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Section B

B.E (C)

Subject Irrigation Engineering

Semester 6th

Final Examination Paper

Q.No1:- (a) Explain anti water logging measures.

Answer:- (i) Lining of canals and water Course:-

It reduce seepage of water.

(ii) Reducing Intensity of irrigation:-

Only small portion of land should recieve canal water is one particular season.

(iii) By Introducing Crop rotation:-

High water requiring Crop should be followed by one requiring less water and then by requiring almost no water.

e.g:- Rice followed by wheat and then by cotton.

(iv) Improving natural drainage of area:-

water should not be allowed to stay in one area.

→ Natural flow is provided by bush and jungle Cutting.

(v) Economical use of water according to need.

(vi) Adoption of sprinkler method of irrigation.

→ Only predetermined amount of water is supplied to land.

→ No percolation losses from water courses.

Ans(8):- Differentiate between saline and alkaline soils.

Answer:-

	Saline soils	Alkaline Soils
(1)	Saline soils contain high Content of soluble salts.	→ Alkaline soils are clay soil.
(2)	They have less PH	→ They have high PH.
(3)	It is basic in nature.	→ They are more basic.
(4)	It PH is 7-8.5	→ PH greater than 8.5.
(5)	Dominating compound is sodium carbonate salts.	→ Dominating compound is sodium carbonate.

Ques 1 (c) How do you reclaim salt affected lands?

Answer:- Reclaimation salt effected lands:

Alkali salts (sodium chloride, sodium sulphate, and sodium carbonate) are injurious to agriculture.

$NaCl$ ..... Least harmful.

Na_2SO_4 ..... Medium harmful.

Na_2CO_3 ..... Most harmful.

→ The above salts are soluble in water

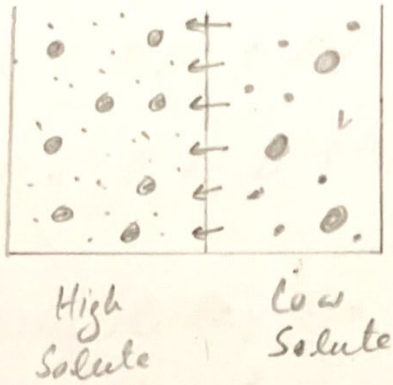
→ when G.T rises up or roots are in capillary zone, the G.W moves upwards and salts are deposited in root zone and surface of soil.

The phenomena of salts coming up in solution and forming a thin crust (5-7.5cm) on the surface after evaporation of water is called Efflorescence.

Land affected by efflorescence is called saline soil salts surrounding the roots reduce the osmotic activity of plants.

Diagram (OSMOSIS)

Semi permeable membrane



Ques 2 (a) Explain the procedure of designing of an irrigation canal by Kennedy's theory.

KENNEDY THEORY :-

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

→ $V_o = CD^n$

where V_o is critical velocity (non-silting or non-scouring)

C is constant depends upon quantity of silt.

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 Eq^n. 1 : $Q = AV$

$A = Q/V$

$A = BD + D^2/2$ for assumed D determined B Find

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

$R = A/P$

Step 3 :- Substitute the value of R in eqn. 2 (Mutten 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 (Kennedys Eqn) Then the assumed depth is correct. Otherwise repeat the procedure with changed value of D.

Q.No 2 (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 :- $D = 2.3\ m$

$Q = 30$ Cumecs

$C.V.R = m = 1$

$N = 0.0225$

$S = 1/5000 = 0.0002$

We know that

$$Q = AV$$

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

Thus, Using formula to compute "V"

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

$$\boxed{V_o = 0.935\ m/s} \rightarrow \text{put this volume}$$

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

Now, $A = B.\Delta^2 + \frac{\Delta^2}{2}$

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

$\Rightarrow$ Now

$$\boxed{B = 12.77\ m}$$

put the values in below eq

$$P = 17.9\ m$$

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

Substituting the value of "R" in Kuller's and Chezy's eq

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

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

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

Put the values in eq (a)

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

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

This is equation to Vo thus no more trail required.

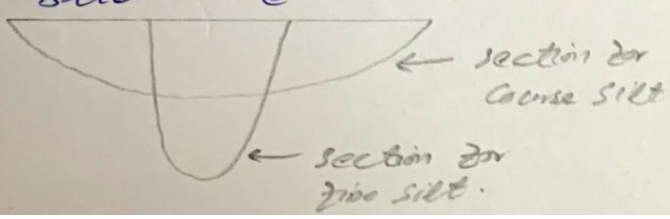
Q.No 3 (a) Differentiate between initial regime and final regime in accordance to Laceys theory:

→ According to Kennedy, a channel is regime (No silting, No scouring) but according to Lacey even though channel with no silting or scouring may actually be not in regime.

→ He differentiate between initial regime and final regime but this theory is applicable to final regime.

→ Initial regime :- When only bed slope 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, 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.



Question No 3 (b)

Design a regime channel by laceys theory for discharge of 30 cumecs and mean diameter of silt Particle of 0.56 mm.

Given :- $Q = 30 m^3/sec$

$M = 0.56$

Solution :- $f = 1.76 M^{0.5}$

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

$f = 1.3$

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

$V_m = 0.844$

$Q = AV$

$A = Q/V = 30/0.844$

$A = 35.55$

$P = 4.75 \sqrt{Q}$

$P = 26.00$

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

$$R = 1.36$$

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

$$35.5 = BD + \frac{D^2}{2} \quad \text{——(i)}$$

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

$$26.01 = B + 2.236\,D \longrightarrow \text{(ii)}$$

Put (i) & (ii)

$$35.54 = (26.01 - 2.236)\,D + \frac{D^2}{2}$$

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

$$\frac{-1.736\,D^2}{a} + \frac{26.01}{b} - \frac{35.54}{c} = D$$

$$a = -1736, \quad b = 26.01, \quad C = -35.54$$

By Quadratic Eq

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

$$\boxed{D = 1.52}$$

Put in eq (2)

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

$$B = 22.611$$

$$S = \frac{z^{5/3}}{3.340\, Q^{1/6}}$$

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

$$\boxed{S = 0.00026}$$

Ans 4(a) Explain the components of headworks with neat diagram.

⇒ Components of a diversion head works :-

→ Weir or barrage.
→ Undersluices.
→ Divide wall.
→ Fish ladders.
→ Canal head regulator.
→ River training works (Marginal bunds and guide bunds)
→ Silt excluders / silt prevention devices.

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

⇒ 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.

⇒ 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. The suspended silt goes on depositing in front of the canal head regulator.

⇒ Divide wall :-

The divide wall is a long wall constructed at right angles in the weir or barrage, it may be constructed with stone masonry or cement concrete. On the upstream

upstream side, the wall is extended just to cover the canal head regulator and on the downstream side, it is extended up to the launching apron.

⇒ 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 upstream to downstream in monsoons. This movement is essential for their survival. Due to construction of weir or barrage, this movement gets obstructed, and is detrimental to the fishes.

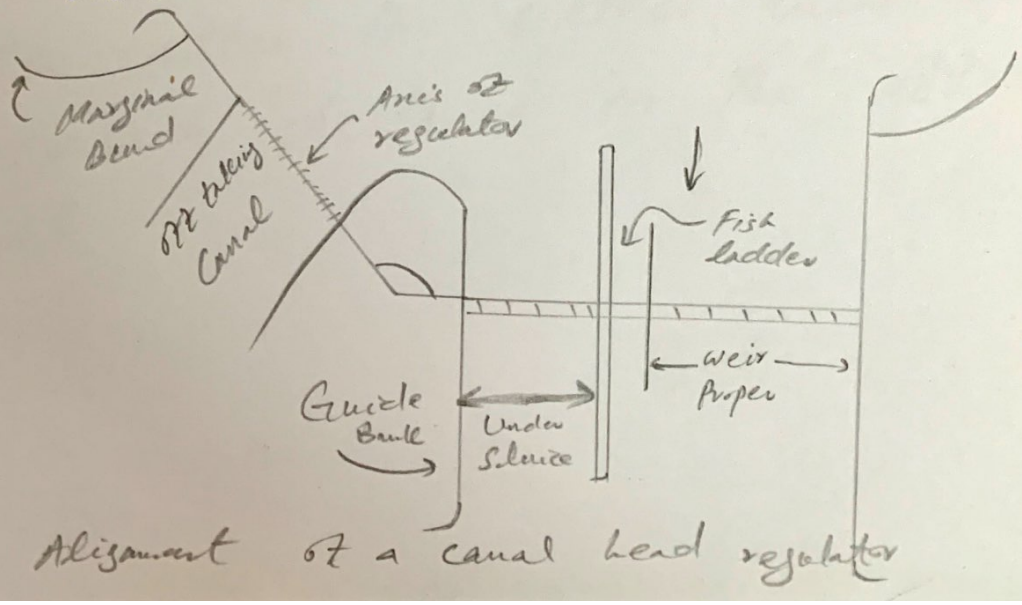
⇒ Canal head Regulator :- A structure which is constructed at the head of the canal to regulate flow of water is known as canal head regulator. It consists of a number of piers which divide the total width of the canal

canal into a number of spans which are known as bays. The piers consist of number ties on which the adjustable gates are placed.

The gates are operated from the top by suitable mechanical device. A plat form is provided on the top of the piers for the facility of operating the gates. Again some piers are constructed on the down stream side of the canal head to support the roadway.

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.



Alignment of a canal head regulator

⇒ Silt regulation works :-

The entry of silt into a canal, which takes off from a head works, can be reduced by constructed certain special works, called silt control works. These works may be classified into the following two types.

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

→ Silt Ejectors :- Silt ejectors, also called silt extractors, are those devices which extract the silt from the canal water after the silted water has travelled a certain distance in the off-take canal.

⇒ 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 traing works required on a canal headwork are:

(a) Guide banks.

(b) Marginal bunds.

(c) Spurs or groynes.

Q.No 4 (b) :- What are the functions of head regulators.

Answer :- Head Regulator is constructed at the off taking are called head regulators.

→ When it is constructed at head of main canal it is known as canal head regulator.

Function :-

→ To control the entry

entry of water either from the reservoir or from the main canal

→ To control the entry of silt into off taking or main canal.

→ To serve as a meter for measuring discharge of water.