Name : Muhammad Furqan

ID : 7802

Section : A

Paper : Irrigation Engineering
CE 324

Semester : 6th

Instructor : Dr Jahangir Durrani

Page No. : 01

Question : 01

Part : A

1- Define "Delta" and Duty and derive their relationship in MKS and FPS System.

Delta:-

Certain amount of water needed by crop at fixed interval throughout its base period. Depth of each watering 5cm (2") – 10 cm (4").

Definition:-

The depth of water in cm or inches required for the crop Through out the base period is called Delta of the Crop.

Example :-

If a crop required about 12 watering at interval of 10 days and a water depth of 10 cm. If area under crop is A acres. The total quantity will be $1.2 \times A = 1.2A$ hectare meter in period of 120 days.

→ **Duty :-**

The duty of water is the relationship between the volume of water and the area of crop it matures.

Volume of water ~~and~~ ~~the~~ is generally expressed by a unit discharge flowing for a time of base period of crop.

Example :-

1 cu.m per sec or 1 cu.ft/sec of water for B days matures D hectares or acres of land. Then the Duty of water for that particular crop is D hectare/cumecs or D acres/cusecs.

→ Relation Between Duty and Delta :-

In MKS System :-

1- 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.

2- Now volume of water applied to this crop during B days = $V = (24 \times 60 \times 60 \times B)\ m^3$

$$V = 86400\ m^3$$

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 $10^4 Dm^2$ of area.

4- Total depth of water applied on this land.

$$= \frac{\text{Volume}}{\text{Area}} = \frac{86400}{10^4} = 8.64\ B/Dm.$$

This total depth of water is called Delta 'D'.

Therefore $D = 8.64\ B/Dm = 864\ B/Dcm$

D = is in cm.

B = is in days.

In F.P.S System :-

let Duty = D (Acres/cusecs)

Delta = A foot Base period = B days by def

→ 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

$= 1 \times 24 \times 60 \times 60 = 86400\ ft^3$.

→ Volume of water 1 ft^3 sec in "B" days.

$= 1 \times 24 \times 60 \times 60 = 86400\ B\ ft^3$

→ As 1 acre = 43560 ft^2 or

1 ft^2 = 143560 Acre.

Then volume of water 1 ft^3 Sec in B days

= 86400 ft^3 = 86400 B x 143560 Acres-ft

Volume of water 1 ft^3 sec in B days.

= 1.9883 B acre ft.

→ Depth of water required by Crop A.

= Volume Area = 1.9883 B acres ft D

Acre A = 1.983 BD ft.

Part : B

If wheat required about 9 cm of water after every 35 days and the base period and crop period of wheat is 140 days. Find out the delta "Δ" for wheat ?

Given Data :-

Water requirment of wheat = 9 cm

Days Interval = 35 days

Base period = 140 days.

Required :-

Delta = Δ = ?

Solution :-

As we know that.

$$\text{Delta} = \Delta = \frac{\text{Water required} \times \text{Base period}}{\text{Day interval}}$$

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

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

Total depth of water required in 140 days = 36 cm.

Part : C

Explain Indus Water Treaty.

Indus Water Treaty :- Signed on September 19, 1960 between India and Pakistan and brokered by the world bank. It fixed the rights and obligations of both countries concerning the use of the waters of the Indus River System.

The Indus River System has been used for irrigation since time immemorial. Modern Irrigation engineering work began about 1850. in 1947 British India was partitioned, resulting in the creation of an independent India and west Pakistan (later called Pakistan). The water system was thus bifurcated, with the headworks in India and the canals running through Pakistan. After the expiration of short term standstill Agreement of 1947, on April 1, 1948, India began with holding water from canals that flowed into Pakistan. In 1954 the world Bank submitted a proposal for a solution to the

impasse. After six years of talks, Indian Prime Minister Jawaharlal Nehru and Pakistani President Mohammad Ayub Khan signed the Indus waters Treaty in September 1960.

Importance :-

The treaty gave the water of the western rivers - The Indus, Jhelum and Chenab to Pakistan and those of the eastern rivers - The Ravi, Beas and Sutlej to india. It is also provided for the funding and building of dams, link canals, barrages, and tube wells notably the Tarbela Dam on the Indus River and the Mangla Dam on The Jhelum Rivers. These helped provide water to Pakistan in the amounts that it had previously received from the rivers now assigned to India's exclusive use.

Part : D

Significance of Duty of Crop :-

1- It helps in designing efficient canal irrigation system.

2- Knowning the total available water at the head of the main canal and the overall duty for all crops required to be irrigated in different seasons of the year, the area which can be irrigated can be worked out.

Inversely if we knew the crop area required to be irrigated and their duties, we can work out the discharge required for designing the canal.

Question No. 2
Part : A

Q Explain the factors affecting consumptive use.

Ans. Consumptive Use :-

It is the amount of water required by a crop for its vegetated growth to evapotranspiration and building of plant tissues plus evaporation from soil and intercepted precipitation. It is expressed in term of depth of water.

Consumptive use various with temperature, humidity, wind speed, topography, sunlight hours, method of irrigation, moisture availability.

Factors Affecting Consumptive Use :-

1- Temperature :- Increased temperature leads to increased cellular and tissue activity leading to increased water use and loss by the plants.

2- Humidity In Air :- Humidity in air and processes of transpiration and evaporation are inversely related that is increase in humidity leads to decrease in transpiration and exporation and vice vesa.

3. Velocity of Wind :-

Velocity of wind and processes on evaporation and transpiration are directly evaporated That is when velocity of wind increase The processes of evaporation and transpiration also increases.

4. Sunlight :-

Increase exposure To sunlight leads To increased cellular metabolism → heat generation → water loss by transpiration and evaporation.

Part : B

Wheat is To be grown at a certain place, the usefall rainfall for the whole season is 10 cm and its cumulative consumptive use is 40 cm. Determine consumptive irrigation requirement (CIR) and field irrigation Requirement (FIR). If the water application efficiency is 80%.

Given Data :-

Usefull Rainfall = 10 cm

water application Efficiency $\eta_a = 80\% = 0.8$

Commulative Consumptive use $C_u = 40$ cm

Required :-

Field Irrigation Requirment = FIR = ?

Consumptive Irrigation Requirment = CIR = ?

Solution :-

By formula

$$CIR = Cu - R_e = 40 - 10$$

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

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

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

Part : C

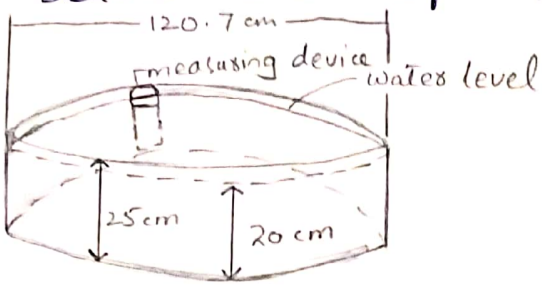
→ Class A Pan Evaporation (EP) Measurment :-

1- Determination of evaporation (Ep) can be done experimentally by directly measuring the quantity of water evaporated from this standard class a pan.

2- This dimensions of pan include 25cm deep, 1.0m in diameter, and bottom is raised 15cm above the ground surface.

3- The depth of water is to be kept in fixed range such that the water surface is atleast 5cm, and never more than

7.5 cm, below the top of pan.



The pan evaporation (Ep) can also determined by using christiansen formula which states.

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

where

R = Terrestrial radiation unit as cm or mm.

Ct = co-efficient for temperature.

Cw = co-efficient for wind velocity.

Ch = co-efficient for humidity.

Cs = co-efficient for %age of sunshine.

Ce = co-efficient for elevation.

Part : D

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

Ans. **Rabi :-** The season of rabi crops is from 1st october To 31st March. winter.

Example of Rabi Crops :-

Wheat, barley, Gram, Mustard and potatoes.

2- Kharif :-

The season of Kharif crops is from 1st April To 30st September summer.

Example of Kharif Crops :-

Rice, bajra, Jawar, maize and cotton

→ Kharif and 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.

Question : 03

Part : A

→ Field Capicity :-

A certain amount of water is retained by surface of soil even when all the gravity has been drained down to water table, This amount of water which cannot be drained out easily under action of gravity is called field capicity (F.C).

Drainage period = 2-5 days

FC is measured after 2 or 5 days

1- Capillary Water -2- Hygroscopic water.

Capillary water :-

The water which is attached to soil by surface tension and can be easily extracted by plants by capillary action is called capillary water.

2- Hygroscopic Water :-

The water which is attacheed to soil by chemical bonds, which cannot be extracted by plants by capillary action is called hygroscopic water.

$$\text{Field Capicity} = \frac{\text{Weight of water retained volume of soil}}{\text{Weight of Same Soil}} \times 100$$

$$F.C = \frac{\text{wt of water retained volume of soil}}{\text{wt of same soil.}} \times 100$$

Part : B

→ Permanent Wilting Point :- (P.W.P)

A plant continues To extract water from soil Till a permanent wilting is reached.

P.W.P is theat water content at which a plant can no longer extract sufficient water for its growth and wilts up

$$P.W.P \text{ water} = \frac{\text{Water available To plant}}{\text{field Capicity}}$$

Part : C

Available And readily available moisture Contents:-

The portion of available moisture which is most easily extracted by plants is called readily available moisture.

It is approximately 75 to 80% available moisture.

→ Soil Moisture Deficiency (S.M.D):-

The amount water required to bring the soil moisture content of given soil to field capacity is called S.M.D.

→ Equivalent Moisture (E.M):-

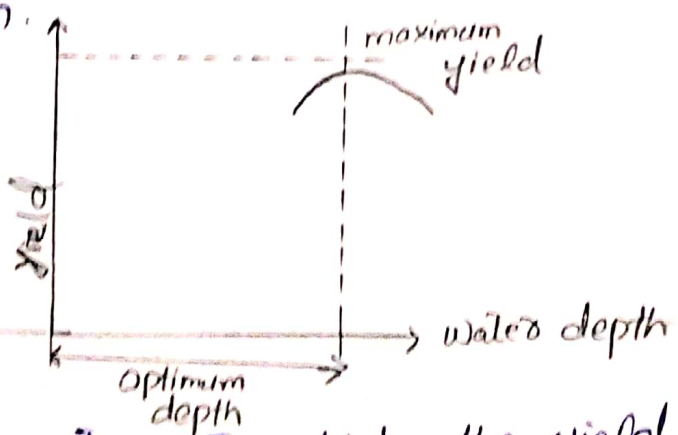
water which is retained by a saturated soil after being configured for 30 minutes by centrifugal force of 1000 times that of gravity.

E.M = Field gravity

Part : D

→ Optimum Utilization of Water:-

The crop is sown and produced under absolutely identical condition using different amount of water depths, the yields is found to vary. The yields increases with water reaches a certain maximum value and than falls down.



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