QUESTION NO. 1

(a) DELTA:

"The depth of water in centimeter or inches required for the crop throughout the base period is called Delta of the crop".

SIGNIFICANCE OF DUTY OF CROP:

The duty of crop means the area of land that can be irrigated with unit volume of irrigation water. It is the relation between the areas of a crop irrigated in the quantity of irrigation water required during the entire period of growth of the crop.

It helps 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 irrigated in different season of the year, the area which can be irrigated. If we know the crops area required to be irrigated and their duties we can work out the discharge required for designing canal.

(b) Find out the Delta for wheat:

Solution:

No of required watering for wheat crop =140/35 = 4
The depth of water required each time i-e interval = 10 cm
Total depth of water required in 140 days = 4x10= 40 cm
Delta for wheat crop is: 40 cm

(c) FACTOR AFFECTING CONSUMPTIVE USE OF WATER:

i. Precipitation:

The amount and rate of precipitation may have some effect on the amount of water consumptively in the field.

ii. Temperature:

It is an important factor and may affect consumptive use more as in summer because water will be lost due to evaporation while in cold weather less loss due to low temperature.

iii. Humidity in Air:

Humid air shall effect on consumptive use in such a way that less evaporation will be carried out and as a result less wastage of water.

iv. Velocity of Wind:

If velocity of wind is more, water loss will be more.

v. Soil Topography:
If soil topography is plain and even, the consumptive use of water will be less otherwise more.

vi. Sun Light:
Sun light off course cause of high temperature and more evaporation will be carried out of the water.

QUESTION NO. 2

(a) PRINCIPAL CAUSES AND ILL EFFECTS OF WATER LOGGING:

1. **Intensive Irrigation:**
   If maximum area of land is irrigated, percolation of water takes place. This causes the rise of water table and then water logging occurs.
2. **Seepage:** Seepage of water from adjoining high land causes water logging. Seepage of water through canal reservoirs. Water seeping below the soil moves horizontally which may cause obstruction and water table may rise.
3. **Improper Drainage:** Inadequate surface drainage like storm water and excess of irrigation water should be removed. If proper drainage is not provided water percolates to rise water table.
4. **Rainfall:** Excessive rain may cause temporary water logging and no drainage causes permanent.
5. **Submergence due to flood:** Continued floods causes the growth of water-loving plants which obstruct natural surface drainage and increase water logging.
6. **Irregular and Flat Topography:**
   In depressions, the drainage is poor water detention is more. The percolation increases the water table.

(b) ANTI-WATER LOGGING MEASURES :

i. **Lining of canals:** Lining of canals and water courses will reduce the seepage of water and no water logging.
ii. **Intensity of Irrigation:** By reducing intensity of irrigation such as small portion of land should receive canal water in one particular season. Remaining areas can receive water is next season by rotation.
iii. By Introducing crop rotation:
High water requiring crop should be followed by one requiring less water and hen by one requiring almost no water.
iv. Optimum Use of Water:
Certain amount of water gives the best result. Less or more water reduce the yield cultivators should be educated so that not to be use more water.

v. **Improving Natural Drainage of Area.**
Water should not be allowed to stay in one area. Natural flow is provided by bushes and jungle cutting.

vi. **Pumping or tube wells or vertical drainage:**
Lift irrigation should be introduced to use ground water. Canal irrigation may be substituted by tube well irrigation.

vii. Economical use of water according to need.

viii. **Adoption of sprinkler method of irrigation:**
Only predetermined amount of water is supplied to land. No percolation losses from water courses.

(c) <u>METHOD TO ADOPT RECLAIM SALINE SOIL.</u>

i. **Water Table:** By maintaining water table sufficiently below the roots.

ii. **Drainage:** An efficient drainage (surface & sub surface) must be provided to lower the water table in saline water.

iii. **Leaching Process:**
Land is flooded with water which dissolves the alkaline salts and water get percolates which is then drained off by sub surface drains.

iv. High Salts resistant crops like rice are grown lo leached land for 1 or 2 seasons.

v. **Land Drainage:**
Sub surface drains and surface drains are made in water logged soils/land to drain off the water and to reclaim the soil.

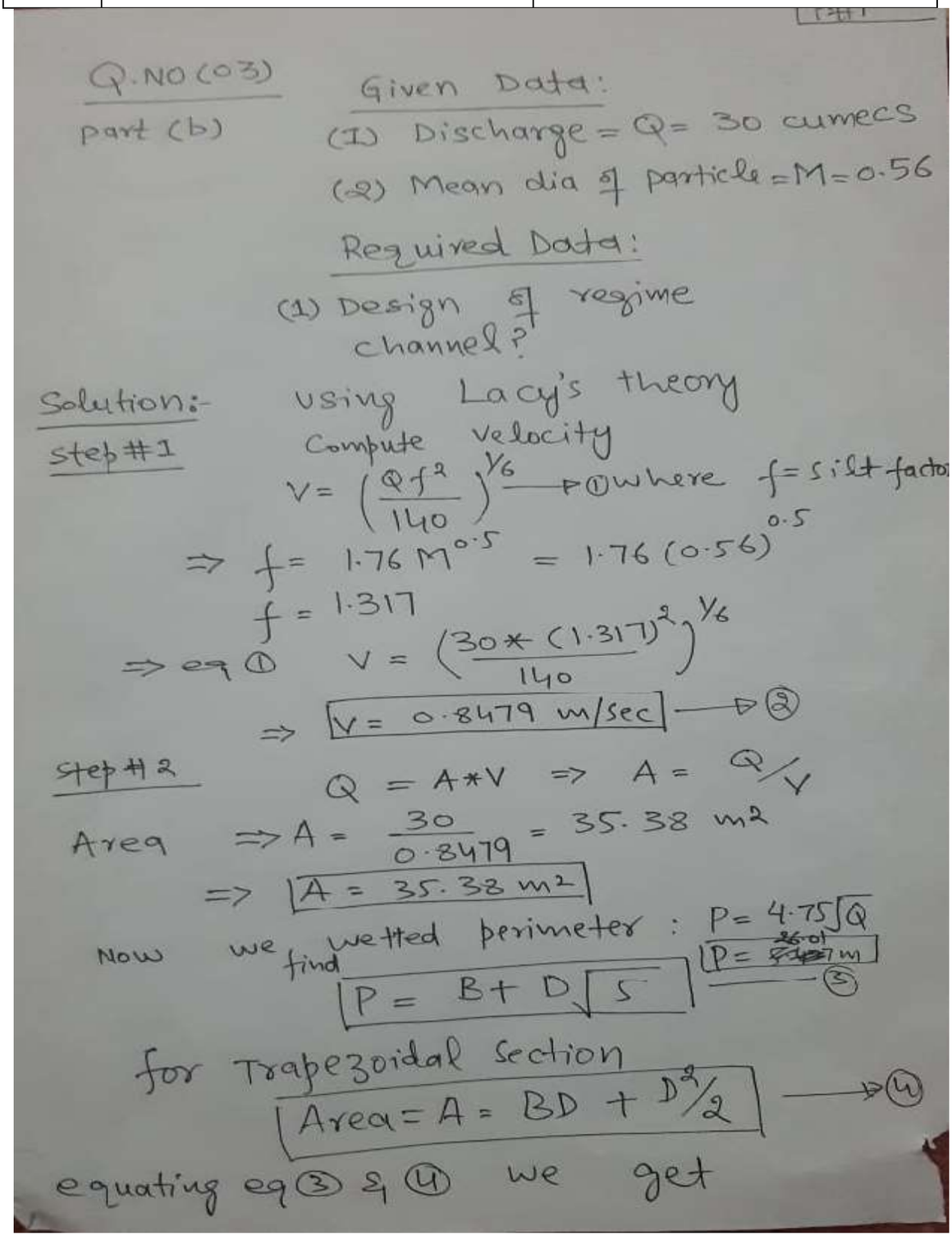
vi. **Land Grading:**
Continuous land slope towards field drains is maintained to drain off the water.

<u>QUESTION NO. 3</u>

<u>COMPARISON OF KUTTER'S & LACEY'S THEORY:</u>

S. NO.	KENNEDY'S THEORY	LACEY'S THEORY
1.	It states that the silt carried by the flowing water is kept in suspension by the vertical component of eddies which are generated from the bed of the channel.	It states that the silt carried by the flowing water is kept in suspension by the vertical components of eddies which are generated from the entire wetted perimeter of the channel.
2.	It gives relation between 'V' & 'D'	It gives relation between 'V' & 'R'
3.	In this theory, a factor known as critical velocity ration 'm' is introduced to make the equation	In this theory, a factor known as silt factor 'f' is introduced to make the equation applicable to

	applicable to different channels with different grades	different channels with different silt grades.
4.	In this theory, Kutter's equation is used for finding the mean velocity	This theory gives as equation for finding the mean velocity
5.	In this theory, the design on based on trial and error method	This theory does not involve trial and error method.



Q.NO (03)

part (b)

Given Data:

(1) Discharge = Q = 30 cumecs

(2) Mean dia of particle = M = 0.56

Required Data:

(1) Design of regime channel?

Solution:- using Lacy's theory

Step #1

Compute velocity

$V = \left(\frac{Q f^2}{140}\right)^{1/6}$ ⟶ ① where f = silt factor

$\Rightarrow f = 1.76\, M^{0.5} = 1.76\,(0.56)^{0.5}$

$f = 1.317$

$\Rightarrow$ eq ① $V = \left(\frac{30 * (1.317)^2}{140}\right)^{1/6}$

$\Rightarrow$ $V = 0.8479$ m/sec ⟶ ②

Step #2

$Q = A * V \Rightarrow A = Q/V$

Area $\Rightarrow A = \frac{30}{0.8479} = 35.38\ m^2$

$\Rightarrow A = 35.38\ m^2$

Now we find wetted perimeter : $P = 4.75\sqrt{Q}$

$P = 26.01$ m ⟶ ③

$P = B + D\sqrt{5}$

for Trapezoidal section

$\text{Area} = A = BD + D^2/2$ ⟶ ④

equating eq ③ & ④ we get

$$D = \frac{P - \sqrt{P^2 - 6.94A}}{3.472} = \frac{26.01 - \sqrt{(26.01)^2 - 6.94(35.38)}}{3.472}$$

$$= \frac{26.01 - \sqrt{676.875 - 266.35}}{3.472}$$

$$= \frac{26.01 - \sqrt{410.5178}}{3.472} = 1.655\ m$$

$$\boxed{D = 1.655\ m}$$ Now to find B

$$\Rightarrow B = P - 2.236 * D = 26.01 - 2.236 * 1.655$$

$$\boxed{B = 22.309\ m}$$

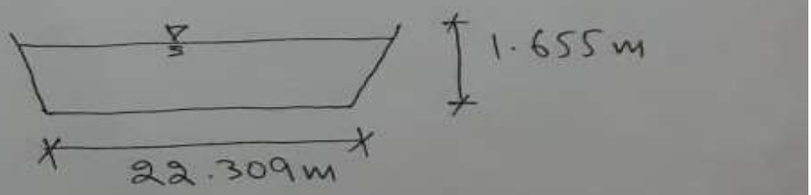
step #3 Now to compute slope

we have

$$S = \frac{f^{5/3}}{3340\ Q^{1/6}} = \frac{(1.317)^{5/3}}{3340 * (30)^{1/6}}$$

$$= \frac{1.582}{5887.53} = 2.687 * 10^{-4}$$

$$\Rightarrow \boxed{S = 0.0002687}$$



$$S = 0.000268$$

Question NO. 4

(a) <u>FIELD CAPACITY: (F.C)</u>

When all gravity water has drained down t 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 as called field capacity.

Period of Drainage: 25 Days

F.C measured after 2 of 5 days

There are two type of field capacity.

(a) Capillary Water:

Water attached to soil by surface tension which can easily be extracted by plants by capillary action.

(b) Hygroscopic Water:

Water attached to soil by chemically bonds which cannot be extracted by plants by capillary action.

Field capacity:- $\frac{\text{weight of water retained in a certain volume}}{\text{weight of same volume of soil}} \times 100$

(B) PERMANENT WILTING POINT:

A plant can extract water from soil till permanent wilting is reached. Permanent wilting point is that water content at which a plant cannot longer extract sufficient water for its growth and wilts up.

Water available to plant: Field capacity PWP water

PWP Water: Water available to plant + Field Capacity

(C) HEAD REGULATOR:

A structure which is constructed at the head of canal to regulate flow of water is known as canal head regulator.

It consist of a number of piers which divided the total width of canal into a number of spans which are known as bays. The piers consist of number tiers in which the adjustable gates are placed the gates are operated from the top by suitable mechanical device. A platform is provided on the top of the pier for the facility of the operating the gates. Again some piers are constructed on the downstream side of the canal head to support the road way.

(D) UNDER SLUICES:

Also known as scouring sluices. The under sluices are the opening provided at the base of the weir or barrage. These opening are provided with adjustable gates normally the gates are kept closed. The suspended silt goes on depositing in front of the canal head regulator. When the silt deposition becomes appreciable the gates are opened and the deposition silt is screamed with an agitator mounting on a boat. The gates are the closed but at the period of flood the gates are kept opened.