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Subject : Irrigation Engineering

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Exam : Final Term.

Q1

Part(A):- Explain anti water-logging measures?

Ans:- Anti-water logging Measure:- Quantity of water into soil below is reduced.

Inflow into underground reservoir is reduced & outflow should be increased.

Methods of Control of water logging:- Lining of canals and water courses.

- It reduces seepage of water.

a) Reducing Intensity of Irrigation:- only small Portion of land should receive canal water in one particular season.

-) Remaining axes 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, 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. cultivators should be educated so that not to use more water.

Revenue should be charged on the basis of quantity of water rather than the area of land.

5) Improving natural drainage of Area:- Water should not be allowed to stay in on one area.
- Natural flow is provided by bush and jungle cutting

6) Pumping or Tubewells or Verticle Drainage:- Canal irrigation may be substituted by tube well 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 precolation losses from water courses.

Q1
Part: B Differentiate between saline & alkaline Solids?

Ans

Saline Soil	Alkaline soil
• Saline Soils are the soils that have a PH in between 7 & 8.5 an exchangeable Sodium percentage below 15%.	Alkaline soils are the soils that have a PH greater than 8.5 and an exchangeable 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.
• Saline salt are white or light gray in colour.	• Alkaline soil are black in colour.

Q1

Part C:- How do you reclaim salt affected.....?

Ans:- Salt effected areas can be reclaimed by the following methods.

* **Leaching:-** The process of removing salt from the effected area by flooded the land with water. The water will dissolved the salt and then this soluble water is drain out from the land which took salt with it self. High salt resistance crops can be grows on leached land i-e rice, cotton for two seasons

* **Good Surface & Internal Drainage:-** The use of tile drains and open ditches in the field can increase drainage & remove some of the salt.

* **Land Grading:-** It is continous land slope towards field drains. It is necessary for surface irrigation & help removing salt.

* **Applying Magnetized water:-** Magnetized water break down the salt crystal twice as fast as unmagnetized water allowing the salt to be extract from soil.

Que: 2

Part A:- Explain the procedure of designing of an irrigation cannal by kennedy's theory?

Ans :- Kennedy Procedure for Canal Design.

Step: 1 Assum the trial value of D & put it eqn 1 and determine.

$V_o = 0.56m\ D^{0.64}$

Step: 2 In eqn 1 $Q = AV$

$A = Q/A$

$A = BD + D^2/2$

$A = B + D^{5/2}$

For assumed D determine B

Fond $R = A/P$

Step: 3 Substitute the value of R in eqn 2 (kuttler & chazy's eqn) to obtain V which will be actual velocity for assumed dimensions.

Step: 4 IF velocity worked out from eqn 2 agrees with that of obtain eqn 3 (kennedy's eqn) then assumed the depth is correct.

Otherwise repeat the procedure with different values of D.

Q2

Part B:- Design an irrigation channel by kennedy's theory to carry a discharge of 30.....?

Given Data:-

Discharge (Q) = 30 m^3/sec

$CV_r(m)$ = 1

N = 0.0225

Bed Slope = 1 in 5000

Depth (D) = 2.3m.

Solution:-

Finding Velocity.

By Formula

$V_k = 0.546\, D^{0.64}$

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

$\Rightarrow V_k = 0.930m$

Now Calculating Area of canal.

By Formula

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

$A = 30/0.930$

Area = 32.25 m^2

Now we have to calculate B, By using formula

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

$\Rightarrow$ **By putting values.**

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

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

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

$= 29.605 = 2.3(B)$

$= B = 12.87m$

Now we have to calculate wetted Perimeters

So by formula,

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

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

Now we have to calculate Hydraulic Radius,

$$R = A/P$$

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

Now calculating mean velocity from chezy equation,

$$V_c = C\,(Rs)^{1/2}$$

where

$$C = \frac{\frac{1}{n} + \left(23 + \frac{0.00155}{s}\right)}{1 + \left(23 + \frac{0.00155}{s}\right)\frac{n}{\sqrt{R}}} \Rightarrow \frac{\frac{1}{0.0225} + \left(23 + \frac{0.00155}{(1/5000)}\right)}{1 + \left(23 + \frac{0.00155}{(1/5000)}\right) \times \left(\frac{0.0225}{\sqrt{1.79}}\right)}$$

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

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

$$V_c = 0.93$$

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

Q3

Part A:- Differentiate between initial regime & final regime .....?

Ans

According to Lacey's theory:-

Initial Regime:- when only bed slope of channel changes but cross section remains same then also no scouring or setting take place But this is rare.

Final regime:- If all the parameters (Diameters, depth & slope) have equally free to vary and adjust according to discharge & silt grades. then channel is said to have final regime.

Q3 Part(B) Design a regime channel by Lacey's theory for discharge of 30 . . . . . ?

Given Data:

$Q = 30\ m^3/sec$

$m = 0.56\ mm$

Sol:

silt factor $= f = 1.76 \times M^{0.5}$

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

$f = 1.3$

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

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

$V_m = 0.844$

$Q = AV$

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

$A = 35.54$

$P = 4.75\sqrt{Q}$

$P = 4.75\sqrt{30}$

$P = 26.01$

$$R = \frac{5}{2} \times \frac{V^2}{f} = \frac{5}{2} \times \frac{(0.844)^2}{1.3}$$

$R = 1.36$

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

$$35.54 = BD + \frac{D^2}{2} \quad \text{——} \quad (1)$$

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

$$26.01 = B + 2.236D$$

$$B = 26.01 - 2.236D \quad \text{——} \quad (2)$$

Put eq (2) in eq (1)

$$35.54 = (26.01 - 2.236D)D + D^2/2$$

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

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

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

$$\frac{-1.736D^2}{a} + \frac{26.01D}{b} - \frac{5.54}{c} = 0$$

$$a = -1.736$$

$$b = 26.01$$

$$c = -35.54$$

By Quadratic eq.

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

$$D = 1.52$$

Put in eq (2)

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

$$B = 22.611$$

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

$$S = \frac{(1.3)^{5/3}}{3340\, (30)^{1/6}}$$

$$\boxed{S = 0.00026}$$

Q4
Part:-A Explain the components of headworks with neat diagram?

Ans **Head works:-** Any hydraulic structure which supplies water to the off-taking cannal is called a headwork.

=> Headwork may be divideal into two. categories.

1) Storage headwork
2) Diversion headwork.

Components of head works.

Weir or Barrage:- Weir is a structure constructeal across river to raise the water level & divert the water into the cannal weir aligneal at right angles to the direction flow. shutters are provides at the crest of the weir so that part of raising up of water is carrieal out by shutters.

Divideal wall:- long wall constructeal at right angles in the weir or barrage, with stone mansary or cement concrete.

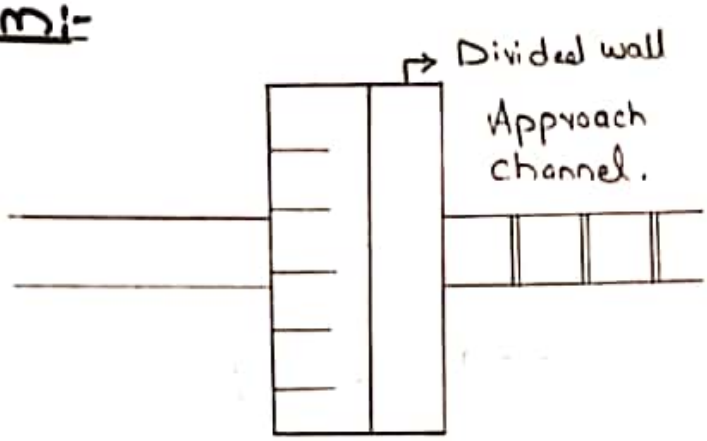
=> on the upstream side, the wall is extendeal just to cover the cannal head regulator and on the down stream side, it is extendeal up to the launching pron.

Function:- From a still water pocket in front of the canal head in which helps in setting of silt.

=> Controls the eddy current or cross current in front of cannal head.

⇒ Provides straight approach in front of the canal head.

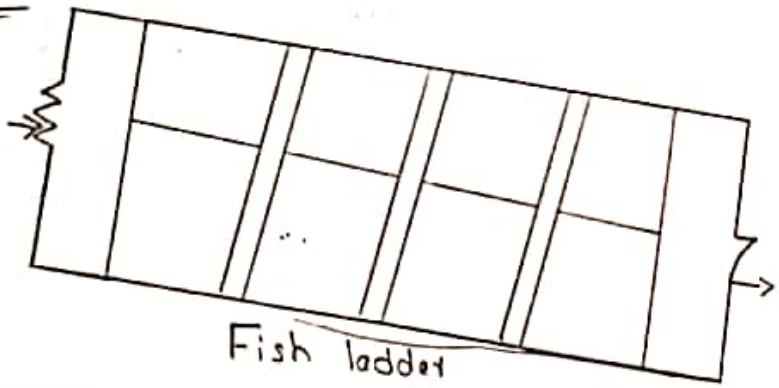
Diagram:-



Fish ladder:- Consists of an inclined channel with a slope not exceeding 1 in 10.

⇒ The compartment of bays of fish ladder should be sufficiently large so that the fish do not collide with sides of the bay when ascending.

Diagram:-



Silt excluders:- Device to exclude silt from water entering the canal.

⇒ Consist of a number of rectangular tunnels.

⇒ The tunnels are of different lengths.

⇒ The lengths of the tunnels gradually decreases as the distances of the head regulator.

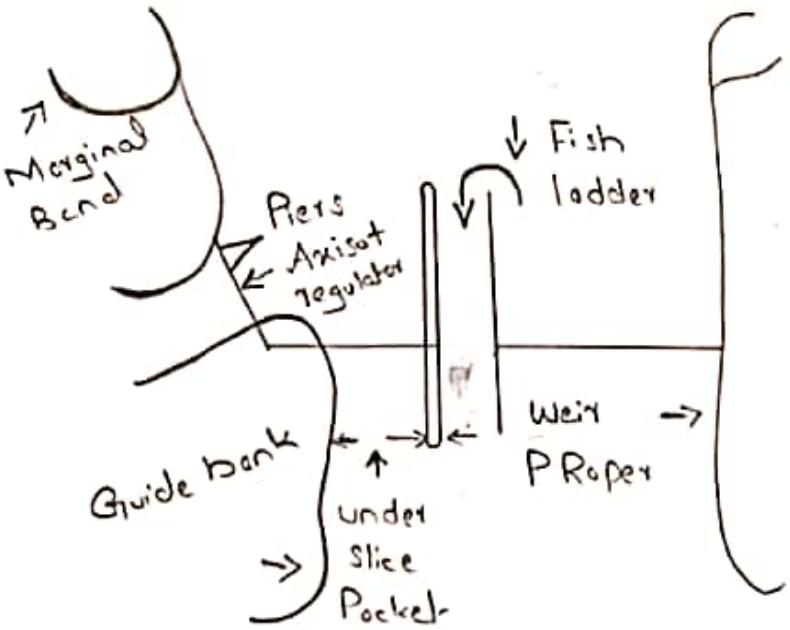
A structure which is constructed at the head of the cannal to regulate flow of water is known as canal head regulator.

* It consists of no of piers which divided the total width of the cannal into a number of spon which are known as bays.
* The piers consist of number tiers on which the adjustable gates are placed.

Function:-

* It regulates the supply of water entering cond
* It controls the entry of silt in the cond.

Diagram:-



Q4
Part(B) What are the functions of Head regulators?

Ans:- **Function of head regulators**

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.
* To indicate the discharge passed into the canal from design discharge formula & observed head of water on the crest.