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Section: "A"

Paper Subject

Irrigation

Mid Exam

Semester 6th

Question 1

Q1 (a)

Define "Delta" and "duty" and derive their relationship in "MKS" and "FPS" systems.

Ans (a)

Duty:-

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

It is the relation the between the area

of a crop irrigated and the quantity of irrigation water required during the entire period of the growth of that crop.

For example :-

If 3 cumes of water supply is required for a crop sown in an area of 5100 hectares, the duty of irrigation water will be 5100/3 = 1700 hectares / cumecs, and the discharge of 3 cumecs will be required throughout the base period.

Delta:

It is the total depth of water required by a crop during the entire period the crop is in the field and is denoted by the symbol Δ.

For example:-

If a crop requires about 12 watering at an interval of 10 days, and a water depth of 10 cm. If the area under the crop is A hectares, the total quantity will be $1.20 \times A = 1.20A$. hectare-meters in a period of 120 days.

Mathematical Relation in M.K.S System:

Let,

Duty = D (hectares / cumecs)

Delta = d metres : Base period = B days

By defination:-

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

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

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

$= 86400\ m^2 m$ —(i)

As 1 Hectare = $10000 m^2$

$1 m^2 = 1104 H$

Then, eq (i) becomes,

Volume of water
$1 m^3$ sec in "B" days
$= 86400 B\ m^3$
$= 86400 B * 1104\ H \cdot m$

Volume of water $1 m^3$ sec in "B" days $= 8.64 \times B\ H \cdot m$
—(ii)

Depth of water required by crop, A = Volume
Area A = $8.64 \times B\ H \cdot m D$
$H A = 8.64 * B\ D\ m$.

In "F.P.S" System:

Let,

Duty = D (Acres / cusecs)

Delta = A feet; Base period = B days.

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Def:- One cusec of water flowing continuously for "B" days gives a depth of water "d" over an area of "D" acres.

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

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

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

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

$= 86400 ft^2 ft$ —(i)

We know, $1 acre = 43560 ft^2$

$1ft^2 = 143560 acre$

Then the equation become.

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

$= 86400 B\ ft^3 = 86400 B^*$

143560 Acre-ft

$= 1.983^* B$ Acre-ft

—(ii)

Depth of water required by crop, A = Volume

Area of = $1.983 B$ Acre-ftD

Acre A = $1.983 \times B D$ ft.

Q.1 (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?

Ans (b)

Given Data:

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Given Data :-

Water requirement of Wheat = 9 cm

Days Interval = 35 cm

Base period = 140 days

Required :-

Delta of wheat (Δ) = ?

Solution :-

We know that

35 days = 9 cm

And.

140 days = Δ

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

$$\Delta = \frac{1260}{35} \Rightarrow 36 \text{ cm}.$$

Answer :-

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Q1 (c)

Explain Indus water treaty?

Indus Water Treaty

The indus water treaty bw India and Pakistan is a water distribution are brokered by the world bank to use the water available in the Indus System of rivers located in India. The Indus System water Treaty was signed in karachi on September 19, 1960 by the The first Prime Minister of India Pandit Jawaharlal Nehru and then

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President of Pakistan
Ayub Khan.

According to this agreement, control over the water flowing in three "eastern rivers" of India;

- The Beas
- The Sutlej
- The Ravi with

the mean annul flow of 33 million acre-ft was given to India;

While control over the water flowing in three "western rivers" of India;

- The Indus
- The Chenab
- The Jhelum

with mean annul flow 80 MAF was given to Pakistan

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More controversial, however, were the provisions on how the waters was to be shared. Since Pakistan's rivers receive more water flow from India, the treaty allowed India to use western rivers water for limited irrigation use and unlimited use for power generation, domestic, industrial and non consumptive uses such as navigation, floating of property, fish culture, etc.

While laying down precise regulations for India to build projects. The preamble of the treaty are recognizing rights &

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obligations of each contry in settlement of optimum water use from the Indus System of rivers in a spicit of good will. friendship and cooperation contrary to the fears of Pakistan that India could potentially create floods or droughts in Pakistan, especially at times of war since substantial water inflows of Indus basin rivers are from India.

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Q1 (d)

Q Write signification of Duty of crop?

Significance of Duty

It help in designing efficient canal irrigation system. knowing the total available water at the head of the 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.

Inversly if we know the crop area required

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to be irrigated and their duties, we can work out the discharge required for designing the canal.

Crop	Duty in hectares/cumecs
Sugar cane	730
Rice	775
Other kharif	1500
Rabi	1800
Perennials	1100
Hot fodder	2200

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Question 2

Q2 (a)

Explain the factors affecting cosumptive use?

Factors :-

1:- Tempreture

The rate of cunsumptive use of water by crops in any particular locality is probably affected more by temperature, which for long-time period is a good measure of solar radiation than by any other factor.

Abnormally low

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temperatures retard plant growth and unusually high temperatures may produce dormancy.

2:- Humidity :-

Evaporation and transpiration are accelerated on days of low humidity and showed during period of high humidity. During period of low relative humidity, greater rate of use of water by vegetation may be expected.

3:- Wind Movement

Evaporation of water

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from land and plant surfaces take place more rapidly when there is moving air than under calm air conditions.

4:- Growing Season

The growing season which is tied rather closely to temperature, has a major effect on the seasonal use of water by plants. It is frequently considered to be the period b/w killing frosts.

5:- Latitude and Sunlight

Although latitude may hardly be a called a climatic factor. it does have considerable influence on the rate of consumptive use of water by various plants.

6:- Soil Fertility

If a soil is made more fertile through the application of manure or by some other means, the yields may be expected to increase with an accompanying small increase in use of water.

Q2 (6)

Wheat is to be grown at a certain place. The useful rainfall for the whole season is 10 cm and its cumulative consumptive use is 40cm. Determine : consumptive irrigation requirement and FIR water application is 80%.

Ans :-

Given Data :-

Useful Rainfall = 10

Water application effiency (η_a) = 80 %

= 0.8

Cumulative Consumption

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use (Cu) = 40 cm

Required :-

Field Irrigation requirment (FIR) = ?

Consumptive Irrigation requirment (CIR) = ?

Sol :-

We know that

By Formula :-

$$CIR = Cu - Re$$
$$= 40 - 10$$
$$CIR = 30$$

2nd Formula :-

$$FIR = \frac{CIR}{na}$$

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$= \frac{30}{0.8}$

$= 37.5$ cm Answer

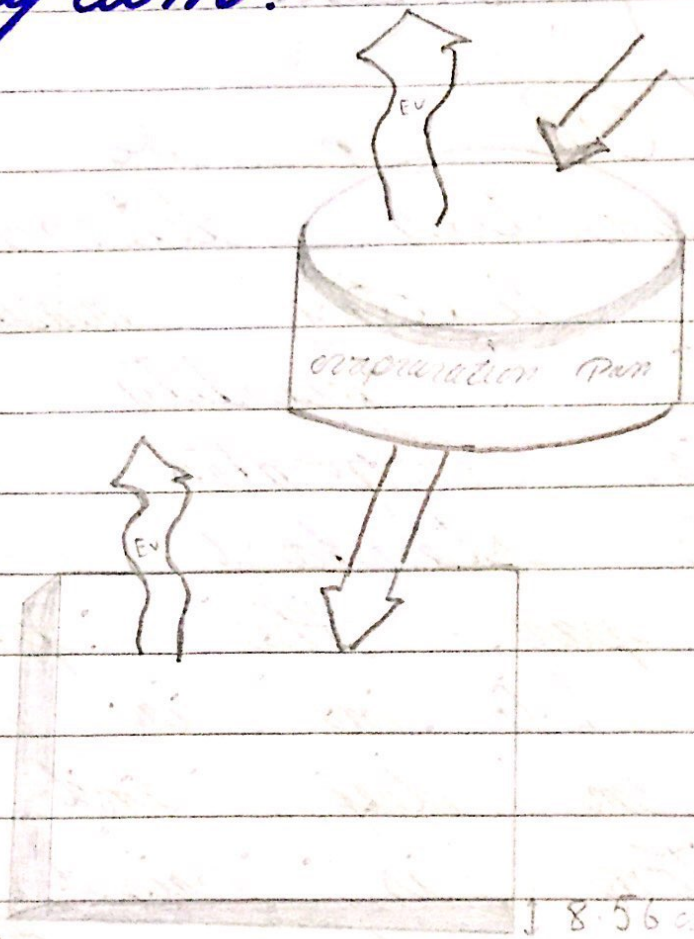
Q2 (c)

Class A Pan Evaporation Measurement :-

EP can be experimentlly determinid 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 the bottom is raised 15 cm above the ground surface. The depth of water is

to be kept in a fixed range such that the water surface is at least 5cm, and never more than 7.5cm below the top of Pan.

Diagram:-



The pan evaporation Ep can also determined by using the Christiansen formula which states

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

R = extra Terrestial radiation in the same units as Ep in cm or m.m.

Ct = Coefficient for temprature

Cw = Coefficient for wind velocity.

Ch = Coefficient for relative humidity

Cs = Coefficient for precent of possible sunshine.

Ce = Coefficient for elevation.

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Q2 (d)

Croping Seasons

Rabi - 1st October to 31st march - winter

Kharif - 1st April to 30st September summer.

Kharif crops:

Rice Bajra Jawar Maize cotton.

Rabi crops:

Wheat, Barley, Gram, Mustard, Potatoes.

Kharif Rabi Ratio:-

The area to be irrigated for rabi crops generally more than

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that for kharif crops.

This ratio of proposed areas, to be irrigated in kharif seasons to that in Rabi season is called kharif Rabi ratio. This ratio is generally 1:2. ie kharif area is one half of Rabi area.

Question 3

Q3 (a)

Field Capacity

The field capacity is the amount of soil moisture held in the soil after excess water has drained away and the rate of downward movement has decreased. This usually takes place 2-3 days after rain in porous soils of uniform structure and texture.

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Q.3.(b.)

Permanent Wilting Point

The permanent wilting point is defined as the minimum amount of water in the soil that the plant require not to wilt.

If the soil water content decreases to this or any lower point a plant wilt and can no longer recover its turgidity when placed in a saturated atmosphere for 12 hours.

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Q3 (c)

Available Moisture

The difference in moisture content of soil bw field capacity and permanent wilting is termed the available moisture. Available moisture can be expressed as percentage moisture Pw, as percentage Pv or as depth d.

Readily Available Moisture

Soil moisture content near the wilting point is not readily available to the plant

Hence, the term readily available moisture has been used to refer to that portion of the available moisture that is most easily extracted by plants. approximently 75% of the avilable moisture.

Q3 (d)

Optimum Utilization of Water

If a crop is soun and produce under absolutely identical condition using different amount of water depth, the yield is found to vary.

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The yield increase with water, reaches a certain maximum value & then falls down as shown fig:-

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

Fig:-