IRRIGATION ENGINEERING

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SECTION A

Submitted to

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Q.No(01)

a) Explain anti water-logging measures.

Ans: 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, and they 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 one area.
- Natural flow is provided by bush and jungle cutting.

6) Pumping or Tubewells or vertical Drainage.

Lift irrigation should be introduced to use G.W. 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 percolation losses from water courses.

(b)

	Saline soils	Alkaline soils
1)	Saline soils are the soils that have a pH in between 7 and 8.5 and 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%
2)	PH less than 8.5	PH Greater than 8.5
3)	Exchangeable sodium percentage less than 15	Exchangeable sodium Percentage Greater than 15.
4)	Electrical conductivity 4 or more mmhos/cm	Electrical conductivity usually less than 4 mmhos/cm
5)	Most common ions. mainly sodium chloride and sodium sulphate. Also calcium chloride. calcium sulfate.	Most common ions. Mainly sodium carbonate. Potassium carbonate. calcium carbonate and magnesium carbonate in small amounts.

calcium bicarbonate. Magnesium sulfate and magnesium bicarbonate in small amounts.

6) Organic matter content is High

7) colour of the soil is white or light gray.

6) organic matter content is low.

7) colour of the soil is Black colour.

(C) How do you reclaim salt affected lands?

Ans Reclamation of salt affected lands:-

- 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 (surface and subsurface) must be provided to lower the water table in saline soils.

✱) Surface Drainage :~

- Removal of excess of water using open ditches, field drains; land grading etc.
- open drain which remove excess of irrigation and storm water are broad and shallow are called shallow surface drains.
- shallow surface drains carry runoff to point of entrance to outlet ditches. These large and deep outlet ditches are called deep surface drains.

✱ Subsurface drainage :~

- Surface drainage alone is seldom sufficient to remove excess water from the crop root zone. Deep ditches or subsurface pipe drainage systems enable a more rapid water table drawdown. The downstream ends of the lateral are normally connected to a collector drain. The required diameter of the pipe collectors increases with the area drained. Drain spacing is usually dependent on soil hydraulic conductivity and a design drainage rate coefficient

Q. No (02)

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

Ans Assumptions of Kennedy

1) Vertical component of eddies support the silt particles
2) The silting power of a channel depends upon its velocity, which controls the eddies.
3) The silt transporting power depends upon its depth.
4) The silt transporting power of a channel is independent of bed width.

* Kennedy Procedure for canal design

Step 1:~

Assume the trial value of D and put in eqn 1 and determine.

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

Step 2:~ In Eqn. 1: $Q = AV$

$A = Q/V$

$A = BD + D^2/2$

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

For assumed D determine B

Find $R = A/P$

Step 3 :~

Substitute the value of R in eqn.2 (Kutters and chazys Eqn) to obtain V which will be the actual velocity for assumed dimensions.

Step 4 :~

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

Q. No 02) [B]

(b) Given data:-

Discharge (Q) = 30 m^3/sec

Cur (m) = 1

N = 0.0225

Bed slope = 1 in 5000

Depth (D) = 2.3 m

Solution

Finding velocity,

By formula,

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

$= 0.546\,(1)\,(2.3)^{0.64} \Rightarrow \boxed{V_R = 0.930\ m}$

Now calculating area com, by formula

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

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

$\Rightarrow$ Now we have to calculate B, By using formula $A = BD + \frac{D^2}{2}$

$\Rightarrow$ By Putting values,

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

$32.25 = 13(2.3) + 0.5(2.3)^2$

$22.25 - 2.645 = 2.3(13)$

$29.605 = 2.3(B)$

$\Rightarrow \boxed{13 = 12.3(B)}$

Now we have to calculate wetted perimeter, so by formula.

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

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

$\Rightarrow$ Now we have calculate Hydraulic Radios,

$R = A/P$

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

$\Rightarrow$ Now calculating mean velocity from chezy equation,

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

where

$$C = \frac{\frac{1}{n} + \left(12 + \frac{0.00155}{S}\right)}{1 + \left(23 + \frac{0.00155}{S}\right)\frac{n}{\sqrt{R}}} \Rightarrow \frac{\frac{1}{0.0225} + \left(23 + \frac{0.00155}{1/5000}\right)}{1 + \left(23 + \frac{0.00155}{1/5000}\right)\times\frac{0.0225}{\sqrt{1.79}}}$$

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

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

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

(10)

Q No (03)

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

Ans Initial regime :-

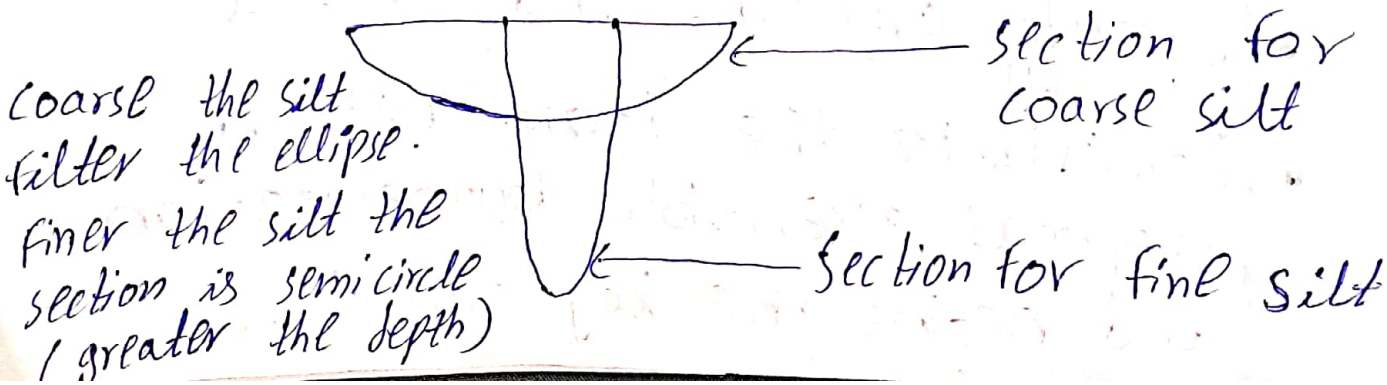
- when only bed slope of changes but the cross section remains same then also no silting or scouring take place.
- But this is rare.

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~~

In final regime the cross section assumes semi-ellipse shape.



(b)

Given Data

Discharge (Q) = 30 m3/sec

Mean dia of Silt Particle (M) = 0.56 mm

Solution :-

First we have to calculate velocity, (mean)

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

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

$$V_m = 0.85 \text{ m/sec}$$

∵ f = Lacey's silt factor

$f = 1.76\, M^{0.5}$

$= 1.76 (0.56)^{0.5}$

$f = 1.32$

⇒ Now we will hydraulic mean depth

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

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

⇒ Now finding the value of "P" ~

By formula)

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

First we have to find area :

By discharge formula,

$$Q = AV$$

$$\Rightarrow A = Q/V$$

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

Now,

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

Finally, we have to calculate "S" By using formula

$$S = \frac{f^{5/3}}{3340\, Q^{1/2}}$$

$$= \frac{(1.32)^{5/3}}{3340 \times (30)^{1/2}}$$

$$\Rightarrow S = 0.000269$$

Q No (04) (13)

(a) Explain the components of headworks with neat diagrams.

Ans The components of Headworks :-

The components of headworks are:

1) 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 the river.
- In such cases weir is constructed across the river to raise the water level.
- Surplus water pass over the crest of weir.

2) Barrage :-

When the water level on the up stream side of the river 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 wier.

3) Under sluices :-

Also known as scouring sluices.

- The under sluices are the openings provided at the base of the weir or barrage.
- These openings are provided with adjustable gates. Normally the gates are kept closed.
- When the silt deposition becomes appreciable the gates are opened and the deposited silt is loosened with an agitator mounting on a boat.

4) Divide wall :-

The divide wall is along wall constructed at right angles to the weir or barrage, it may be constructed with stone masonry or cement concrete.

- on the upstream side, the wall is extended

5) 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 upstreams to downstream in winters and from downstream to upstreams in moonsoons.

6) 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.

- It consists of a number of piers which divide the total width of the canal into a number of spans which are known as bays.

7) Silt Excluders :-

Silt excluders are those works which are constructed on the bed of the river, upstream of the head regulator.

- The clearer water enters the head regulator and silted water enter the Silt excluder.

8) River training works :-

River training works are required near the weir site in order to ensure a smooth and an axial flow of water, and thus, to prevent the river from outflanking the works due to a change in its course.

- The river training works required on a canal headwork - are:

(a) Guide bank (b) Marginal bunds
(c) ~~Spurs~~ Spurs or groynes

1) Guide Bank :~

When a barrage is constructed across a river which flows through the alluvial soil, the guide banks must be constructed on both the approaches to protect the structure from erosion.

2) Marginal Bunds :~

The marginal bunds are earthen embankments which are constructed parallel to the river bank on one or both the banks according to the condition.

(b) 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.