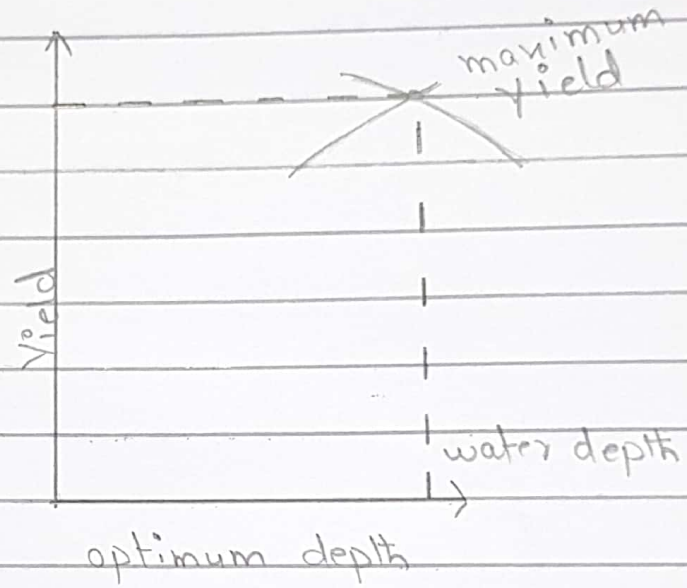
Readily available Moisture :-

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

d → **Optimum utilization of water :-**

If a crop is sown and produced under absolutely identical condition using different amount of water depth the yield is found to vary. The yield increases with water, reaches a certain maximum value and

then goes down as shown in the following figure.



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

Irrigation Efficiencies : The ratio of water output to the water input and is usually expressed as percentage.

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