ID : 7856

SUBJECT: CE 324 IRRIGATION ENGINEERING

INSTRUCTOR : Dr JAHANGIR DORRANI

SEMESTER : 6th

Q NO 1 (a)

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

ANSWER:

DELTA:

The required total quantity of water (volume) to the uop to get matured during its base period.

In simple words, total quantity of water divided by total irigated plaue, it obtain Delta of uop of irigated area.

DUTY:

The land area that can be irigated with unit volume irigation water is known as the term "duty".

The irigation capaity of a unit is represented by Duty. Basically its relation between the area of uop irigated and quantity of irigation water which is required during the whole period of the growth of that uop.

Relation of Delta and Duty in MKS

Let Duty = D (hectares / cumecs)

Delta = A meters Base period = B days

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

$1 \times 24 \times 60 \times 60 = 86400 m^3$ is the volume of water @ $1 m^3 sec$ in one day.

$1 \times 24 \times 60 \times 60 = 86400 Bm^3 = 86400 m^3 m(i)$ is the volume of water @ $1 m^3$ sec in "B" days.

As $10000 m^2$ = 1 Hectare

$1 m^2 = 1/10^4 H$

The equation then becomes

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

$86400\ Bm^3 = 86400 B \times 1/10^4 H \cdot m$

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

$8.64 \times BH \cdot m$ — (ii)

Depth of water required by Crop,

A = volume Area A = $8.64 \times BD_m$

let Duty = D (Acres / cusecs)

Delta = A feet Base period = B days

By definition a depth of water 'A' over an area of 'D' acres is given by one cusec of water flowing continously for 'B' days.

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

$1 \times 24 \times 60 \times 60 = 86400 ft^3 = 86400 ft^2 ft$ — (I)

As $43560 ft^2 = 1$ Acre

eq (I) =

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

$86400 B \times 14360$ Acre-ft

volume 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 =

$1.983 \times BD ft$

D is the duty in ha / cumec.

Q NO 1 (b)

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

GIVEN DATA:

Base period = 140 days
Depth of water = 9cm

Requirement =

Delta for wheat, Δ = ?

SOLUTION:

As number of watering required = $140/35 = 4$

Total depth of water required =

no. of watering x depth of water

$4 \times 9 = 36cm$

Δ for wheat = 36cm

Result =

Δ for wheat = 36 cm

Q NO 1 (c)

Explain Indus Water Treaty

INTRODUCTION:

President of Pakistan Ayub Khan and former Prime minister Jawaharlal Nehru in 1960 signed this treaty.

PURPOSE:

An arrangement that was made was the only purpose of this treaty to chalk out the control over the 6 river that run across Pakistan and India into the Indus Basin.

Rivers given to India:

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

Rivers given to Pakistan:

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

Q NO 1 (d)

Write significance of Duty of Crop?

In efficient canal irrigation system designing duty of crop help.

The area which can be irrigated can be worked out if the total available water at the head of main canal is known and the overall duty of all the crops required to be irrigated in different seasons of the year.

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

QNO 2 (a)

Explain the factor affecting consumptive use.

Mentioned below are the factors affecting consumptive use:

Humidity in air
Temperature
Sunlight
Soil Topography
Velocity of wind

HUMIDITY:

On days of low humidity transpiration and evaporation are accelerated and slowed during periods of high humidity. Greater rate of use of water by vegetation may be expected during periods of low relative humidity.

TEMPERATURE:

In any particular locality the rate of consumptive use of water by crops is probably affected more by temperature, which for long time period is good measure of solar radiation, then by any other factor. Dormancy may be produced by Abnormally low temperatures retard plant growth and unusually high temperatures.

Latitude And Sunlight:

Latitude can be barely called as a climate factor, it surely have significant influence on the rate of consumptive use of water by various plant. The hours of daylight during summer are much greater in northern than at the equater because of the earth movement and axial inclination. As the source of all energy used in growth and evaporation of water is sun, 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.

Velocity of Wind:

when there is moving air than under claim air condition, the evaporation of water from plant surfaces and land take place more rapidly. The amount of water consumptively used is affected by dry, hot winds and other unusual wind condition during the growing period. The utilization of water amount however has a limit.

Q NO 2 (b)

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

Given,

Useful Rainfall (cm) = 10

Water application Efficiency (η_a) = 80% = 0.8

Cummulative Consumptive Use (C_u) = 40cm.

Required;

Field Irrigation Requirement (FIR) = ?

Consumptive Irrigation Requirement (CIR) = ?

By formula,

Consumptive Irrigation Requirement (CIR) = $C_u - R_e$

= 40 - 10

= 30cm.

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

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

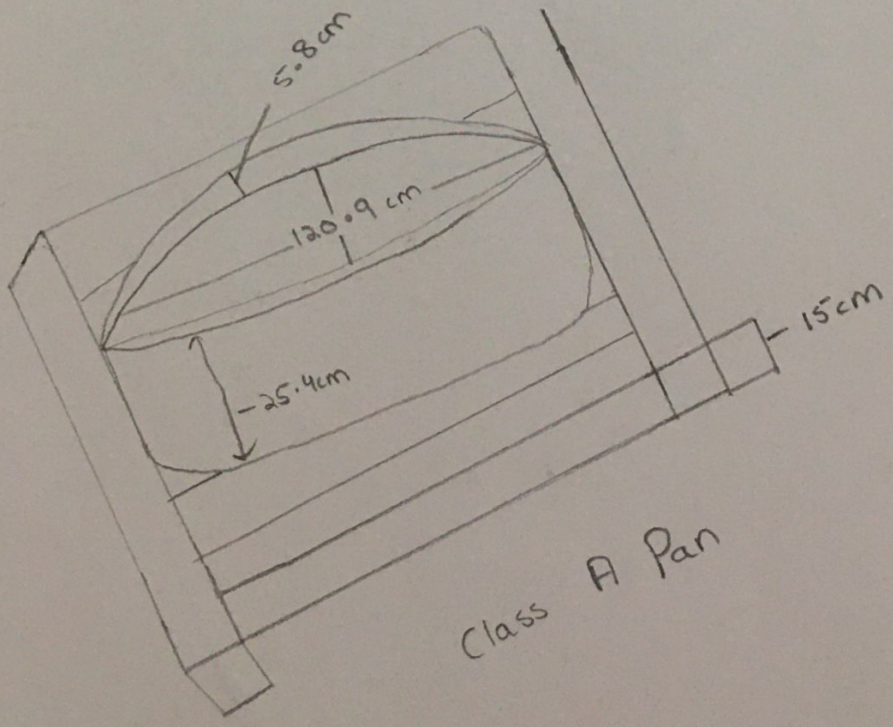
Q NO 2 (C)

Explain class A Pan Evaporation (Ep) measurement with help of diagram.

ANSWER:

By measuring directly the water quantity evaporated from this standard class A pan Evaporation can be determined Experimentally.

Bottom of pan is raised 15cm above the ground surface. Diameter of pan is 1.0 m, 25cm deep. The water depth is to be kept in a fixed range such that water surface is least 5cm, and is never more than 7.5 cm bellow the top of pan.



Q NO (2) (d)

Explain crop season (Rabi and Karif) and Karif Rabi.

ANSWER:

CROP SEASON:

The part of the year is growing season during which the normal plant growth is permitted by the local weather condition (i-e rainfall and temperature)

Kharif: 1st April to 31st September – Summer

Rabi: 1st October – 31st March – Winter

Kharif Hops:

rice, maize, sorghum, pearl, bajra etc.

Rabi Hops:

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

Q NO (3)(a)

Field Capacity

Definition:

A certain amount of water is retained by surface soil when all the gravity water has drained down to water table. This water is called field capacity which cannot be easily drained under the action of gravity.

Period of drainage = 2-5 days

FC is measured after 2 or 5 days.

Field Capacity:

Hygroscopic water

Capillary water

Q NO 3 (b)

Permanent Wilting Point:

Water can be extracted from soil by plant till a permanent wilting is reached. The water content at which a plant can no longer extract sufficient water for its growth and wilts up is P.W.P.

Water available to plant =

Field Capacity - P.W.P water

Q NO 3 (c)

Available and Readily available Moisture

Available Moisture Content:

Between field capacity (F.C) and permanant wilting the difference in moisture content of soil is termed as the available moisture. It can also be expressed as percentage moisture.

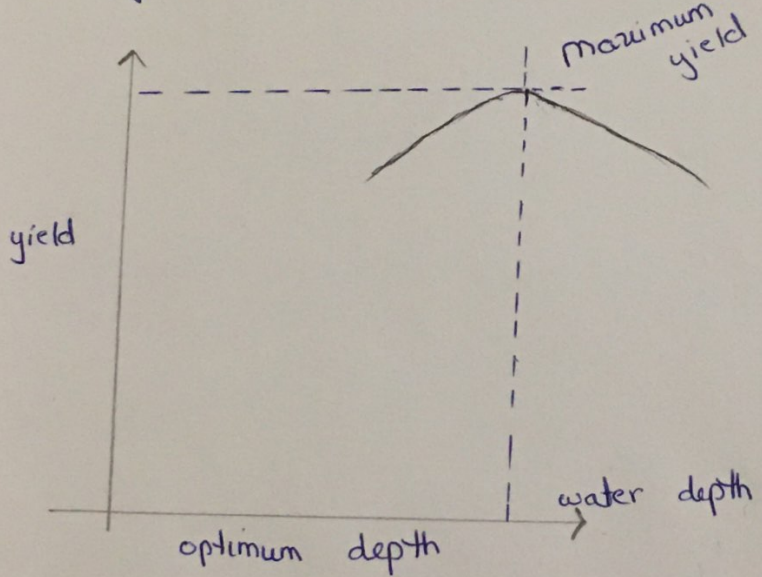
Readily Available Moisture:

The most easily extracted, portion of available moisture, by plants and is approximately 75 to 80% available moisture.

Q NO 3 (d)

Optimum Utilization of Water:

The yield is found to vary if a crop is produced and sown under absolutely identical condition using different amount of water depth. With water the yield increases, a certain maximum value is reached and falls down as shown in following figure.



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

Irrigation Efficiencies:

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