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Subject: Irrigation Engineering

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CE: 324

Mid term Examination

Semester 6th

Q No 1(a)

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

ANSWER:

DELTA:

the total quantity of water(volume), required to the crop, to get matured, during its base period

Simply means, total quantity of water divided by total irrigated place, it obtain Delta of crop of irrigated area.

DUTY:

the term 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 (hectares/cumecs)

Delta = A meters Base period = B days by definition,

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

Volume of water @ $1 m^3$ sec in one day =

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

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

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

$$86400 m^2 m \quad (i)$$

As 1 Hectare = $10000 m^2$

$$1 m^2 = 1104 H$$

Then, equation becomes

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

$86400 B m^3 = 86400 B \times 1104$ H-m. Volume of water @ $1 m^3$ sec in 'B' days = $8.64 \times B$ H-m — (i

Depth of water required by crop, A = Volume Area A =

$8.64 \times B$ Dm

b) 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 continuously 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 $= 1 \times 24 \times 60 \times 60 =$

$86400 ft^3 = 86400 ft^2 ft$ — ①

As 1 Acre $= 43560 ft^2$

eq ① ⇒

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

$86400 B \times 143560$ Acre-ft

Volome of water @ $1 ft^3$ sec in B days =

$1.983 \times B$ Acre-ft — (ii)

Depth of water required by crop, A =

Volume Area A = 1.983B Acre-ft D. Acre A =

1.983 × B D ft

D is duty in ha/cumec

Q No 1(b)

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

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

× Depth of water

$= 4 \times 9 = 36cm$

Δ for wheat = 36cm

RESULT:

Δ for wheat = 36cm

QNo1(c)

Explain Indus Water Treaty.

ANSWER:

Introduction:

It was signed in year in 1960 by formes Prime Minister Jawaharlal Nehru and President of Pakistan, Ayub Khan.

Purpose of Indus Water Treaty:

The purpose of Indus water treaty is an aggrement that was made to Chalk out the control over the 6 rivers that run across India and Pakistan into the Indus Basin.

River given to Pakistan:

Control of water flowing in three western river of India Indus, Chenab and Jehlum with mean annual flow of 80MAF were given to Pakistan.

River given to India:

Eastern river of India, Beas, River and sutlej with mean annual flow of 33MAF was given to India.

Q No 1(d)

Write Significance of Duty of Crop?

ANSWER:

SIGNIFICANCE OF Duty of CROP:

It help us in designing an efficient canal irrigation system.

Knowing the total available water at the head of main canal, and the overall duty of all the crops required to be irrigated in different seasons of the year, the ea area which can be irrigated can be workout.

Inversly, if we know the crop area required to be irrigated and their duties, we can work out the discharge required for designing the channel.

Q No 2(a)

Explain the factor affecting consumptive use

ANSWER:

Following are the factors affecting Consumptive use:

Temperature

Humidity in air

Velocity of wind

Soil Topography.

Sunlight.

Temperature:

The rate of consumptive use of water by crops in any particular locality is probably affected more by temperature, which for long time period is good measure of solar radiation, then by any other factor Abnormally low temperatures retard plant growth and unusually high temperatures may Produce dormancy

P.T.O

HUMIDITY:

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

Velocity of Wind:

Evaporation of water from land and Plant surfaces take place more rapidly when there is moving air than under claim air condition. Hot, dry winds and other unusual wind condition during the growing period will affect the amoont of water consumptive Used. However, there is a limit in the amount of water that can be utilized.

Latitude AND SUNLIGHT:

Although latitude may hardly be called a Climatic factor, it does have considerable influence on the rate of consumptive use of water by Various Plant. Because of the earth movement and axial inclination the hours of daylight during summer are much greater in northern

than at the Equator. Since the sun is the source of all energy used in crop growth and evaporation of water, this longer day may allow plant transpiration to continue for a longer period each day and to produce an affect similar to that of lengthing growing season.

Q No 2(b)

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

Given Data:

Useful rainfall(cm) = 10cm

Water application efficiency (η_a) = 80% = 0.8

Commulative consumptive use (Cu) = 40cm

Required Data:

Field Irrigation Requirement (FIR) = ?

Consumptive Irrigation Requirement (CIR) = ?

Solution:

Consumptive Irrigation Requirement CIR =

$$Cu - Re$$

$$= 40 - 10$$

$$CIR = 30cm$$

Field Irrigation Requirement (FIR)

$$= \frac{CIR}{\eta_a}$$

CIR = NIR
i.e neglect leaching requirem

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

RESULT:

CIR = 30cm

FIR = 37.5cm

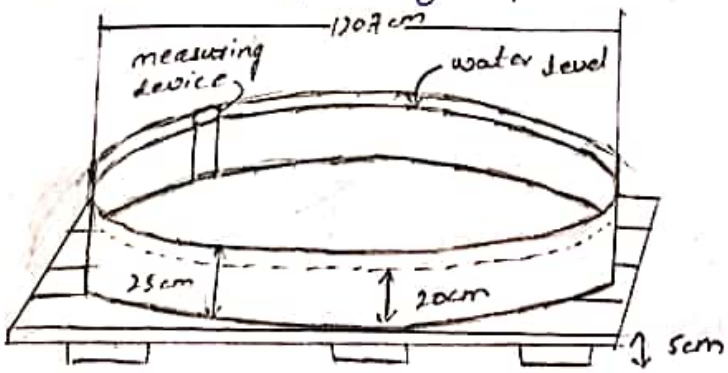
Q No 2(c)

Explain Class A Pan Evaporation (Ep) measurement 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



Q No (2)(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 — 31st March - Winter

Kharif Crops:

rice, maize, sorghum, Pearl, bajra etc

RABI Crop:

Barley, Flax seed, Pea, Wheat, Potato etc.

~~RABI~~

Kharif Rabi ratio

The area to be irrigated for Rabi crop is generally more than that of Kharif crop. This ratio of proposed area, 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.

Q NO (3) (a)

Field Capacity:

Definition:

When all gravity water has drained down to water table, a certain amount of water 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

Field Capacity:

Capillary Water

Hygroscopic water.

Q No 3(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 its growth and wilts up.

Water available to plant =

Field capacity - P.W.P water

Q No 3(c)

Available and Readily available Moisture Content

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. Available moisture can be expressed as Percentage moisture.

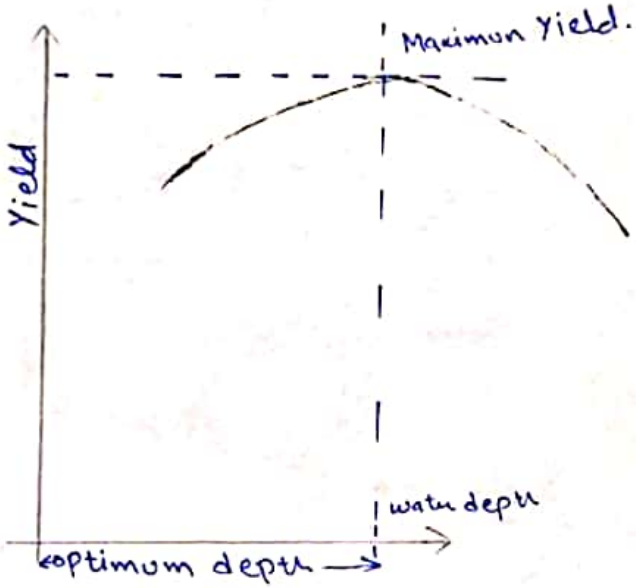
Readily Available Moisture:

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

Q No 3(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. The is found to vary. The yield increases with water, reaches a certain maximum value & then falls down as shown is following fig.



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

Irrigation Efficiencies:

Efficiency is the ratio of water output of water to the water input and is usually expressed as percentage.