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Section:- A
Date:- 23rd June, 20

Question No:-1 (a)

Anti-Water logging Measures:-

- Quantity of water into soil below is reduced
- Inflow into underground reservious is reduced and outflow is increased.

1. Lining of canals & water courses.
2. Reducing intensity of irrigation in which only small portion of land should recieve canal water.. ~~too~~ in one particular season & remaining areas will recieve water in next season.
3. By introducing crop rotation in which high water requiring crop is followed by one less requiring water crop & then by one requiring no water.
4. Optimum use of water should be done since we know that certain amount of water gives the best result.
5. We should improve natural drainage area in which water is not allowed to stay in one area & natural water flows by cutting bushes & jungle.
6. ~~Pump~~ Lift irrigation should be introduced to use GW.
7. Economical uses of water according to need.
8. We should adopt sprinkler method of irrigation

Question 1 Part (b) :-

Difference Between Saline & Alkaline Soils :-

Saline Soils :- Soils having pH value between 7-8.5 are saline soils while they also have an enchangable sodium %age below 15%.

Alkaline Soils :- Soils having pH greater than 8.5 and an exchangable sodium percentage greater than 51%.

Saline Soils	Alkaline Soils.
1) pH value less than 8.5	pH value greater than 8.5.
2) Colour of soil is white or light gray	It consists of black colour.
3) It has high organic matter content	It has low organic matter content.
4) Electric conductivity is 4 or more mmhos/cm	Electric conductivity is less than 4 mmhos/cm.
5) Most common ions present in it are NaCl & sodium sulphate, Calcium chloride, calcium sulphate, calcium bicarbonate, magnesium sulphate etc.	Consists mainly of sodium carbonate, potassium carbonate, calcium carbonate and magnesium carbonate in small amounts.

Question No:- 1(c)

Reclamation of Salt Affected Lands:-

- We can ~~adv~~ avoid efflorescence 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 & subsurface) must be provided to lower the water table in saline soils.

Leaching:- This process includes;

1) Land is flooded with water.
2) Alkaline salts will be dissolved in water.
3) Percolation to the ground water.
4) Drained by sub-surface drains.

Surface Drainage:-

It is a process in which removal of excess of water using open ditches, field drains & land grading etc occurs.

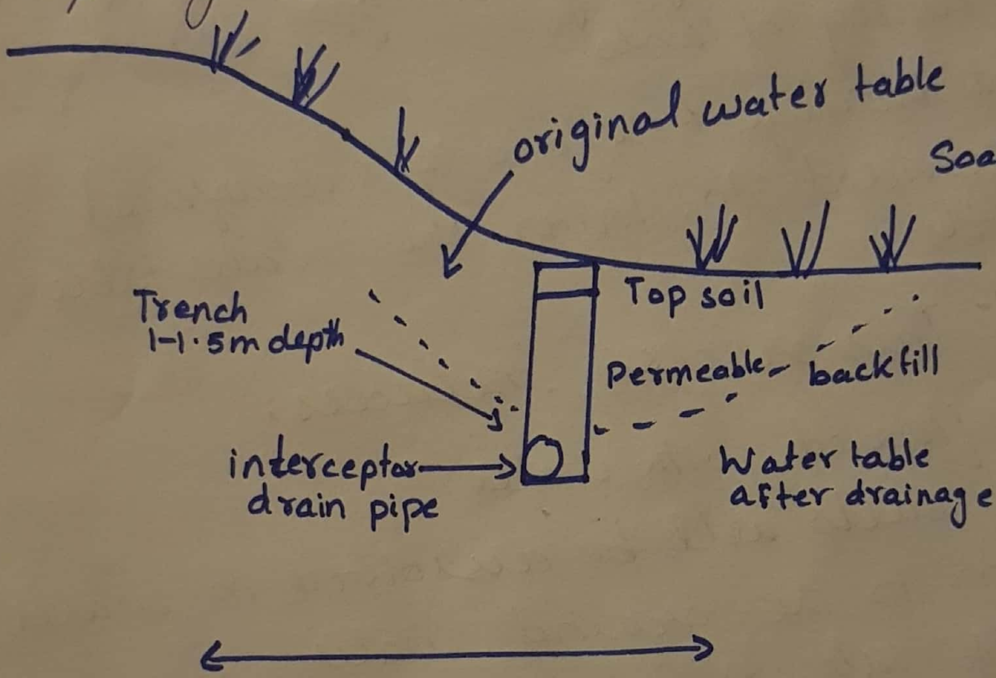
Land Grading:- Continuous land slope towards field drains necessary for surface irrigation.

Sub-Surface Drainage :-

It is the process of removing water that percolates through or is contained in underlying sub-grade. This water, typically the result of high water table or exceptionally wet weather can accumulate under the pavement structure by means of

↳ gravity flow

↳ Capillary rise.



Question No:- 2 (a)

Kenedy Procedure For Canal Design

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 & C is constant depending on quantity of silt.
- Sedement is kept in suspension solely by the vertical ~~compomponent~~ component of eddies.
- Weight of sedment vertically acts downwards.
- Vertical component of eddies act upward
- Result:- the sediment is in suspensions
- $V_o = 0.84D^{0.64}$ FPS system.
- $V_o = 0.546D^{0.64}$ MKS system, D is depth.
- $V_o = 0.546D^{0.64}$ where $m = V/V_o$ = critical.
- V = critical velocity for all sizes of sedment, V_o is V_{cr} for upper Bari Doab canal only.

Step No#1 :-

Assume the trial value of D & put in equation (1) & determine

$$V_o = 0.546mD^{0.64}$$

Step No#2 :-

In equation (1) $Q = AV$

- $A = Q/V$
- $A = BD + D^2/2$
- $P = B + D\sqrt{5}$

For assumed D, determine B.
Find $R = A/P$

Step No 3#:-

Substitute the value of R in eq (2) which is Kutters & Chazy's equation to obtain V which will be actual velocity for assumed dimensions

Kutters Equation:-

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

MKS System!

$$C = \frac{41.65 + \frac{0.00281}{S} + \frac{1.811}{n}}{1 + \frac{n}{\sqrt{R}}\left(41.65 + \frac{0.00281}{S}\right)}$$

FPS System!

Chazy's Equation:-

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

Step No:- 4#:

If the velocity worked out from eq (2) agrees with that of obtained with eq (3) which is kennedy's eq. Then the assumed depth is correct. Otherwise repeat the procedure with changed value of D.

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Question No:- 2(b)

Given Data:-

Discharge, $Q = 30 m^3/sec$

CVR (m) = 1

N = 0.0225

Bed slope = 1 in 5000

Depth = 2.3m

Solution:-

Finding velocity,

By formula

$V_K = 0.546 m D^{0.64}$

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

$V_K = 0.930m$

Calculating area of canal.

$Q = AV$

$A = Q/V = \frac{30}{0.930}$

$A = 32.25 m^2$

Calculating 'B',

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

~~A=~~

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

$32.25 - 2.645 = 2.3(B)$

$B = 12.87m$

Calculating wetted parameter.

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

$P = 12.87 + \sqrt{5}(2.3)$

$\boxed{P = 18.01m}$

Calculating hydraulic radius.

$R = A/P \Rightarrow 32.25/18.01$

$\boxed{R = 1.79m}$

Chezy's equation.

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

$$C = \frac{\frac{1}{0.0225}\left[23 + \frac{0.00155}{(1/5000)}\right]}{1 + \left[23 + \frac{0.00155}{(1/5000)}\right]\left(\frac{0.0025}{\sqrt{1.79}}\right)}$$

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

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

$\boxed{V_c = 0.93m}$ Answer.

Question No 3 (a).

Lacy's Theory:-

According to Lacy, channel with no silting or scouring may actually not be in a regime.
He differentiated between initial and final regime but this theory is applicable to final regime.

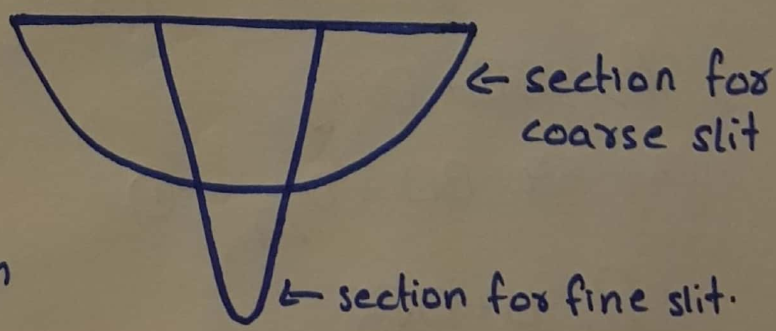
Initial Regime:-

When the bed slopes of channel changes but the cross-section remains the same then also no silting or scouring takes place. This is a rare case.

Final Regime:-

If all the parameters i.e depth, slope have equally free to vary and adjust according to discharge and slit grades then the channel is said to be in final regime.

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



↳ coarse the slit flatter the ellipse.

↳ finner the slit the section is semi-circle

Question No:- 3(b)

Given Data:-

$Q = 30 m^3/sec$

$M = 0.56 mm$

Solution:-

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

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

$\boxed{f = 1.3}$

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

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

$\boxed{V_m = 0.844}$

$Q = AV \Rightarrow A = \frac{Q}{V} = \frac{30}{0.844} = \boxed{35.54}$

$P = 4.75\sqrt{Q}$

$P = 4.75\sqrt{30}$

$\boxed{P = 26.01}$

$R = \frac{5}{2} \times \frac{V^2}{f} = \frac{5}{2} \times \frac{(0.844)^2}{1.3}$ $\boxed{R = 1.36}$

$A = BD + D^2/2$

$35.54 = BD + D^2/2$ —(1)

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

$26.01 = B + 2.236D$

$B = 26.01 - 2.236D$ — (2)

Put eq (2) in eq (1)

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

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

$35.54 = 26.01D - 1.736D^2$

$\underset{a}{\underline{-1.736D^2}} + \underset{b}{\underline{26.01D}} - \underset{c}{\underline{35.54}} = 0$

$a = -1.736, b = 26.01, c = -35.54$

By quadratic eq.

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

$\boxed{D = 1.52}$

put in equation (2)

$B = 26.01 - 2.236(1.52)$

$\boxed{B = 22.611}$

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

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

$\boxed{S = 0.00026}$ Answer.

Question No:- 4 (a):-

Components of Headworks:-

1. Weir:-

A weir is an obstruction or barrier constructed across the river. The obstruction is of a small height in comparison to a dam. It raises water level locally and supports the water against its face. Surplus water passes over crest of weir. Adjustable shutters are provided on crest to raise water level to required height.

2. Barrages:-

Barrages are constructed when the water level on the up stream side of the weir is required to be raised to different levels at different times.

3. Under Sluices:-

These are openings provided at the base of the barrages or weirs. These openings are provided with adjustable gates

4. Divide Wall:-

It is a long wall constructed at right angles in the weir or barrage, it may be constructed with stone masonary or cement concrete

5) **Fish Ladder :-**

It is provided just by the side of the divide wall for the free movement of fishes. In fish ladder, the fable walls are constructed in a zig zag manner so that the velocity of flow within the ladder does not exceed 3m/sec.

6) **Canal head Regulator :-**

It is constructed at the head of the canal to regulate flow of water & it consists of a no. of piers which divides the total width of canal into a no. of spans known as bays.

7) **Slit Regulation Works :-**

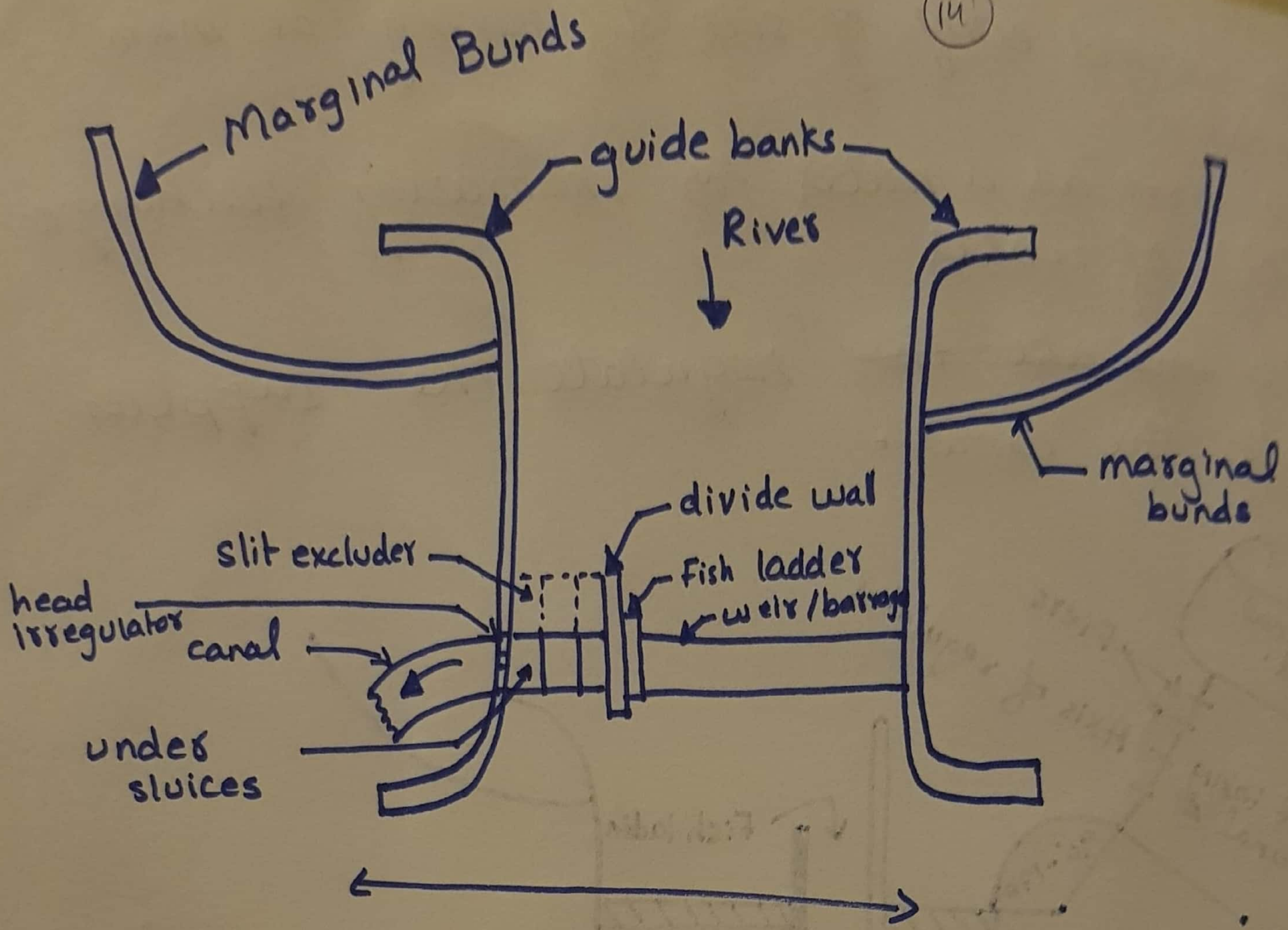
The entry of slit into a canal, which takes off from a head works can be reduced by constructing special works called slit control works.

8) **River Training Works :-**

These are required near the weir ~~sig~~ site to ensure a smooth & an axial flow of water.

↳ **Guide Banks :-** We construct it to prevent the structure from erosion.

↳ **Margmal Bunds :-** Earthen embankments which are constructed parallel to river bank on one or both banks according to condition



Question 4 Part (b) :-

Functions of Canal Head Regulator :-

Regulators constructed at the off taking points are called head regulators. When it is constructed at the main canal it is known as canal head regulator. And when it is constructed at the head of distributary, its called distributary head regulator.

Functions

↳ To control the entry of water either from the reservoir or from the main ~~channel~~ canal.

(15)

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

↳ To serve as a meter for measuring discharge (Q) of water.

↳ To ~~indicate the~~ regulate the supplies into the canal.