ID # 7809
Section# A

Asadullah

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Name Asadullah
ID 7809
Section "A"
Semester 6th
Subject Irrigation Engineering

Question (1) part (A)
Define Delta and Duty and derive their relationship in MKS and FPS system.

Answer:-

Delta:-

The amount of water required for the crops through out the base period is called Delta of the crop.

Duty:

Duty represents the irrigating capacity of a unit water. It is the relationship between the area of a crop irrigated and the quantity of irrigation water required during crop period.

It is denoted by "D" and expressed in hectares/cumec.

Crop		Duty in hectares/cumec
Rice	→	900
Wheat	→	1800
Cotton	→	1400

Relation ship:

Relationship between Delta and Duty in MKS and FPS system.

IN MKS System:-

let

Duty = D (hectares/cumecs)

Delta = A meters Base period
= B days by definition

One cumec of water flowing Continously for "B" day gives a depth of water "A" over an area of "D" hectares.

Volume of water at $1 m^3 sec$ in one day = $1 \times 24 \times 60 \times 60 = 86400 m^3$

Volume of water at $1 m^3 sec$ in B days = $1 \times 24 \times 60 \times 60 = 86400 B m^3$
$= 86400 m^2 m$ — (i)

As $1 \text{ Hectare} = 10000 m^3$

$1 m^2 = 1 \backslash 104 H$

Then equation (1) become

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Volume of water at 1 m^3 sec in "B" days = 86400B m^3

= 86400B X 1104H-m volume of water at 1 m^3 sec in B days

= 8.64 X B H.m —— (11)

Depth of water required by Crop, A = volume Area ~~A = 8.64XB~~

A = 8.64 X B H-m D HA = 8.64XB Dm.

IN FPS System

let

Duty = D (Acres/cusecs)

Delta = A feet Base period = B days

By Definition.

one cusec of water flowing Continously for "B" days gives a depth of water "A" over an area of "D" acres.

Volume of water at 1 ft^3 sec in one day = 1 X 24 X 60 X 60 = 86400^3

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Volume of water at $1 ft^3$ sec in one day = $1 \times 24 \times 60 \times 60 = 86400^3$

Volume of water at $1 ft^3$ sec in B days = $1 \times 24 \times 60 \times 60 = 86400B\ ft^3$ — (i)

As 1 acre = $43560\ ft^2$ $1 ft^2 = 143560$ Acre then equation (1) become.

Volume of water at $1 f^3$ sec in "B" day = $86400\ ft^3 = 86400B \times$ 143560 Acre-ft volume water at $1 ft^3$ sec in "B" days = $1.983 \times B$ Acre-ft. — (ii)

~~one cusec of water flowing continously for "B" days gives a depth of water "A" over an area of "D" acres.~~

Depth of water required by crop A = Volume Area A = $1.983B$

Acre A = $1.983 \times BD$ ft.

(5)

Question (1) part (B)
if wheat requires about 9cm of water after every 35 days and the base period or crop period of wheat is 140 days. Find out the delta of wheat.

Solution:

Water Requirement of wheat = 9cm
Days Interval = 35 days.
Base period = 140 day
Delta of wheat (Δ) = ?

35 days = 9cm
140 days = Δ

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

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

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Question (1) part (c)
Explain Indus water Treaty.

Indus water Treaty:-

Indus waters Treaty is a water-distribution treaty between India and pakistan. brokered by the world Bank to use the water available in the indus system of rivers located in india. The indus water Treaty (IWT) was signed in Karachi on September 19, 1996 by the first prime minister of india Pandit Jawaharal Nehru. and then president of Pakistan Ayub Khan.

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 (MAF) wa given to india while control over the water flowing in thme "western rivers" of india the "Indus" the "Chenab" and the Jhelum with the mean flow of 80(MAF) was given to Pakistan.

The indus river is spread across an area of 11.2 lakh kilometer. 47% of which lies in Pakistan, 39% in Indig 8% in China, and 6% in Afghanistan.

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Question (1) part (D)
Significance of Duty of Crops:

Significance of Duty of Crops:

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 irragated in different season of the year the area which can be irrigated can be worked out.

Inversly if we know the crops area required to be irriaged and their duties, we can work out the discharge required for designing the canal.

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Question No# (2) Part (A)
Explain the factors affecting Consumptive use.

Factors affecting Consumptive use :-

Factors affecting consumptive uses are given below:-

Temperature:-

The rate of consumptive uses of water by crops in any particular locality is probably affected more by temperature, which for long-time periods is good measure of solar radiation, then by other factors. Abnormally low temperature retard plant growth and usually high

may produce dormancy. Consumptive use may vary widely even in years of equal accumulated temperatures because of deviations from normal seasonal distribution.

Humidity:-

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

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Sunlight and latitude:-

Although latitude may hardly be called a climatic factor, It does have considerable influence on the rate of consumptive use of wate by various plants, Because of the earth's movement and axial inclination, the hour of day light during the summar are much greather in the northern latitudes than at the equator. Since the sun light is the source of all energy used in crop growth and evaporation of water, this longer day may allow plant transpiration ~~is~~ to Continues for a longer period each day and to produce an effect similar to that of the lengthening the growing season.

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Velocity of wind :-

Evaporation of water from land and plant surface takes place more rapidly when there is moving air than under claim air condition. Hot, dry winds and other unusual wind conditions during the growing period will affect the amount of water consumptively used. However, there is a limit in the amount of water that can be utilized. As soon as the land surface is dry, evaporation pratically stops and transpiration is limited by the ability of the plants to extract and convey the soil moisture through the plants.

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Soil Fertility:-

If a soil is made more fertile through the application of manure or by some other means, the yield may be ~~expressed~~ expected to increase with an accompanying small increase in use of water. However, an increase in fertility of soil causes a decrease in the amount of water consumed per unit of crop yield.

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Question (2) Part (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 irrigation requirement (CCIR) and field irrigation Requirement (FIR) if the water application efficiency is 80%.

Solution:

useful rainfal = 10cm.

water application efficency (η_a) = 80%

Cummulative consumptive use (cu) = 40cm

Need:

Field irrigation requirement (FIR) = ?

Consumptive irrigation requirement (CIR) = ?

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So we have formula.

Consumptive irrigation requirement

(CIR) = Cu - Re

= 40 - 10

= 30cm

Field irrigation requirement

$$(FIR) = \frac{CIR}{\eta a}$$

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

= 37.5cm

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Question (2) Part (c)
Explain Class A pan Evaporation (Ep) measurement with the help of diagram.

Class A Pan Evaporation measurement

Class A pan evaporation Pan is a standard device for manual measurement of evaporation (Australian Bureau of Meterology class A type) The pan represent in open body of water. It is filled with water and exposed on a flat plateau. The evaporation rate is calculated by the change in level of the free water surface (daily manual readings) Data can be calculated for any period

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required for estimation of evaporation and evapotranspiration rates.

Ep can be experimentally determined by directly measuring the quantity of water evaporated from this standard class a pan. This pan is ~~0.4~~ 1.0m in diameter, 25cm deep, and bottom is reached 15cm above the ground surface. The depth of water is to be kept in fixed range such ~~as~~ that the water surface is at least 5cm, and never more than 7.5cm, below the top of Pan.

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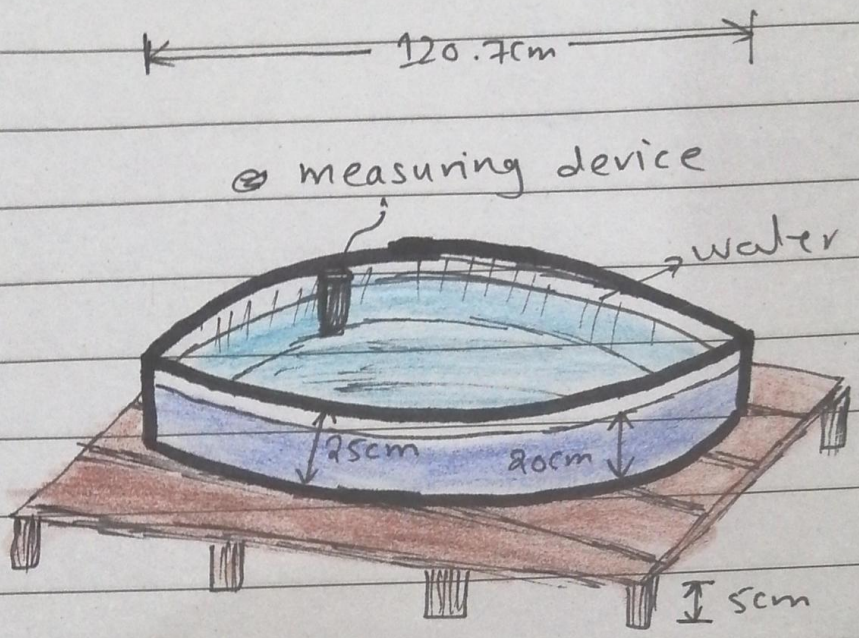
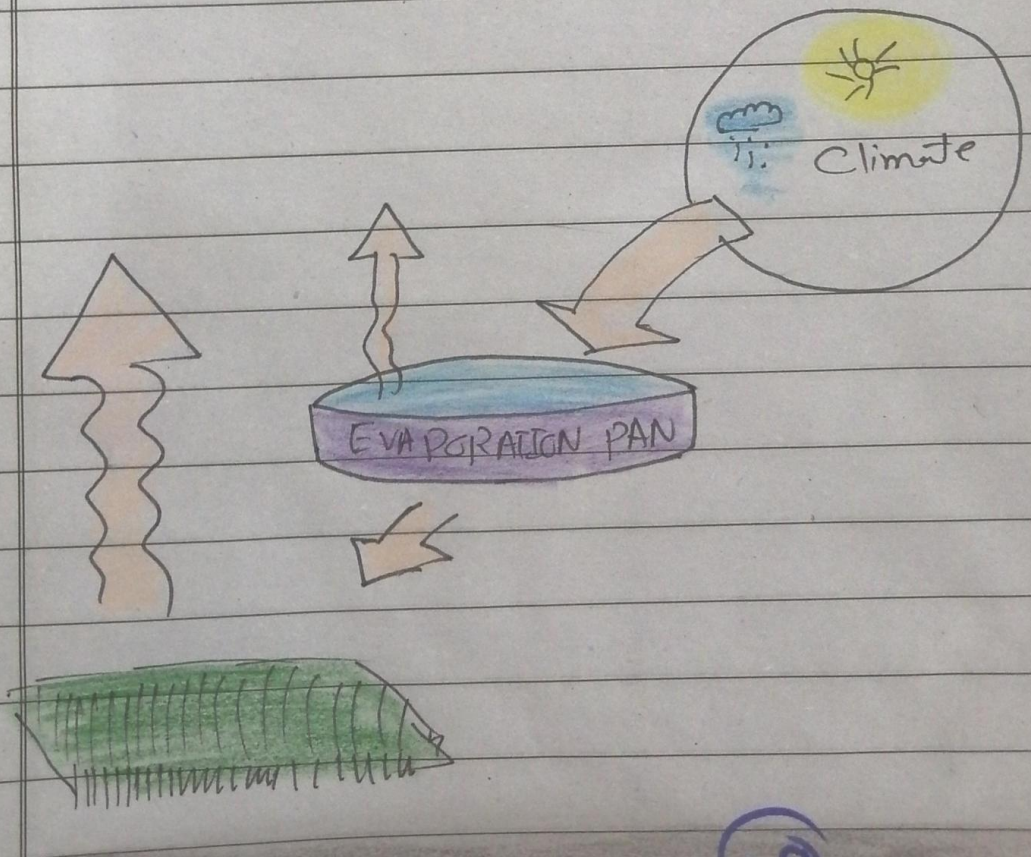


Class A Pan Evaporation.



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Question (2) Part (d)
Explain crop seasons (Rabi and Kharif) and Kharif Rabi Rabi.

Crop Seasons:-

Rabi:-

The time rang of rabi is from 1st October to 31st march (winter)

Rabi crops are:.

- ✓ Wheat
- ✓ Barley
- ✓ Gram
- ✓ Mustard

Kharif:-

The time range of Kharif is from 1st April to 30th September.

Kharif crops are:. Ric, Bajra Jawar Maiz Cotton.

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Kharif Rabi Ratio:-

The area to be irrageted for rabi crops generally more than that of 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 ie Kharif area is one half of Rabi area.

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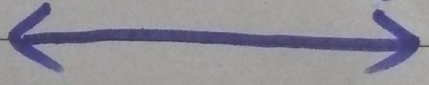
Question (3) Part (A)
Define and explain the following terms.

(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 Field Capacity.

- Period of drainage is (2-5) days.
- Field capacity is measured after 2 or 5 days



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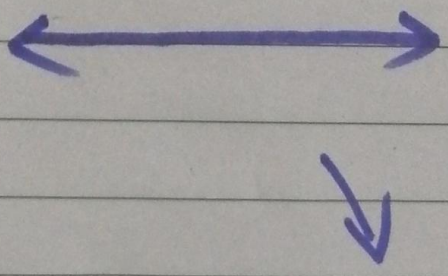
Question (3) Part (b)

(b) Permanent wilting Point:-

Permanent wilting point or wilting cofficient is that water content at which plants can no longer extract sufficient water from the soil for its growth.

✓ It is the lower end of the available moisture range.

✓ If a plant does not ~~need~~ get suffient water to meet its need, it will wilt permanently.



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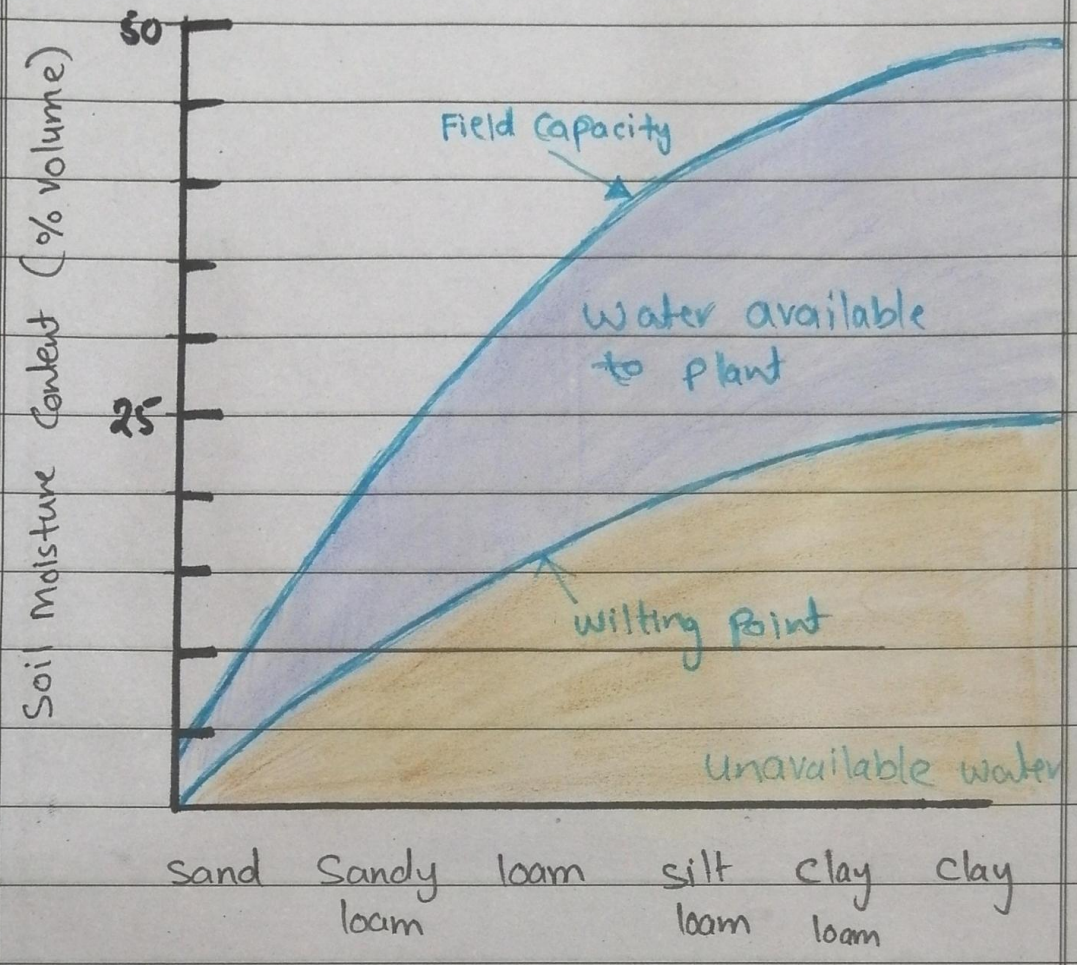

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Question (3) Part (c)
Available and redily available Moisture content

Available Moisture Content:-

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

Redily Available Moisture:-

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

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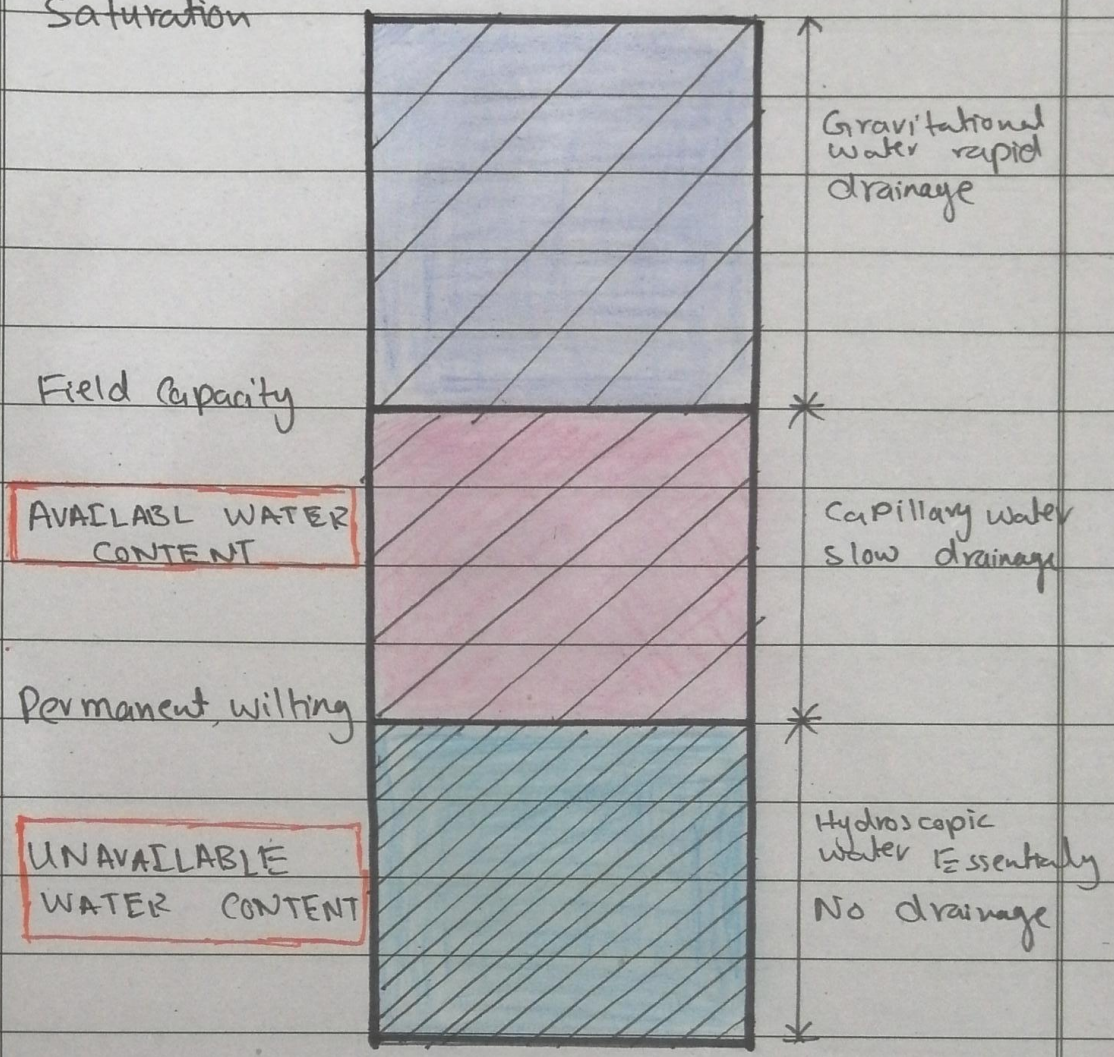

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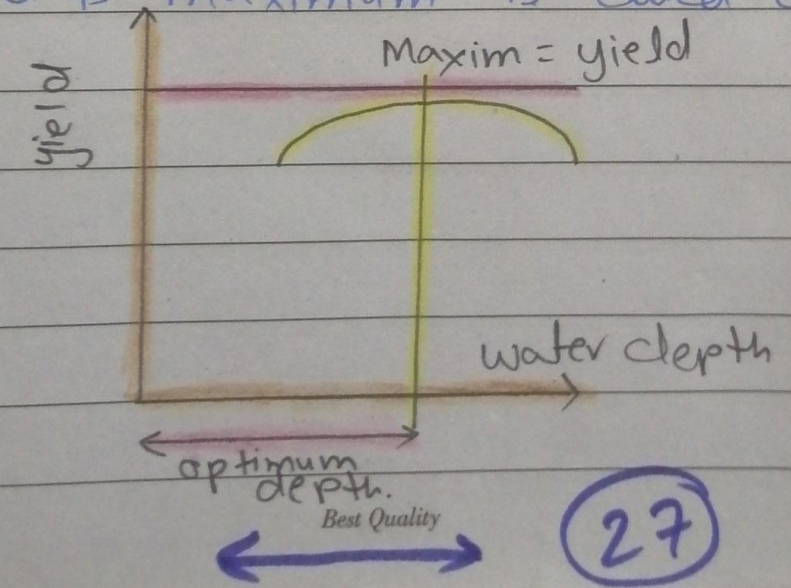
Question (3) Part (D)

optimum utilization of water

optimum utilization of water

⇒ If a crop is sown and produced under absolutely identical condition using different amounts of water depth, the yield is found to vary. The yield increases with water, reaches a certain maximum value and then fall down as shown in the following figure.

⇒ "The quantity of water at which yield is maximum is called OWD"



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