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QNo1 Define "Delta" and Duty and derive their relationship in MKS and FPS Systems.

Ans

Delta ⇒

A Delta is a Landform that forms from deposition of sediment carried by a river as the flow leaves its mouth and enters slower moving or standing water. The occurs where a river enters an occean, sea, estuary, lake, or (more rarely) another river that cannot transport away the supplied sediment.

Definition

Delta is a triangle-Shaped deposit of Sand, Clay or Silt at the mouth of a river.

Example

A Delta is where the Nile river drains into the Mediterranean Sea.

Duty ⇒ The terms 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 between

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

Example => If 3 Cumecs 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.

Derivation between Delta and Duty in MKS Systems.

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

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Volume of water $1 m^3/sec$ in "B" days = $1 \times 24 \times 60 \times 60$ =
$= 86400 B\ m^3 = 86400 m^2$

As, 1 Hectare = $10000 m^2$

$1 m^2 = 1104\ H$

Then, equation (i) 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 — (ii)

Depth of water required by crop, A = Volume

Area A = $8.64 \times B$ H-m D HA = $8.64 \times B$ D m

Derivation between Delta and Duty in F.P.S System.

Let,

Duty = D (Acres/Cusecs)

Delta = A feet Base period = B days By definations,

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

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

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

Volume of water is $1 ft^3/sec$ in "B" days =
$= 1 \times 24 \times 60 \times 60 = 86400 B\ ft^3 = 86400 ft^2/ft$ ⟶ (i)

(4)

As, 1 Acre = $43560 ft^2$ $1 Ft^2 = 143560$ Acre.

Then, equation becomes.

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

= $86400B \times 143560$ Acre-ft volume of water is $1 ft^3/sec$

in "B" days = $1.983 \times B$ Acre-ft ⟶ (11)

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

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

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Q No 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 ?

Sol

Water requirement of Wheat = 9cm

Days Interval = 35 days

Base Period = 140 days

Delta of Water = (Δ) = ?

⇒ 35 days = 9 cm

140 days = Δ

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

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

Q.No1: C => Explain Indus Water Treaty.

The Indus Water Treaty is a water distribution treaty between Pakistan and India brokered by the World Bank to use the water available in the Indus System of Rivers. located in India. This Indus Water treaty was Signed in Karachi on September 19, 1960 by the President of Pakistan Ayub Khan and than the First Prime Minister of India Pandit Jawaharlal Nehru.

According to this agreement, Control over the water flowing in three "eastern rivers" of India The Beas, the Ravi and the Sutlej with the mean annual flow of 33 million acre-feet.

More Controversial, however, were the provisions on how the water was to be Shared. Since Pakistanis rivers recive 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 negivation,

for design

Floating of property, fish culture etc.

The treaty is considered to be one of the most successful water sharing endeavours in the world todays. As per the provisions in the treaty, India can use (excluding domestic, industrial and non consumptive uses from western rivers) nearly 16% of the total water carried by the Indus system of Rivers while Pakistan can use the remaining.

QNo1 D => Write significance of Duty of Crop?

Ans It help us in designing an efficient canal Irrigation System. Knowing the total available water at the head of a 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. Inversely. If we know the crops area required to be Irrigated and their duties, we can work out the discharge required for designing the Channel.

QNO2 A⇒ Explain the factors affecting consumptive use.

Ans It is the quantity of water used by the vegetation growth of a given area. It is the amount of water required by a crop for its vegetated growth to evaportranspiration and building of plant tissues plus evaporation from soils and Intercepted precipitation. It is expressed in terms of depth of water. Consumptive use varies with temperature, humidity, wind speed, topography, Sunlight hours, method of Irrigation, moisture availability.

Mathematically

Consumptive Use = Evaportranspiration = Evaporation + transpiration it is expressed in terms of depth of water.

Temperatur ⇒

If the temperature is highy than more water will be required for the crop & production

Humidity in air.

If the humidity in air is more than less water required for the crops production

Velocity of wind

If the velocity of wind is more than more water is required for the crop production.

Soil Topography

If the soil is soft than less water is required and If the soil is hard than more water is required for the crop production

Sunlight =>

If the Sunlight is very quick than more water required for the crop production.

QNO2 B → 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 (CIR) and field irrigation requirement (FIR) If the water application efficiency is 80%.

Given

Useful Rainfall (cm) = 10

Water application Efficiency (n_a) = 80% = 0.8

Cumulative Consumptive use (CU) = 40cm

Required

Field Irrigation Requirement = (FIR) = ?

Consumptive Irrigation Requirment = (CIR) = ?

By formula

→ Consumptive Irrigation Requirement (CIR) = CU - RC

= 40 - 10

CIR = 30 cm

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

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

Q No2 C ⇒ Explain Class A Pan Evaporation measurement with the help of a diagram.

Ans ⇒ EP can be experimentally determined by directly measuring the quantity of water evaporated from this Standard Class a pan. This pan is 1.0m in diameter, 25 cm 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 at least 5cm and never more than 7.5cm below the top of pan.

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. Terrestrial radiation in the Same units as Ep in cm or mm

C_t = Coefficient for Temperature

C_w = Coefficient for wind velocity.

C_h = Coefficient for relative humidity

C_s = Coefficient for percent of possible Sunshine

C_e = Coefficient for elevation.

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QNo2 - D ⇒ Explain Crop seasons (Rabi and Kharif) and Kharif Rabi Ratio.

(1) Rabi ⇒ 1st October to 31st March - Winter.

(2) 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 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.

QNO3 => Define and explain the following terms.

a) Field Capacity When all gravity water has drained down to water table, a certain amount of water is retained by surface soil. This water which can not be easily drained under the action of gravity and is called F.C

Period of drainage = 2-5 days

fc is measured after 2 or 5 days.

Field capacity: 1 Capillary water 2) Hygroscopic water.

1: Capillary water: Water attached to soil by surface tention which can easily be extracted by plants by capillary action

2) Hygroscopic water ⇒ Water attached to soil by ~~Surface tention~~ Chemic

(2) Hygroscopic Water ⇒ Water attached to soil by Chemical bonds, which can not be extracted by plants by capillary action.

Field Capacity : (Weight of water retained in a certain volume of soil / wt of same volume of soil) x 100. Consider 1 sq/m area of soil d m depth of root zone.

Volume of soil = d x 1 Cu.m

If γ kg/cu.m density of soil = Specific wt of soil

Then wt of d cu.m of soil = γ d kg if f is field capacity

F = wt of water retained in unit area of soil/sd

Wt of water retained in unit area of soil = F sd kg/Cu.m

Wt of water retained in unit area or volume

= Wd1 = γd.F

d1 = depth of water stored root zone = γd.f/w

= kg/sq.m / kg/cu.m = m,

W = Specific wt of water = kg/cu.m.

(B) Permanent Willing Point → A plant can extract water from soil till a permanent willing is reached. Permanent wilting point 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 − Permanent willing Point.

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(C) Available and readily available moisture contents:

The range of avilablee water that can be stored in soil and be avilable for growing crops is known as available soil water moisture.

Readily available moisture content: It is that portion of available moisture which is most easily extracted by plants and is approximatily 75 to 80 % available moisture.

(D) Optimum Utilization of water:

If a crop is sown and producted under absolulely identical conditions using different amount of water depth, the yield is found to vary. The yield increase with water, reaches a

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(18)

a certain maximum value and than fall down as Shown in diagram.

Ans