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Sec : B

Subject : Irrigation Engineering

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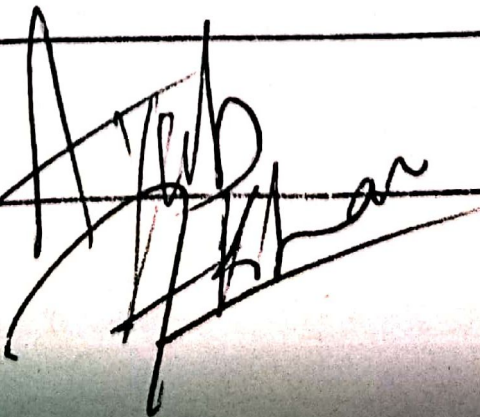
Date : 13-Apr-2020

Subject Code : CE-324

Exam : Mid Term

Dept : BE [Civil] 6th Semester.

Signature :



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Q(1) (a): Define Delta and Duty & Derive Their relationship in MKS & FPS system.

Ans: Duty: The Duty of Crop is defined as "The amount of water required for a fixed interval throughout its base period." is known as Duty of Crops.

Delta: The Delta of Crop is defined as "The quantity of water which is required for any crop to gain its maturity."

Relation - Ship b/w Duty & Delta
In M.K.S and F.P.S System.

In M.K.S System:

let
Volume of $1 \text{ m}^3/\text{Sec}$ water in B days.

(2)

$$\text{Vol of } 1 \text{ m}^3/\text{sec water in } B\text{-days} = 1 \times 24 \times 60 \times 60 = 86400 \text{ m}$$

As 1 hectare = 10000 m².

$$1 \text{ m}^2 = 1104 \text{ H.}$$

Then eq (1) becomes,

Vol of 1 m³/sec in B-days = 86400 × 1104 H-m Volume of water.

Depth of water required by Crop A = Vol/Area

$$\Rightarrow \frac{86400}{104} = 8.64 \text{ B/D m.}$$

$$D = 8.64 \text{ B/D m.}$$

By Definition, The total Depth water is called Delta.

$$\text{Therefore, } \Delta = 8.64 \text{ B/D m} = 864 \text{ B/D cm.}$$

where Delta is in cm, B is in days and

D is duty in ha/cumec.

In F.P.S

$$\Delta = 1.98 \text{ B/D ft.}$$

where Delta is in feet, B in days and

D is in Acres.

Relationship of Delta & Duty in FPS:

let,

$$\text{Duty} = D \text{ (Acre/cusec)}$$

Delta = A feet Base period = B days by definition,
one cusec of water flowing continuously for B
day given a depth of water "A" over an area
of "D" Acre.

$$\text{Volume of water } 1 \text{ ft}^3 \text{ Sec in one day} = 1 \times 24 \times 60 \times 60 = 86400 \text{ ft}^3$$

$$\text{As } 1 \text{ Acre} = 43560 \text{ ft}^2.$$

eq (i) \Rightarrow

$$\text{Volume of water } 1 \text{ ft}^3 \text{ Sec in } B \text{ days} = 86400 B \text{ ft}^3$$

$$= 86400 B \times 43560 \text{ Acre-ft}$$

Volume of water at $1 \text{ ft}^3 \text{ Sec}$ B days.

$$1.983 \times B \text{ Acre-ft} \text{ --- (ii)}$$

Depth of water required by Crop A \Rightarrow

$$\text{Volume Area } A = 1.983 B \text{ Acre-ft } D \cdot \text{Acre } A = 1.983 \times D \text{ ft}$$

D is duty in ha / cume c.

Q no 1: (B) 1: 9 wheat require about 9cm of water after every 35 days, and the Base Period or Crop Period of wheat is 140 days. Find out the ^{delta} Δ for wheat.

Sol:

Given.

Crop period = 140 days.

Water requires, 9cm after every 35 days.

~~By~~ B period = 140 days.

Delta (Δ) = ?

No. of required watering = $140/35 = 4$

Depth of water each time = 9cm.

So

$$\Delta = 9 \times 4 = 36 \text{ cm}$$

Ans.

So the delta for wheat is 36 cm.

(1)

Q.1(C): Explain the Indus water treaty.

Ans: The Indus water treaty is a water ~~treaty~~ distribution treaty b/w Pakistan and India and brokered by World Bank, to use the available water in ~~indus~~ Indus system of River.

The Indus water treaty was signed in Karachi in 19-Sep-1960 by President Gen. Ayub Khan and India prime minister Pandit Jawahir Lal ~~to~~ Nehru.

According to the agreement 3 eastern Rivers Beas, Ravi and Satlaj with annual flow of 33M acre feet was given to given.

~~but~~ While the other 3 western rivers, Indus, Chenab and Jhelum was given to Pakistan with annual flow of 80 million Acre foot.

(5)

As per Article I. W. T, any river and its Catchment Area which is not part of the other 5 rivers, is the part of Indus river including its Creek, ~~left~~ delta Channels and Connecting lakes etc.

A transition period of 10 years was permitted in which India was bound to supply the water from its eastern river to Pakistan until Pakistan was able to ~~be~~ build Canal System for utilizing the water of western Rivers.

(b)

Q.1: (d): Write the Significance of Duty of Crop.

Ans. → It is very help full in designing an effective irrigation System, knowing the total water available in the main Section of the main Channle and the need to irrigate all plants in different Season, throughout the year.

inversly
inversly, if we know that the Crop area required to be irrigated and their duties, we can workout the discharge required for designing the Canals.

(7)

Qno: 2: (a): Explain the factors affecting
Consumptive use. of ~~water~~

Ans:

Factor Affecting the Consumptive use:

Following are the few factor which is affecting
the C.u.

(i) Temperature:

① Degree of Saturation of Soil Surface.

② Temperature of air and soil.

③ Humidity.

④ Wind Velocity

⑤ Extent of vegetative Cover etc.

(ii) Humidity:

→ Transpiration and evaporation - use
Speed up in low humidity.

→ They gets slow in high humidity days.

→ During low humidity, greater rate of use of
water by vegetation may be expected.

→ While in high humidity, the case will be
vice versa.

(3) Wind Movement:

- Evaporation of water is fast when air is moving.
- Hot & dry condition will also affect the amount of water used consumptively.

(4) Latitude and Sunlight:

• Latitude and Sunlight

may be called climatic factor.

- Because of earth's movement and axial inclination, the hours of daylight during the summer are much greater in the northern latitude than at the equator.
- The latitude and sunlight does have considerable influence on the rate of consumptive use of water by various plants.

(5) Quality of Water:

(9)

- According to investigations, Quality of water supply may have a huge impact on Consumptive uses of water.
- If it is necessary to apply additional water to land to leach the salt down, through the soil, more water will be lost.
- Such losses will be chargeable against Consumptive requirement of crop area.

Q2: (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 40 cm.

Determine Consumptive irrigation Requirement (CIR) and field Irrigation Requirement (FIR) if the water application efficiency is 80%.

Sol.

Given data.

(C_m) useful rainfall = 10 cm

(C_u) Cumulative Consumptive Uses = 40 cm

CIR = ?

FIR = ?

Water application Efficiency (n_a) = 80% = 0.8.

By Formula :

Consumptive irrigation Req, (CIR) = $C_u - R_c$
40 - 10.

CIR = 30 cm.

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

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

Results:

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

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

(12)

Q2: (C): Explain Class A Pan Evaporation measurement with the help of a diagram.

Ans: • This experiment can be determined by directly measuring the quantity of water evaporated from the Pan.

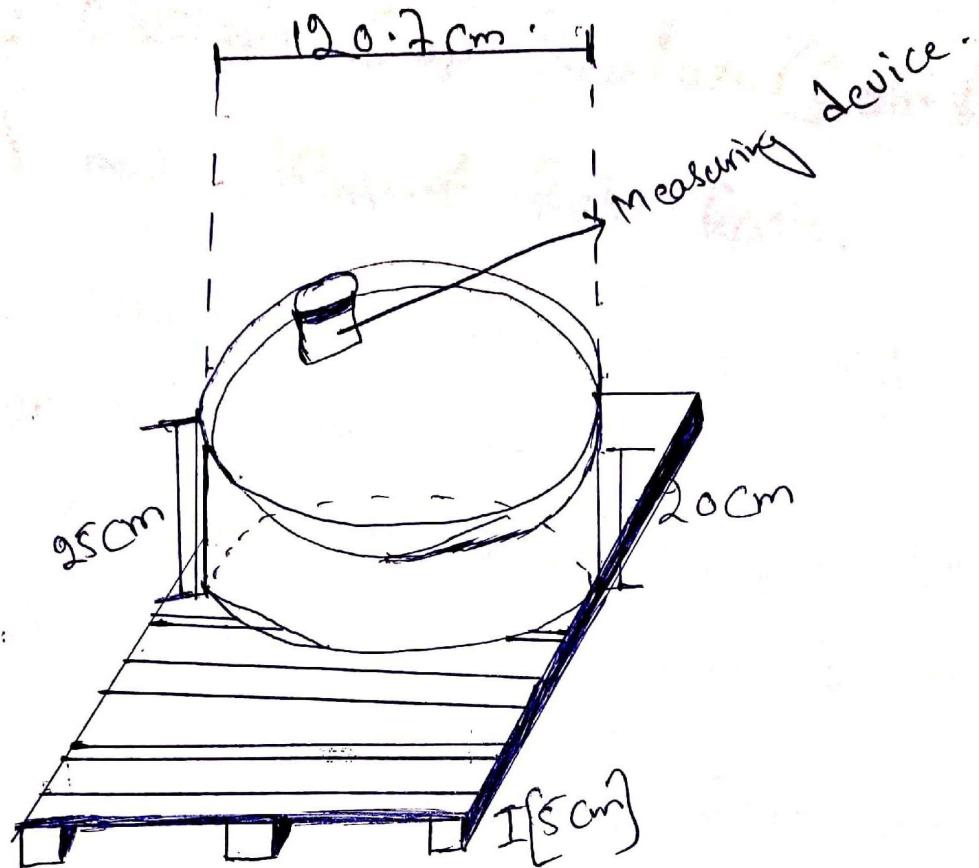
• The Pan is 1 m in dia and 25 cm deep, 15 cm raised from the ground.

• The water level should be ~~at~~ at least 5 cm and never more than 7.5 cm, below the top of Pan.

• The Pan rests on leveled wooden base and is often enclosed by a chain to keep away animals.

• Evaporation is ~~measured~~ measured daily as the depth of water evaporates from the Pan.

• The measurement day begins with the Pan filled to exactly two inches from the top.



- The Pan evaporation E_p can also be determined by using the Christiansen formula which states

$$E_p = 0.459 R \cdot C_t \cdot C_w \cdot C_h \cdot C_s \cdot C_e$$

where

- R = extra terrestrial radiation in same unit.
- C_t = Coefficient of tem.
- C_w = Coefficient of wind velocity.
- C_h = Coefficient of relative humidity.
- C_s = Coefficient for percent possible sunshine
- C_e = Coefficient for elevation.

Q 2: (d): Explain Crop Season (Rabi & Kharif) and Kharif Rabi Ratio.

Ans: There are two Crops Season which are known as, Rabi and Kharif.

The time of Rabi is from 1st Oct till 31st March which is the winter Season.

Rabi Crop are ; wheat, barley, Gram, Mustard and potatoes.

On the other hand, the Kharif time is from 1st April to 30th of the September, which is Summer Season.

The Kharif and Rabi Ratio:

to be irrigated for Rabi Crops generally more than that for Kharif Crops. This Ratio of proposed area, to be irrigated in Kharif Season to that in Rabi Season is called Kharif Rabi ratio.

Q: (3) Define and Explain the following:

- (a) field capacity.
- (b) Permanent wilting Point
- (c) Available and readily available moisture Content.
- (d) optimum utilization of water.

(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 cannot be easily drained under the ~~an~~ action of gravity and it is called f. c.

or

The amount of water in soil, after the excess water has drained away and downward movement has decreased. This usually takes place 2-3 days after rain or irrigation in previous soil.

(b) Permanent Wilting Point:

A plant can extract water from soil till a permanent wilting is reached.

So the permanent wilting point is the minimum amount of water in the soil, that the plant require not to wilt. If the soil water content decrease to this or any lower point a plant wilt & can no longer recover its turgidity when place in in saturated atmosphere for 12 hour.

(c) Available & Readily Available Moisture:

R.A.W

is the water, that a plant can easily extract from the soil.

RAW is the soil moisture held between field capacity and a nominated wilting point for unrestricted growth.

①) Optimum utilization of water

"The quantity of water at which, the yield is maximum is called optimum utilization of water."

It generally means that, getting maximum yield with any amount of water, to the various crop, the supply of water should be adjusted in such a fashion, as to get optimum benefit ratio.