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Question#01:

a) Explain anti water logging measures

Water logging:

A land is Said to be water logged, when its productivity is affected by high water table.

Anti-water logging measures;

water logging can be control by reducing the quantity of water into the Soil below.

It can also be preventing by reducing the inflow into underground reservoir and by increasing the outflow

water logging can also be control by taking the following measures.

1) Lining of canals and water courses:

It will reduce the See page of water.

2) Reducing intensity of irrigation:

Only Small portion of land Should reciere canal water in one particular season, Remaining area can reciere water in next Season by rotation.

3) 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 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 cutting bushes and jungles.

6) Pumping or Tubewells or vertical Drainage:

Lift Drainage should be introduced to use G.W.

Canal irrigation may be substituted by Tube wells irrigation

7) Economical use of water, according to need

8) Adoption of Sprinkler method of irrigation:

↳ only predetermined amount of water is Supplied to land

↳ No percolation losses from water courses.

Question#01

b) Differentiate between Saline and alkaline Soils.

Answer: The key difference between Saline and alkaline Soil is that ~~Soil~~ Saline Soil is having a PH less than 8.5 and an exchangeable Sodium percentage less than 15, while alkaline Soil have PH greater than 8.5 and an exchangeable Sodium percentage higher than 15.

Neutral Soils have PH = 7.

Saline Soil	Alkaline Soil
↳ Flocculated Soils therefore Soil aeration and permeability is normal	↳ Dispersed and compact Soil therefore aeration and permeability is low

↳ Easy to manage because Physical condition of the Soil is good.	↳ Physical condition is good So Easy to manage the Soil.
↳ In rainy season, Some natural vegetation is grown.	↳ No Kind of any natural vegetation except some grasses are grown.

Question #01:

c) How do you reclaim Salt affected lands?

Ans: We can reclaim the Salt affected lands by maintaining the water table Sufficiently below the roots

↳ Also if we can prevent water logging, by this way we can reclaim Salt affection

↳ An effecient drainage (surface and Sub surface) must be provided to lower down the water table in Saline Soils.

Question#02:

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

Answer:

Kennedy's theory:

R.G Kennedy studied straight reaches of upper Bari Doab canal which are stable for 30 years.

According to him

$$V_o = CD^n$$

where V_o is critical velocity (non silting or non-scouring) and C is constant which depends upon the quantity of silt.

Kennedy's Procedure for designing of an irrigation canal:-

Step#01:-

First of all Assume the trial value of D and put in equation below and determine V_o

$$V_o = 0.546\, m D^{0.64} \rightarrow eq(1)$$

Step#02:

As $Q = AV$

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

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

$$P = B + D\,5^{1/2}$$

For the assumed D in step 1, determine B

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

Step#03:

Subtitute the value of R in "Kutters and chazys Equation" to obtain V which will be the actual velocity for assumed dimensions.

Step#04,

If the velocity worked out from Kutters and chazy equations, agrees with that of obtained with kennedy equation. Then the assumed depth is correct, otherwise repeat the procedure with different assumed value of D.

Question # 02

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

Given data:

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

$$CVR = m = 1$$

$$N = 0.0225$$

$$S = 1/5000$$

Solution: Assume that depth = D = 2.3 m

Trail 1:

Step # 1:

As we know

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

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

$$\Rightarrow \boxed{V_o = 0.931 \ m/sec}$$

Step # 02:

As $A = \frac{Q}{V}$ $\because Q = AV$

$$\Rightarrow A = \frac{30}{0.931}$$

$$\Rightarrow \boxed{A = 32.223 \ m^2}$$

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

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

$$\Rightarrow B = \frac{A - D^2/2}{D}$$

$$B = \frac{32.223 - (2.3)^2/2}{2.3}$$

$$\Rightarrow \boxed{B = 12.86}$$

Now we have to calculate P, wetted perimeter

As
$$P = B + D \cdot 5^{1/2}$$
$$= 12.86 + (2.3)(5)^{1/2}$$

$$\Rightarrow \boxed{P = 18.003 \text{ m}}$$

Now, we have to find Hydraulic radius

$$R = \frac{A}{P} = \frac{32.223}{18.003}$$

$$\Rightarrow \boxed{R = 1.79 \text{ m}}$$

Step #03:

Now we have to calculate the mean velocity (V) by using Kutters and chazys Equation,

$$V_c = C(RS)^{1/2} \quad -(*)$$

where

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

$$= \frac{\frac{1}{0.0225} + \left[23 + \frac{0.00155}{1/5000}\right]}{1 + \left[23 + \frac{0.00155}{2}\right]\left(\frac{0.0225}{\sqrt{1.79}}\right)}$$

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

$$\Rightarrow \quad C = 49.56$$

$$(*) \Rightarrow \quad V_c = C(R.S)^{1/2}$$

$$= 49.56\left[1.79 \times \frac{1}{5000}\right]^{1/2}$$

$$\Rightarrow \boxed{V_c = 0.931 \text{ m/sec}}$$

As $V_o = V_c = 0.931$

So $D = 2.3m$

Question # 03:-

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

Lacey's theory:

According to Lacey, even though channel with no silting or Scouring may actually be not in regime.

↳ Lacey differentiated b/w initial regime and final regime but Lacey's theory is applicable to final regime.

Initial regime:

when only the bed Slop 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.

↳ In final regime, the cross section assumes Semi ellipse shape.

Question #03

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

Given data:

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

$$M = 0.56\ mm$$

Solution:

As we know Silt Factor, F

$$F = 1.76 \times M^{0.5}$$

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

$$\Rightarrow \boxed{F = 1.317}$$

Step #01,

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

$$= \left[\frac{30 \times (1.317)^2}{140}\right]^{1/6}$$

$$\Rightarrow \boxed{V_m = 0.848\ m/sec}$$

Step # 02:

$$R = \frac{5}{2} \times \frac{V^2}{F}$$

$$= \frac{5}{2} \times \frac{(0.848)^2}{1.317}$$

$$\Rightarrow \boxed{R = 1.365 m}$$

As $Q = AV$

$$\Rightarrow A = \frac{Q}{V} = \frac{30}{0.848}$$

$$\Rightarrow \boxed{A = 35.377 \ m^2}$$

As $A = BD + 0.5 \times D^2$

$$\Rightarrow 35.377 = BD + \frac{D^2}{2} \quad - (1)$$

and

$$P = B + D \times 5^{1/2} \quad - (2)$$

as $P = 4.75\sqrt{Q} = 4.75 \times \sqrt{30}$

$$\boxed{P = 26.017 \ m}$$

$$(2) \Rightarrow 26.017 = B + D \times 5^{1/2}$$

$$\Rightarrow B = 26.017 - D \times 5^{1/2} \quad - (3)$$

Put eq ③ in eq ①

$$35.377 = (26.017 - \sqrt{5} \times D) D + \frac{D^2}{2}$$

$$\Rightarrow 35.377 = 26.017 D - \sqrt{5} D^2 + \frac{D^2}{2}$$

$$35.377 = 26.017 D - (2.236 - 0.5) D^2$$

$$35.377 = 26.017 D - 1.736 D^2$$

$$-1.736 D^2 + 26.017 D - 35.377 = 0$$

we will Solve this by quadratic equation

here $a = -1.736$, $b = +26.017$, $c = -35.377$

$$D = \frac{-(26.017) + \sqrt{(26.017)^2 - 4(-1.736)(-35.377)}}{2(-1.736)}$$

$$\Rightarrow \boxed{D = 1.52 m}$$

put $D = 1.52$ in eq ③

$$B = 26.017 - 1.52 \times \sqrt{5}$$

$$\boxed{B = 22.618 m}$$

Step # 04:
$$S = \frac{F^{5/3}}{3340 Q^{1/6}}$$

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

$$\boxed{S = 2.688 \times 10^{-4}}$$

OR

$$\boxed{S = 0.000269}$$

Question#04

a) Explain the components of Headworks with neat diagram.

Answer:

Head work:

Any hydraulic structure which supplies water to the off taking canal is called a Headwork.

Components of Head work:

1) weir:

Normally the water level of any perennial river is such that it cannot be diverted to irrigation canal. The bed level of canal may be higher than the existing water level of the river

2) Barrage:

when the water level from the upstream side of the weir is required to be raised to different time, barrage is to be constructed.

3) Under Sluices:

It is also known as Scouring Sluices. The under Sluices are the opening provided at the base of the weir or barrage.

4) Divide wall:

The divide wall is the long wall constructed at ringht angle of the weir or barrage, it may be constructed with stone masonry or cement concrete.

5) Fish ladder:

The Fish ladder is provided just by the side of the divided wall for free movement of fishes.

6) Canal Head regulator:

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

7) Silt regulator work:

The entry of silt into a Canal which take off from a head work can be reduced by constructing certain Special work call Silt regulator work.

8) River traing work:

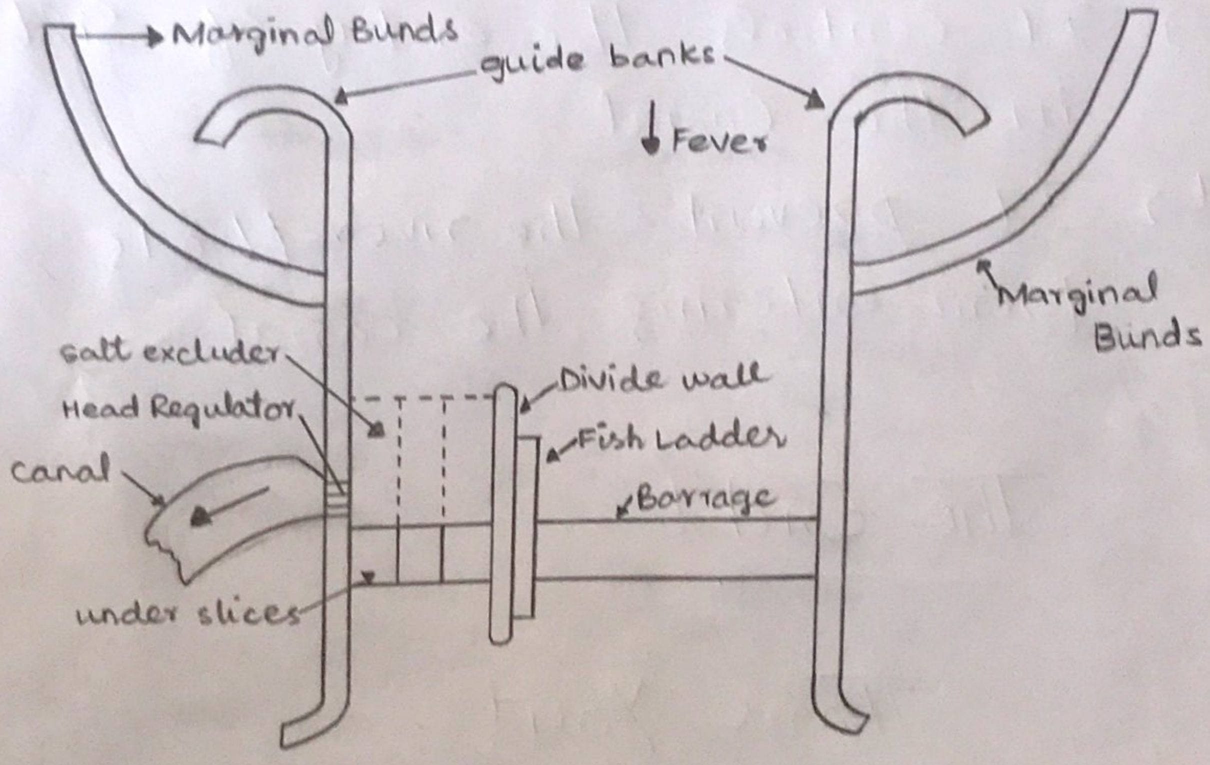
River traing work are required near the weir site in order to ensure a Smooth and an axial flow of water.

9) Guide bank:

when a barrage is constructed across a river which flow through the alluvial Soil, the guide bank must be constructed on both Side to approach to protect the Structure from erosion.

10) Marginal Bonds:

The marginal Bonds are earthen embankment to the river bank, constructed parallel to the river bank.



Q#4: what are the functions of Head regulators?

Answer:

Functions of Head Regulators

↳ Head regulators regulate the Supply of water entering the canal.

↳ It controls the entry of Silt in the Canal

↳ It prevent the river floods from entering the canal.

The End!

Thank You!