Name :- Muhammad Hamza Rashid

ID # 7805

Section :- A

Semester :- 6th

Mid- Semester Examination

Civil Engineering Department

Subject :- Irrigation Engineering

Instructor :- Dr. Jahangir Durrani

Name:- Muhammad Hamza Rashid
ID # 7805

Q①:- a)

Define "Delta" and "Duty" and derive their relationship in MKS and FPS Systems.

Ans:- Delta:-

Any plant or crop needs water for its growth and development. The water required if measured in terms of depth (whether inches or millimeters) for the entire growth period of a crop in its field is called Delta of a crop

=> Denoted by "Δ".

=> For example :- Watering depth (4") or (10 cm) or (100 mm)

Duty :-

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

Relationship Between Duty and Delta :-

In F.P.S System :-

Let,

Duty = D (Acres / Cusecs)

Delta = A feet Base Period = B days

By Definition,

Name:- Muhammad Hamza Rashid
ID # 7805

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

Now,

Volume of water in 1 ft^3 Sec in 1 day = $1 \times 24 \times 60 \times 60$

$= 86400\ ft^3$

Volume of water in 1 ft^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 1 ft^3 Sec in "B" days = $86400\ B\ ft^3$

$= 86400\ B \times 143560$ Acre-ft volume

Similarly,

Volume of water in 1 ft^3 Sec in "B" days =

$= 1.983\ B$ Acre ft.

So,

⇒ Depth of water required by Crop A = Volume Area =

$= 1.983\ B$ Acre-ft-D

Acre A = 1.983 B·D·ft

In M.K.S System :-

Let

Duty = D (hectares / cumecs)

Delta = A (meters) Base period = B days

By Definition,

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 $1 m^3$ Sec in 1 day =

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

⇒ Volume of water in $1 m^3$ Sec in "B" days =

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

As we know that,

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

Then eq (1) becomes,

⇒ Volume of water in $1 m^3$ Sec in B days,

$= 86400\ B \times 1104$ Hectares-meter

⇒ Volume of water in $1 m^3$ Sec in B days,

$= 8.64 \times B \cdot$ Hectares.meter

$= 8.64 \times B \cdot H \cdot m$

⇒ Depth of water required by Crop,

= Volume / Area A

$= 8.64 \times B \cdot A / D \cdot m$

$\boxed{A = 8.64\ B / Dm}$

(Part - B)

If wheat requires about 9 cm 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 Data :-

Water Requirement of wheat = 9 cm
Days Interval of watering = 35 days
Crop Period of wheat = 140 days

Required :-

Delta of wheat (Δ) = ?

So according to condition :-

35 days = 9 cm
140 days = Δ

By Cross Multiplication,

$$\Delta = \frac{\text{Water Requirement} \times \text{Crop Period}}{\text{Days Interval}}$$

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

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

(Part - C)

Q:- Explain Indus Water Treaty.

Ans:- Indus Water Treaty :-

=> The Indus water treaty was an aggrement (treaty) of water-sharing b/w the two Asian Countries India and Pakistan. This treaty was signed on September 19, 1960 b/w the Prime minister of India Jawahar lal Nehru and President of Pakistan Ayub Khan.

=> According to this, Eastern Rivers (Ravi, Beas, Sutlej) are to be governed by India on average annual flow of 34 MAF

=> Western Rivers (Indus, Chenab, Jhelum) are to be taken by Pakistan

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

=> As Indus originates from Tibet, so if china want to break the flow of water to these two Countries so it can, but china has been kept out of the treaty.

(Part - D)

Q:- Write Significance of Duty of a Crop.

Ans:- **Significance of Duty of a Crop:-**

- With the help of it, we can design a canal irrigation system that provides us a better effeciency.
- By knowing the total area of crop to be mature, the overall duty of all the crops required to be irrigated can be worked out.

Question :- 2

Part - A

Q:- Explain the factors affecting consumptive use.

Ans:- **Factors Affecting Consumptive Use:-**

1- **Temprature :-**

Temprature has a great effect on the consumptive use of water by crops. Temprature in normal range is effective for the growth of a crop. Abnormally low temprature may break the efficient growth of a crop and high temprature 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 evapotranspiration Process.

3- Velocity of Wind :-

Velocity of wind also has significant effect in terms of moving or calm air conditions. In the conditions of moving air, evapotranspiration accelerates more rapidly then calm air conditions. Similarly, hot and cold wind also affects the Consumptive use and in turns growth period of a crop.

4- Sun Light :-

Sunlight which is a major source of energy also contributes in the evaporatranspiration of a crop. If the Intensity of the Sunlight is high and it remain throughout the day, it will helps in continuing the Process of evapotranspiration that of the case if weather is cloudy or overcast.

5- Soil Fertility :-

The Fertility of Soil has an inverse relation with the amount of water Consumed per unit of crop yield. Increasing Fertility results in the utilization of small amount of water to the crop. However, if the soil is made more fertile by some artificial ways, the yield may be expected to increase in small use of water.

Name:- Muhammad Hamza Rashid
ID # 7805

(Part - B)

Wheat is to be grown at a certain place, the useful rainfall for the whole season is 10 cm and its commulative Consumptive use is 40 cm. Determine consumptive irrigation requirement (CIR) and Field Irrigation Requirement (FIR) if the water application efficiency is 80 %.

Given Data :-

Useful Rainfall (R_e) = 10 cm

Commulative Consumptive Use (C_u) = 40 cm

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) = $C_u - R_e$

$= 40 - 10$

$\boxed{CIR = 30 \text{ cm}}$

Also we know that,

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

$= \frac{30}{0.8}$

$\boxed{FIR = 37.5 \text{ cm}}$

Name:- Muhammad Hamza Rashid
ID # 7805

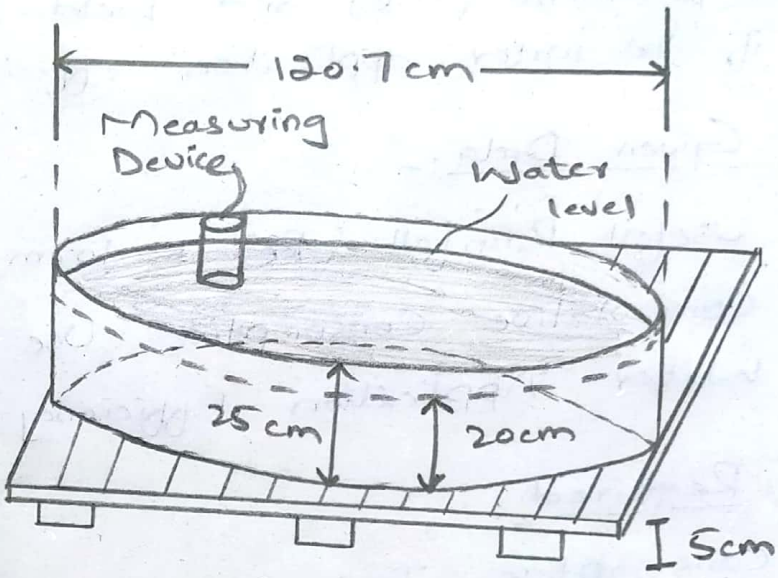
(Part - C)

Q:- Explain Class A Pan Evaporation (Ep) measurement with the help of a diagram.

Ans: **Class A Pan Evaporation (Ep) :-**

Class A Pan evaporation Process of measurement Consists of a wide pan dimensions :

Diameter = 1 m
Depth = 25 cm
Height of bottom 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.

(Part - D)

Q:- Explain Crop Seasons (Rabi and Kharif) and Kharif Rabi Ratio.

Ans :- **Rabi Crops :-**

=> These crops are sown during the winter season. Usually from 1st October to 31st March.

=> Crops that comes under this category are wheat, Barley, Gram, Mustard.

=> Harvesting months are usually March - April.

Kharif Crops :-

=> These crops are sown in the Summer Season (during rainy Season), usually dated from 1st April to 30th September.

=> Crops that comes under this category are Rice, Bajra, Jawar, Maize, Cotton.

=> Harvesting months are usually 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 kharif - Rabi Ratio.

The ratio is generally 1 : 2
(kharif area is one half of Rabi area).

Question :- 3

(Part - A)

Q:- Define and explain the following terms.

a) Field Capacity :-

The amount of water that left on the surface of Soil and Soil does not allow it to drain against gravity is called Field Capacity.

OR

When all gravity water has drained down to water table, a certain amount of water left by soil surface. This water that can not be easily drained under the action of gravity is called Field Capacity.

⇒ The Period of drainage lies b/w 2-5 days, and field capacity is measured after 2 or 5 days.

⇒ Field Capacity Includes:

1- Capillary Water:-
By Capillary action, water attached to soil by surface tension, can easily be extracted by plants.

2- Hygroscopic Water:-
By Capillary action, water attached to soil by chemical bonds, can be extracted by plants.

$$\text{Field Capacity} = \frac{\text{Wt. of water retained in Certain vol. of Soil}}{\text{Wt. of Same vol. of Soil}} \times 100$$

b) - Permanent Wilting Point:-
The water content in a soil that is sufficient or enough to permanent wilt a plant and do not recover is called permanent wilting point.

OR

It is the 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 of water

C - Available Moisture Content :-

The amount of water Content that a soil can hold between the field capacity and Permanent wilting Point is called Available Moisture Content.

⇒ It is the difference b/w the Field capacity and Permanent wilting Point of water.

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 Moisture Content.

⇒ This quantity of available moisture is mostly easily extracted by plants and is approximately 75% to 80% of available moisture.

D - Optimum Utilization of Water :-

The graph shows that if a crop is sown and produced under absolutely identical conditions using different amounts of water depth, the yield is found to vary.

This yield increases with water, reaches a certain maximum value and then falls down.