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Section 'A'

Program BSC (civil)

paper Irrigation Engineering

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QNo1

Explain anti water-logging measures?

Ans1

1- Limiting of canals and water courses
- to reduce seapage of water.

2- Reducing intensity of irrigation
- only small portion of land should recieve canal water in one particular season.

3. By introducing crop rotation.
- High water requiring crop should be followed by one requiring less water, and then by one requiring almost no water.

4- optimum use of water.
- certain amount of water gives the best result. less or more

water reduce to 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 tubewalls or vertical drainage

- Lift irrigation should be introduced to use GW.

canal irrigation may be substituted by tube wall irrigation.

7- Economical use of water according to need.

8. Adopt of sprinkler method of irrigation. only predetermined amount of water is supplied to land.

Q1 (B) Differentiate b/w saline & alkaline solids?

Saline soil	alkaline soil
·) Saline soil are the soil that have a ph in b/w 7 & 8.5 on exchangeable sodium percentage below 15%	·) Alkaline soil are the soil that have a Ph greater than 8.5 and an exchangable sodium percentage greater than 51%.
·) PH less than 8.5	·) PH greater than 8.5
·) sodium percentage less than 15%	·) sodium percentage greater than 15%.
·) Electricity conductivity is 4 or more. mmhos/cm.	·) usually less than 4 mmhos/cm
·) organic matter content is high in saline soil	·) organic matter content is low in alkaline soil.

Q1 Part(c) How do you reclaim 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:

- Land is flooded with water.

- Alkaline salt will be dissolved in water.
- percolation to the ground water.
- Drained by sub surface drains.
- High salt resistance crops like rice are grown on leached land for 1 or 2 seasons.
- Then ordinary crop like wheat or cotton are grown.
- Then the land is said to have reclaimed. when sodium carbonate is present in the soil, gypsum is added befor leaching. Sodium carbonate sulphate is formed which is leached out easily.

Question NO 2

part A

a) Explain the procedure of designing of an irrigation canal by ~~Kee~~ Kennedy's theory,

Ans: R G Kennedy investigated canals systems for twenty years and come up with keneedy's theory. Kennedy studied straight reaches of upper Bari Doab canal which are stable for 30 years.

$\Rightarrow V_o = CD^N$

where

$\Rightarrow V_o \Rightarrow$ is critical velocity

$C \Rightarrow$ is constant depends upon quantity of silt.

Assumptions of Kennedy's

1- The sitting power of a channel depends upon its velocity, which controls the eddies.

2- Vertical component of eddies support the

silt particles.

3- The silt transportation power depends upon its depth.

4- The silt transporting power of a channel is independent of bed width.

Canal designing by Kennedy's theory:

Step 1:

Assume the trial value of D and put in eq (1) and determine

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

Step 2:

From equation (1)

$$Q = AV$$

$$A = BD + D^2/2 \rightarrow (A)$$

$$P = B + D^{5}/_{2} \quad \text{---} \ B$$

$\Rightarrow$ For assumed D, determine B

$\Rightarrow$ Also find $R = A/P$.

Step 3: Now substitute the value of R in equation 2 (Kutters and chazy equation) to obtain V which will be actual velocity for assumed dimensions.

Step 4; If the velocity worked out from equation (2) agrees with that of obtained equation (3) (Kennedy's Equation) then the assumed depth is correct. other wise repeat the procedure with changed value of D.

Question NO 2
part B.

Design an irrigation channel by Kennedy's theory to carry a discharge of $30 m^3/sec$ with CVR (m) of 1 and N as 0.0225 and bed slope of 1 in 5000. Assume the depth (D) as 2.3m.

Given data:

Discharge = $30 m^3/sec$

Cvr (m) = 1

N = 0.00225

Bed slope = 1 in 5000

Depth (D) = 2.3m

Solution:

finding velocity

By formula

$V_K = 0.546 m D^{0.64}$

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

$\Rightarrow \boxed{V_K = 0.930 m}$

Now calculating area of canal

By formula

$Q = AV \rightarrow A = Q/V$

$A = 30/0.930$

~~Area~~ 32.25

$\boxed{\text{Area} = 32.25 m^2}$

Now we have to calculate B, By using formula

$$A = BD + \frac{D^2}{2} \Rightarrow BD + 0.5D^2$$

$\Rightarrow$ By putting values

$$A = BD + 0.5D^2$$

$$32.25 = B(2.3) + 0.5(2.3)^2$$

$$32.25 - 2.645 = 2.3(B)$$

$$29.605 = 2.3(B)$$

$$\Rightarrow \boxed{B = 12.87m}$$

$\Rightarrow$ Now we have to calculate wetted perimeter,

so By formula

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

$$= 12.87 + \sqrt{5}\,(2.3) \Rightarrow \boxed{P = 18.01m}$$

$\Rightarrow$ Now we have to calculate hydraulic Radius

$$R = A/P$$

$$= 32.25/18.01 \Rightarrow \boxed{R = 1.79m}$$

Now calculating mean velocity from chezy equation,

$$V_c = C(RS)^{1/2}$$

where

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

$$\Rightarrow \frac{\frac{1}{0.0225} + \left(23 + \frac{0.00155}{(1/5000)}\right)}{1 + \left(23 + \frac{0.00155}{1/500}\right) \times \left(\frac{0.0225}{\sqrt{1.79}}\right)}$$

Now

$$C = \frac{75.19}{1.517} = 49.56$$

$$\Rightarrow V_c = 49.56\left(1.79\left(\frac{1}{5000}\right)\right)^{1/2}$$

$$V_c = 0.93$$

$$\Rightarrow \boxed{V_c = 0.93\ m}$$

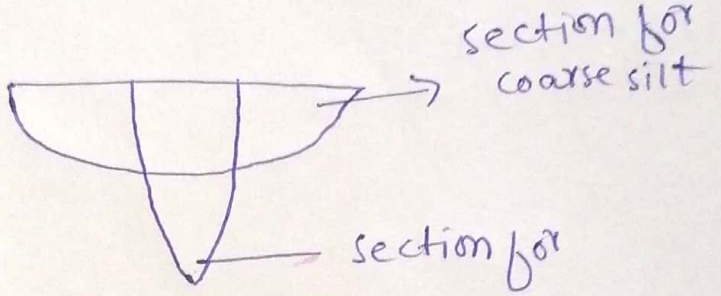
Q3 (A) Differentiate between initial regime and final regime.

1) Initial regime:

When only bed slope of channel changes but the cross section remains same than also no sitting or scouring take place But this is rare. The increased velocity enables the discharge to pass through the channel having small width.

2) Final regime: This is the ultimate regime condition attained by the channel when, in addition to varying bed slope and depth of the channel the width of the channel is also allowed to vary.

in final regime the cross section assume semi ellipse shape.



coarse the silt flatter the ellipse

•) Fine the silt the section is semi circle (greater the depth)

Question 3 part B

Design a regime channel by Lacy's theory for discharge 30 m^3/sec and mean diameter of silt particle is 0.56mm.

Given data:

Discharge (Q) = $30 m^3/sec$

Mean dia of silt particle (M = 0.56mm

Solution:

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

$$= \left[\frac{30 (1.32)^2}{140}\right]^{1/6}$$

$v_m = 0.85$ m/sec

⇒ Now we will hydraulic mean depth

$$R = \frac{5}{2}\left(\frac{v^2}{f}\right)$$

$$\frac{5}{2}\left(\frac{(0.85)}{1.32}\right)^2 = \boxed{R = 1.36}$$

⇒ Now finding the value of 'P'

By formula

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

so Now we have to find area by the help of discharge formula

$$Q = AV$$

$$\Rightarrow A = Q/V$$

$$= \frac{30}{0.85} \Rightarrow \boxed{A = 35.29\ m^2}$$

Now $P = 4.75\sqrt{Q}$

$$= 4.75 \times \sqrt{30} = \boxed{P = 26.02}$$

Finally, we have to calculate 'S'

By using formula

$$S = \frac{f^{5/3}}{3340\, Q^{1/6}}$$

$$= \frac{(1.32)^{5/3}}{3340 \times (30)^{1/6}}$$

$$\Rightarrow S = 0.000269$$

Now dimension cackulations;

By formula

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

$$\Rightarrow 35.29 = BD + \frac{D^2}{2} \rightarrow (i)$$

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

$$26.01 = B + 2.236D$$

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

Put eqn (2) in (i)

$$35.29 = (26.01 - 2.236)D + \frac{D^2}{2}$$

$$35.29 = 26.01D - 2.236D^2 + \frac{D^2}{2}$$

$$35.29 = 26.01D - 2.236D^2 + 0.5D^2$$

$$35.29 = 26.01D - 1.736D^2$$

$$\Rightarrow \underset{a}{-1.736}D^2 + \underset{b}{26.01D} - \underset{c}{35.09} = 0$$

Now By Quadratic equation

$$D = -(26.01) + \frac{\sqrt{(26.01)^2 - 4(-1.736)(-35.29)}}{2(-1.736)}$$

$\boxed{D = 1.51m}$ → put in eq (2)

$$B = 26.01 - 2.236\ (1.51)$$

$$\Rightarrow \boxed{B = 22.63\ m}$$

Question No 4 (A)

Explain the components of head work with neat diagram.

Components of Headwork:

1= Weir: A horizontal barrier is constructed along side the river horizontally which is known as weir. The weir should be situated at right angle to the main stream of the river as far as possible.

2 = under sluices:

The under sluices are constructed on the side of the river where, the canal takes off through the structure known as the head regulator of the canal. if there are canals taking off from both sides of the river upstream, then there shall be two under sluices, one on each sides.

3- Canal head regulator:

The canal head regulator is of three fold.

1. To regulate the supply entering the canal
2. To control the amount of silt entry in to the canal
3. To shut out river floods entering the canal.

4- Fish Ladder.

In the large rivers, the fish are always moving from one part to another, in the begining of winter they leave the cold water in the hills and move down to the relatively warm water in the plains.

The design of the fish ladder should be such that the velocity of the current against which the fish have move shall not be higher than this limit.

5 Divide wall:

The divide wall is simply a long wall built between the weir and the under sluices. The wall extends upstream to a little distance beyond the begining of the head regulator and downstream to the end of the talus of the under sluices.

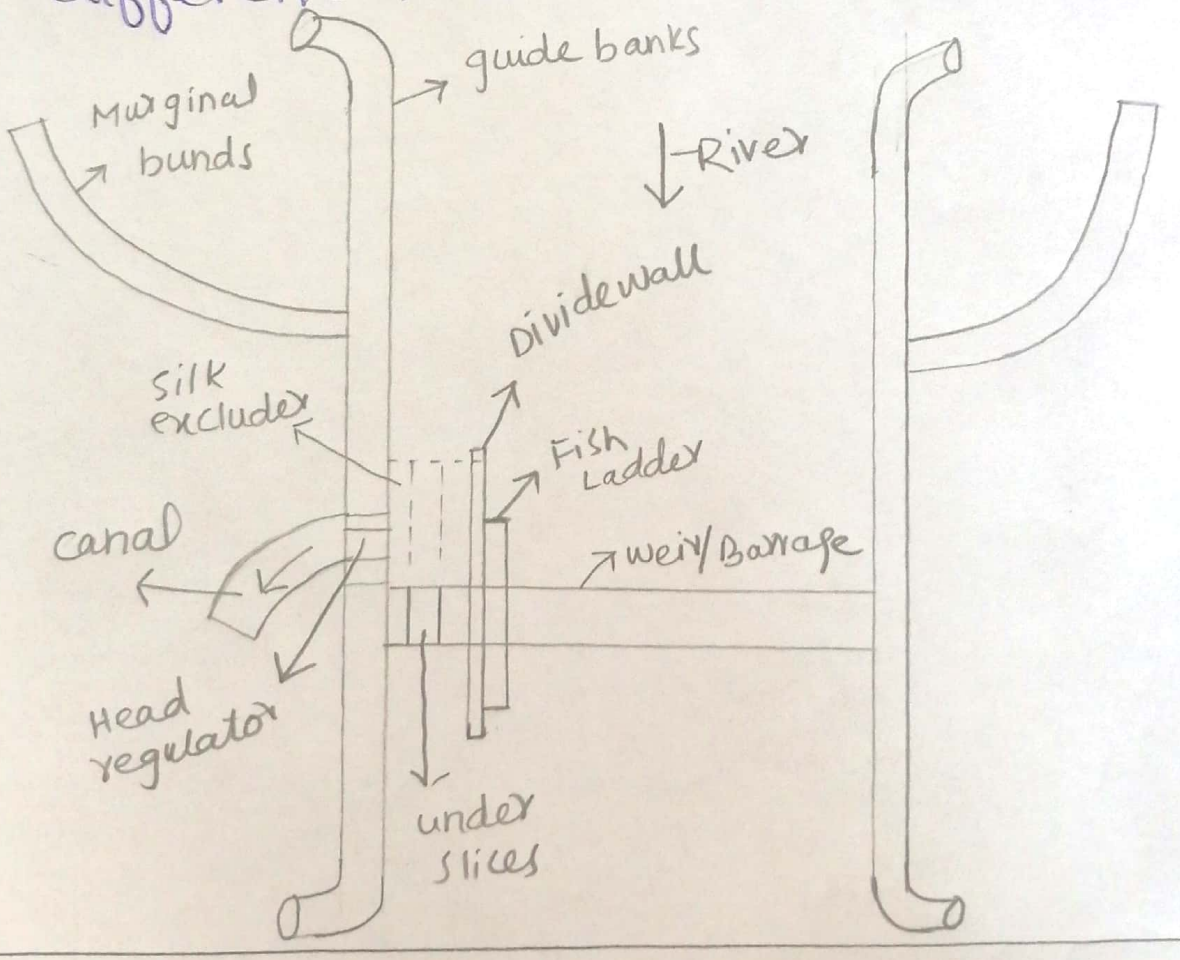
6- River control works:

River control works are used to provide approach to weir and to prevent the river from out flanking the weir. They are also used to prevent the erosion of the river banks and to prevent additional area to be submerged.

in the water due to afflux.

7- Barrage:

when the water level on the up stream side of the weir is required to be raised to different levels at different time, barrage is constructed, Barrage is an arrangement of adjustable gates or shutters at different tires over the weir.



Question No 4 part (B)

What are the function of 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.

1) To admit the supplies in to the canal.
2) To regulate the supplies in to the canal.
3) To indicate the discharge passed into the canal from design discharge formula and observed head of water on the crest.
4) To control the silt entry into the canal. During heavy floods, it should be closed otherwise high silt quantity will leave to the canal.

- It regulates the supply of water entering the cannal.
- It prevents the river-floods from entering the canals.
- To indicate the discharge passed into the canal from design discharge formula & observed head of water on the crest.