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SEMESTER 6th

SUBJECT IRRIGATION ENGINEERING

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Q.4 (1) Explain anti water - logging measures:-

(2) Following are the anti water logging measures;

(1) "Lining of canals and water courses:-"

Lining of canals and water courses reduces seepage of water.

- It also make the diming through the proper channel reducing major losses to greater extent.

(2) "Reducing Intensity of Irrigation:-"

- Small portion of land should recieve canal water in one particular season.
- The remaining area of land can recieve water in next season by crop rotation.

3) "Introduction to crop rotation":-

- High water requires crops should be followed by one requiring less water and then by 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
- Cultivated should be educated so that not to use more water.

5) "Improving natural drainage of Area:"

- Natural flow is provided by brush and jungle cutting.
- water should not be allowed to stay in one area

6) "Pumping or Tubewells :-"

- Lift irrigation should be introduced to use ground water.
- Canal irrigation may be substitute by tube well irrigation.

b)

Saline Soil	Alkaline Soil
• By Principle of osmoses, pure water from root flow outwards in a plant die due to lack	• If the salt efflorescence continous for a long period, a base exchange reaction with clay take place Thus sodiumizing the clay making it

of water, such soil is unproductive and called soline soil.

- Saline soil appearance is as a black crustly core over the surface of earth.

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

- It is white in appearence as white patches appears over earth surface.

C How do you reclaim salt affects land?

Following are the major aspects to reclaim salt affected lands:-

1. Maintain the water table sufficiently below the roots.
2. An efficient drainage (surface & subsurface) must be provided to lower the water table in saline soil.
3. The practise of crops reversal is necessary to reduce the establishment of salt or efflorescence
4. Land should be folded with water so that alkaline salts will be disolved in water
5. High salt resistant crop like rice are grown on leached land for 1 or 2 season.

Q No ②

Following are the steps required for designing an irrigation canal using kennedy's theory.

Step # 01:-

Assume the trail value of D and put it in equation ($Q = Av$) and determine

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

"Step # 02:"

As equation ① is $Q = Av$

$$A = Q/v$$

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

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

for Assumed D determine B,

find $R = A/P$

"Step # 03:-

Substitute the value of R in eq (kutters and chezys eq) to obtain v which will be the actual velocity for assumed dimension.

"Step :- ④"

If the velocity worked out from eq ② agrees with that of obtained with the eq

(Kennedeys equ) → Then the assumed depth is correct - otherwise repeat the procedure with changed value of D.

PART "B"

Given DATA:-

$D = 2.3m$

$Q = 30 \text{ cumec}$

$C.V.R = m = 1$

$N = 0.025$

$S = 1/5000 = 0.0002$

As we know $Q = AV$

$A = Q/V = \frac{30}{V}$ - (1)

Thus using formula to compute "V"

$V_0 = 0.546 (1)(2.3)^{0.64}$

$V_0 = 0.935 \text{ m/s}$ → put this value in eq (1)

$A = \frac{30}{0.935} = 32.01 m^2$

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

$32.01 = B(2.3) + \frac{2.3^2}{2}$

$B = 12.77m$ put the value in below eq :-

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

$= 12.77 + 2.3(\sqrt{5})$

$P = 17.9m$

P.T.O

Now $R = \frac{A}{P} = \frac{32.01}{17.9} = 1.76$

Substituting the value of 'R' in Kutter's and Chezy's equation

$$V = C(RS)^{1/2} \quad - (a)$$

$$C = \frac{\frac{1}{n} + \left(23 + \frac{0.00155}{S}\right)}{1 + \left(23 + \frac{0.00155}{S}\right)\frac{n}{\sqrt{R}}}$$

$$C = \frac{\frac{1}{1} + \left(23 + \frac{0.00155}{0.0002}\right)}{1 + \left(23 + \frac{0.00155}{0.0002}\right)\frac{1}{\sqrt{1.76}}}$$

put the value in eq (a)

$$V = 49.526 (1.76 \times 0.0002)^{1/2}$$

$$V = 0.93 \text{ m/s}$$

This is equated to V_0

Thus no more trial required.

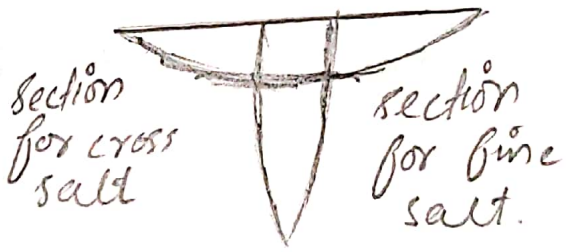
Q No3
(A)

Initial Regime

- When only bed slop of channel changes but the cross-sectional remain the same then their will be no silting and scouring.
- Cross-section or wetted perimeter remains unaffected.
- It is a quick process and occurs within short span time.

FINAL Regime

- If all parameter (depth, slope) have equally free to vary & adjust according to discharge and silt grade then the channel is solid to have final regime.
- In final regime, the cross-sectional assume semi-ellipse Shape.



Part "B"

Given data

$Q = 30$ cumec , $d = 0.56$ mm (m)

By formula silt factor $= f = 1.76 \times m^{0.5} = 1.76(0.56)^{0.5}$

$\Rightarrow V_m = \left[\frac{Qf^2}{140}\right]^{1/6} = \left[\frac{30 \times (1.3)^2}{140}\right]^{1/6}$ $\boxed{f = 1.3}$

Qno ⇒ $\boxed{Vm = 0.844\ m/s}$

⇒ $Q = AV$; $A = Q/V$ ⇒ $\frac{30}{0.844}$ ⇒ $\boxed{A = 35.54\ m^2}$

$P = 4.75\sqrt{Q} = 4.75\sqrt{30}$ ⇒ $P = 26.01$

$R = s/2 \times V^2/g$ ⇒ $s/2 \times \frac{0.844^2}{1.3}$ $R = \boxed{1.36\ mm}$

As we know

- $A = BD + D^2/2$; $35.54 = BD + D^2/2$ ⇒ (1)
- $P = B + D\sqrt{5}$; $26.01 = B + 2.236\ D$ – (2)

Thus $B = 26.01 - 2.236\ D$ – (3)

put eq (3) in eq (1)

$35.54 = 26.01 - 2236\ D + D^2/2$

$35.54 = 26.01\ D - 236\ D^2 + D^2/2$

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

$1.736D = 26.01D + 35.54 = 0$ (using quadrant formula)

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(26.01) \pm \sqrt{(26.01)^2 - 4(1.736)(35.54)}}{2(-1.736)}$

$D = 1.52$ put in eq (3) we get

$B = 26.01 - 2.236\ (1.52)$

$B = 22.611 mm$

NOW $\frac{f^{5/3}}{3340\ Q^{1/6}} = \frac{(1.3)^{5/3}}{3340\ (30)^{1/6}}$

$\boxed{S = 0.00027}$

Q.NO 4
"A"

Following are the component's of headwork:-

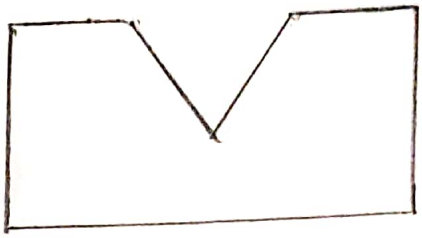
- weir or barrage
- undersluices
- Divide wall
- Fish Ladder
- Canal head Regulator
- silt excluded / silt prevention devices
- River training works

1. Weir or Barrage:-"

Normally the water level of any perennial river is such that it cannot be diverted to the irrigation canal. The bed level of canal may be higher than the existing water level of river. In such cases weir is constructed across the river to rise the water level. adjustable shutter are provided on the crest to arise the water level ~~on the upstream side~~ of to some required height

- when the water level on the upstream side of the river is required to be raised to different level out different time,

barrages is constructed barrages is the arrangement of adjustable gates at different tires over the weir.

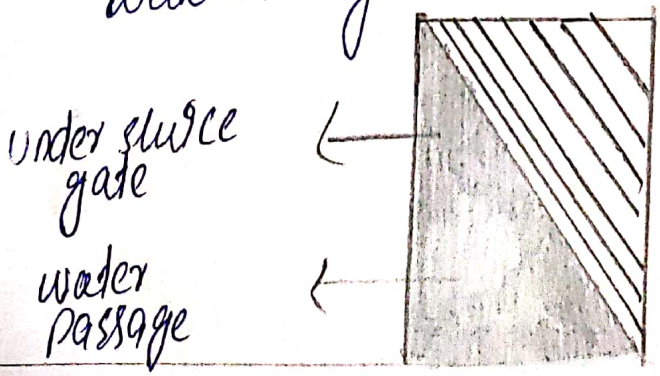


weir.

② undersluice :-"

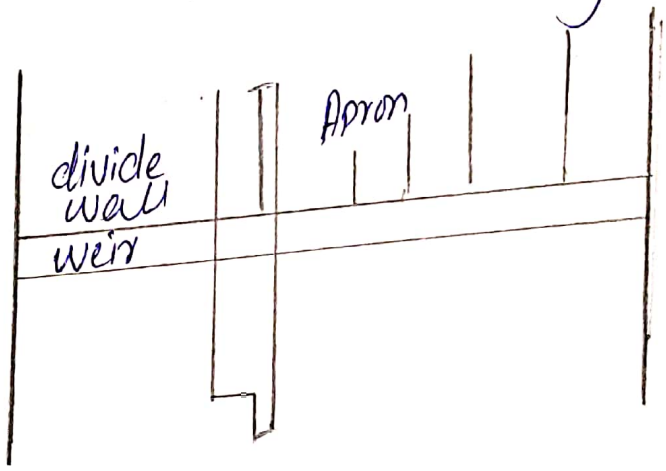
It is also known as scouring sluice - The undersluice are the opening provided at the base of the wire- these opening are provided with adjustable gates are kept closed normally. The suspended silt goes on depositing in front of the canal head regulator.

- when the side depositing becomes appreciable the gates are opened and the deposided site is loosened with an agilator mounting on a boat.



3. "Divide Wall":-

The divided wall is a long wall constructed at a right angles in the weir. It may be constructed with stone masonry or cement concrete. on the upstream side, the wall is extended just to cover the canal head regulator and on the downword side, the wall is extended just to cover the canal head regulator and on the downword side, it is extended upto the launching apron.



4. Fish Ladder:-

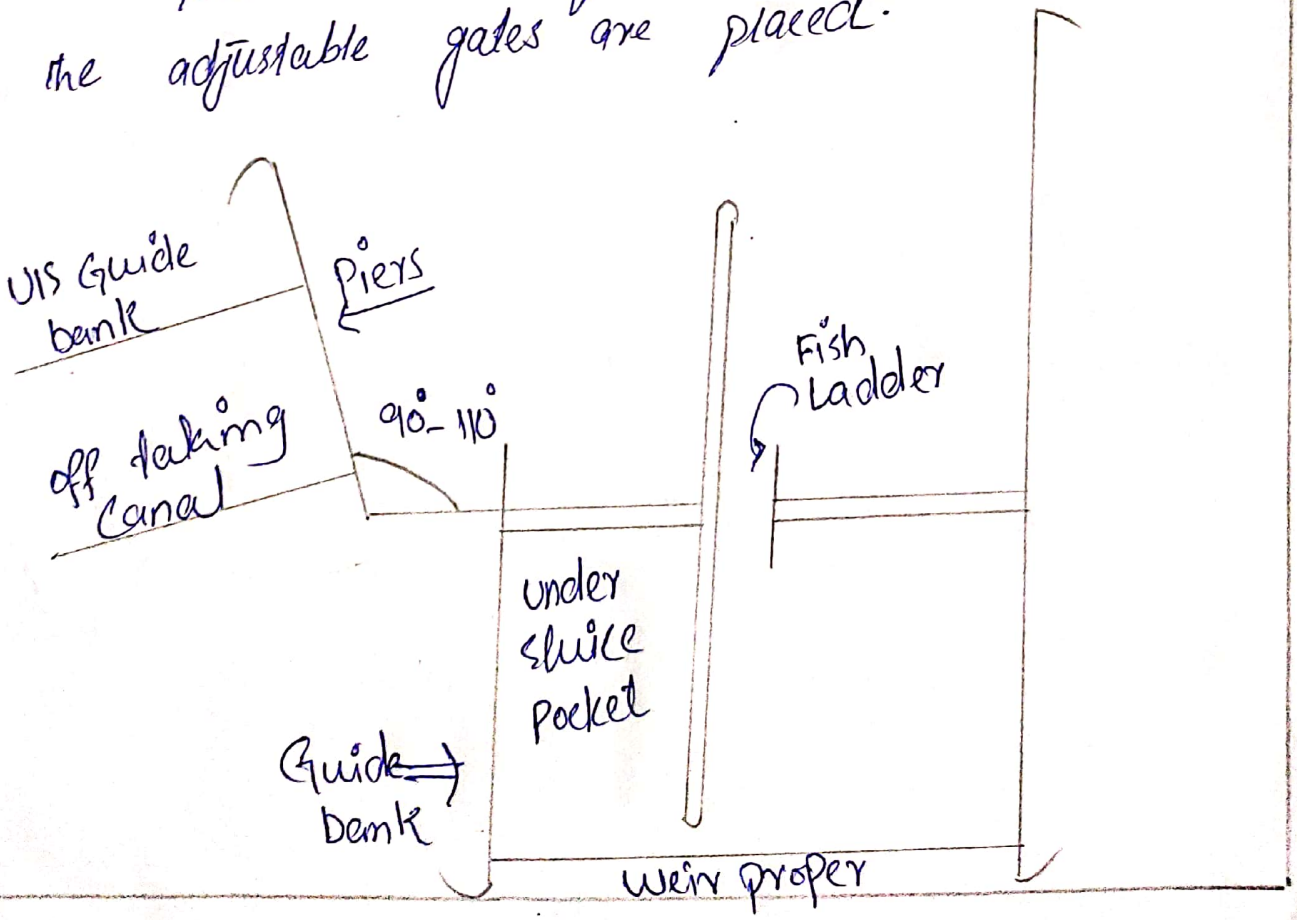
The fish lader is provided just by the side of the divide wall for the free movement of fishes. Rivers are the important sources of fishes. The tendency of fish is to move from upstream to downstream in winter and from downstream to upstream in moonsoons. This movement is essential for their survival. Due to construction of

Weir and barrages, this movement gets obstructed and is detrimental to the fishes.

Fish Ladder

(5) "Channel head regulator:-"

A structure which is constructed at the head of the canal head regulator. It consist of number of the piers which divide the total width of the canal into number of span which are known as bays. the piers consist of number of tires on which the adjustable gates are placed.



Part (B)

- The major function is to regulate the supply of water into the canal - It control the entry of silt in the canal. It prevent the river floods from entering the canal.
- It regulate / indicate the discharge passed into the canal from design discharge formula.