Final Term

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Section	B
Subject	Irrigation Engineering
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QNo1:

a) Explain anti water-logging measures.

Ans Methods of control of water logging

1. Lining of canals and water courses.

It reduces seepage of water

2. Reducing intensity of irrigation:

Only small portion of land should receive canal water in one particular season.

- Remaining areas can receive water in next season by rotation.

3. By introducing crop rotation.

- High water requiring crop should be followed by one requiring less water,

one requiring almost no water.

Example: Rice followed by wheat and then by cotton.

4. 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 use more water.

5. Improving natural drainage of area: Water should not be allowed to stay in one area.

- Natural flow is provided by bush and jungle cutting.

6. Pumping or Tubewells or Vertical Drainage:

Lift irrigation should be introduced be use GW. Canal irrigation may be substituted by tubewell irrigation.

7. Economical use of water according to need.

8. Adoption of Sprinkles method of irrigation.

- Only predetermined amount of wat is supplied to land.
- No percolation losses from water courses.

b) Differentiate between Saline and alkaline Soils.

Ans. Difference between Saline and alkaline soil.

- By principle of osmosis, the pure water from root flows outwards in a plant die due to lack of water. Such soil is unproductive and is called Saline soil.

- If the salt efforescence continues for a longer period, a base exchange reaction with clay takes place, thus Sodiumizing the clay, making it

impermeable, illerated and highly unproductive. such soil are called alkaline soils.

c) How do you reclaim salt affected lands?

Ans Reclamation of Salt affected lands

How to avoid efforescence

- By maintaining the water table sufficiently below the roots.
- Hence all the measures which were suggested for preventing water logging hold good for preventing salinity of lands.

- An efficient drainage must be provided to lower the water table in saline soils.

Leaching

In this process,

1) Land is flooded with water
2) Alkaline salts will be dissolved in water
3) Percolation to the ground water
4) Drained by sub surface drains.

- High salt resistant crops like rice are grown on leached land for 1 or 2 seasons.

- Then ordinary crops like wheat or cotton are grown.
- Then the land is said to have declaimed.
- When Sodium carbonate is present in soil, gypsum is added before leaching
- Sodium sulphate is formed which is leached out easily.

$$NaCO_3 + CaSO_4 \longrightarrow Na_2SO_4 + CaCO_3$$

QNo2:

a) Explain the procedure of designing of an irrigation canal by Kennedy's.

theory

Ans Kennedy Procedure for canal design

Step1:- Assume the trail value of D and put in eqn.1 and determine

$$V_0 = 0.546 m D^{0.64}$$

Step2:- In Eqn.1: $Q = AV$

$$A = Q/V$$

$$A = BD + D^2/2$$

$$P = B + D S^{1/2}$$

For assumed D determine B

Find $R = A/P$

Step 3:- Substitute the value of R in equation 2 (Kutters and chazys Eqn) to obtain V which will be the actual velocity for assumed dimension.

Step 4:- If the velocity worked out from Eqn 2 agrees with that of obtained with eqn. 3 (Kennedeys Eqn) Then the assumed depth is correct. Other wise repeat the procedure with changed value of D.

b) Design an irrigation channel by Kennedy's theory to carry a discharge of 30 cumecs with cvs m of 1 and

N as 0.0225 and bed slope of 1/5000 Assume the depth D. as 2.3m

Given Data

$$Q = 30\ m^3/sec$$

$$C.V.R = m = 1$$

$$N = 0.0225$$

$$S = 1/5000$$

Sol:- First Assum the depth $d = 2.4m$

Step 01 Trail 1

$$V_0 = 0.55\ m\ D^{0.64}$$

$$V_0 = 0.55 \times 1 \times (2.4)^{0.64}$$

$$V_0 = 0.963$$

Step 02

$$Q = AV$$

$$A = \frac{Q}{V}$$

$$A = \frac{30}{0.963}$$

$$\boxed{A = 31.153\ m^2}$$

$$A = BD + D^2/2$$

$$31.153 = B \times 2.4 + \left(\frac{2.4}{2}\right)^2$$

$$\boxed{B = 11.78\ m}$$

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

$$P = 11.78 + 2.4\sqrt{5}$$

$$P = \boxed{17.146\ m}$$

$$R = \frac{A}{P} = \frac{31.153}{17.146}$$

$$\boxed{R = 1.82}$$

Step 3 $V = C(\sqrt{RS})$ (Kutter and Chezy eq)

$$C = \frac{1}{0.0225} + \frac{\left(23 + \frac{0.00155}{0.0002}\right)}{1 + \left(23 + \frac{0.00155}{0.0002}\right)} \times \frac{0.0025}{\sqrt{1.82}}$$

$$C = \frac{75.194}{1.513}$$

$$C = \boxed{49.703}$$

$$V = C(\sqrt{RS})$$

$$V = 49.703 \times \sqrt{1.82 \times 0.0002}$$

$V = 0.948$ which less than $V = 0.963$

Then decrease the depth

$d = 2.3\,m$

Trail 2 this and trail are directly calculated value

$D = 2.3\,m$

Step 1- $V_0 = 0.55 \times 1 \times (2.3)^{0.64}$

$$\boxed{V_0 = 0.937\ m/sec}$$

Step 2- $A = \frac{Q}{V} = \frac{30}{0.937}$

$A = 32.017\ m^2$

$A = BD + \frac{D^2}{2}$

$B = 12.77\ m$

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

$P = 17.913\ m$

Step 3 $C = \frac{75.195}{1.518}$

$C = 49.535$

$R = \frac{A}{P}$

$R = 1.787$

$V = C \times \sqrt{RS}$

$$V = 49.535\sqrt{1.787 \times 0.0002}$$

$V = 0.93$ m/sec which equal to V_0

V_0

Q No3.

a) Differentiate between intial regime and final regime in accordance to Laceys theory.

Ans Initial Regime

When only bed slope of channel changes but the cross section remains same then also no silting or scouring take place. But this is rare.

Final Regime:

- If all the parameters (perimeter, depth and slope) have equally free to vary and adjust according to discharge

and silt grades then the channel is said to have final regime.

i. In final regime the cross section assume semi ellipse shape.

The channel is said to be regime when the following conditions are satisfied.

1. The channel is flowing in unlimited, in-coherent alluvium of same character (grade)

2. Silt grade and silt discharge is constant

3. Q is constant.

b) Design a regime channel by Lacey's theory for discharge of 30 cumecs and mean diameter of silt particle of 0.56mm

Given Data

$Q = 30\ m^3/sec$

$M = 0.5mm$

Sol:- Silt Factor $= f = 1.76 \times M^{0.5}$

$f = 1.76 \times (0.56)^{0.5}$

$\boxed{f = 1.3}$

$V_m = \left[\frac{Q f^2}{140}\right]^{1/6}$

$$= \left(\frac{30 \times (1.3)^2}{140}\right)^{1/6}$$

$$\boxed{Vm = 0.844}$$

$$Q = AV$$

$$A = \frac{Q}{V} = \frac{30}{0.844}$$

$$A = 35.54$$

$$P = 4.75\sqrt{Q}$$

$$P = 4.75\sqrt{30}$$

$$\boxed{P = 26.01}$$

$$R = \frac{S}{2} \times \frac{V^2}{f} = \frac{S}{2} \times \frac{(0.844)^2}{1.3}$$

$$\boxed{R = 1.36}$$

$$A = BD + \frac{D^2}{2}$$

$$35.54 = BD + \frac{D^2}{2} \rightarrow (1)$$

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

$$26.01 = B + 2.36D$$

$$B = 26.01 - 2.236D \rightarrow (2)$$

Put equ (2) in eq (1)

$$35.54 = (26.01 - 2.236D)D + \frac{D^2}{2}$$

$$35.54 = 26.01D - 2.236D^2 + \frac{D^2}{2}$$

$$35.54 = 26.01D - 2.236D^2 + 0.5D^2$$

$$35.54 = 26.01D - 1.736D^2$$

$$\frac{-1.76D^2}{a} + \frac{26.01}{b} - \frac{35.54}{c} = 0$$

$a = 1.736 \quad b = 26.01 \quad c = -35.54$

By Quadratic eq

$$D = \frac{-(26.01) + \sqrt{(26.01)^2 - 4(-1.736)(-35.54)}}{2(-1.736)}$$

$$\boxed{D = 1.52}$$

Put in eq (2)

$$B = 26.01 - 2.236(1.52)$$

$$\boxed{B = 22.611}$$

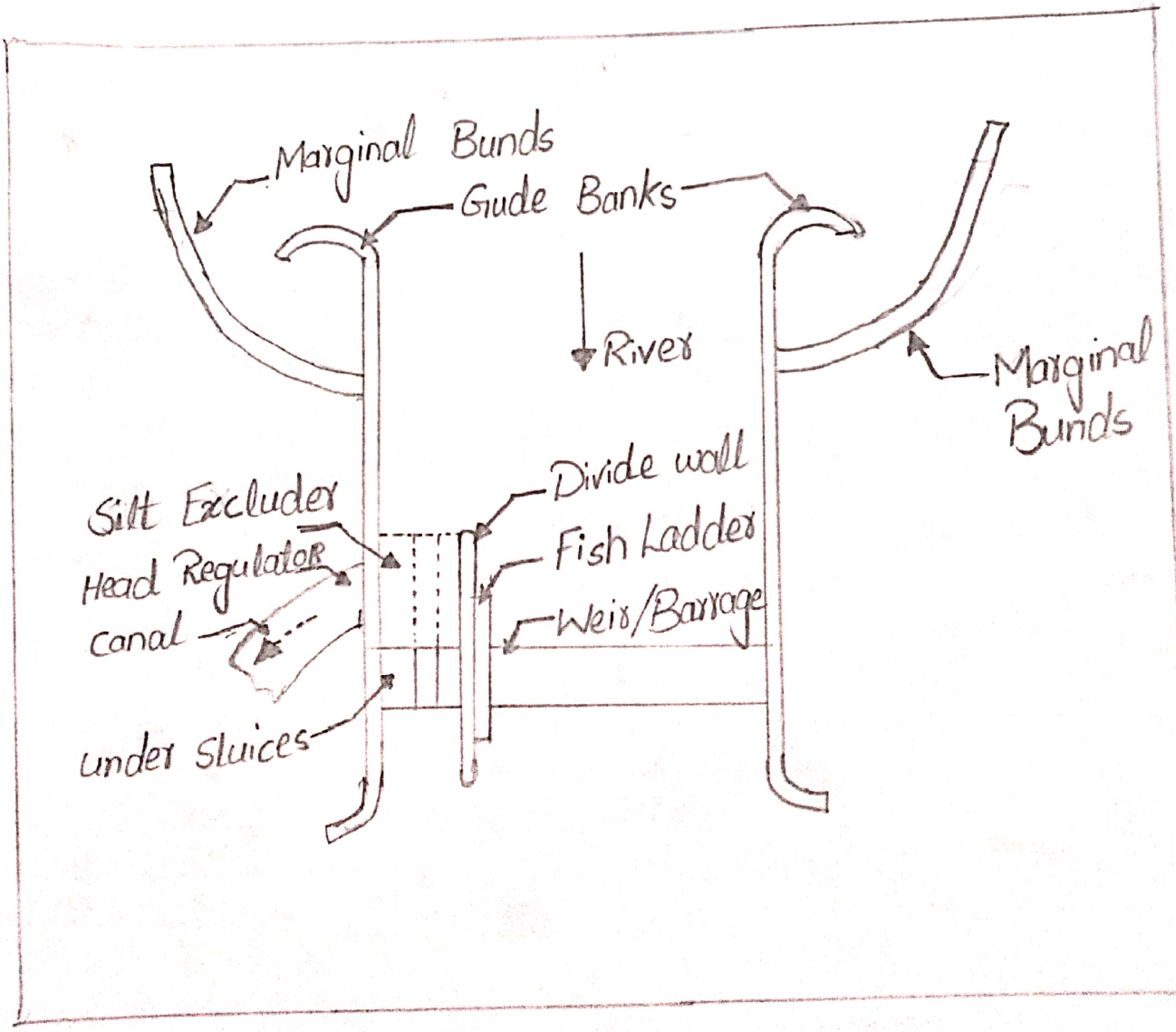
$$S = \frac{\int (F_3)}{3340\, Q^{1/6}}$$

$$S = \frac{(1.3)^{5/3}}{3340\, (B_0)^{1/6}}$$

$$\boxed{S = 0.00026}$$

Q.No 4

a) Explain the components of headworks with neat diagram.



Weir :-

Normally the water level of any perennial river is such that it cannot be diverted to the irrigation canal. The bed level of the canal may be higher than the existing water level of river. In such cases weir is constructed across the river to raise the water level. Surplus water pass over the crest of weir. Adjustable shutters are provided on the crest to raise the water level to some required height.

Barrage :-

When the water level on the up stream side of the weir is required

be raised to different time, barrage is constructed. Barrage is an arrangement of adjustable gates or shutters at different tires over the weir.

Under sluices:- Also known as scouring sluices. The under sluices are the openings provided at the base of weir or barrage. These are openings are provided with adjustable gates.

Divide wall:- The divide wall is a long wall constructed at right angles in

the weir or barrage, it may be constructed with stone masonary or Cement Concrete. On the upstream side, the wall is extended just to cover the canal head regulator and on the downstream side it is extended up to the launching apron.

- Fish ladder: The fish ladder is provided just by the side of the divide wall for the free movement of fishes. Rivers are important source of fishes. The tendency of fish is to move from

upstream to downstream in winter and from downstream to upstream in monsoons. This movement is essential for their survival. Due to construction of weir and barrage, this movement gets obstructed, and is detrimental to fishes.

b) What are the functions of Head regulator

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

Functions of Canal Head Regulator:

it regulates the supply of water entering the canal. It controls the entry of silt in the canal. it prevents the river-floods from entering the canal.