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Q No: 1

Part (a)

Anti water logging measures are
The following:

1) Lining of canals and water course:
It reduces seepage of water.

2) Reducing intensity of irrigation:
→ only small Portion of land should recive 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 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.

5) Improving natural drainage of area:

-> water should not be allowed to stay in area.

-> Natural flow is Provided by bush and jungle cutting.

6) Pumping or Tubewells or vertical Drainage:

Lift irrigation should be introduced to use GW. 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.

X ———— X ———— X ————

Part B:

Differentiate b/w saline and alkaline 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 Efforescence.
land affected by efforescence is called saline soil.

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

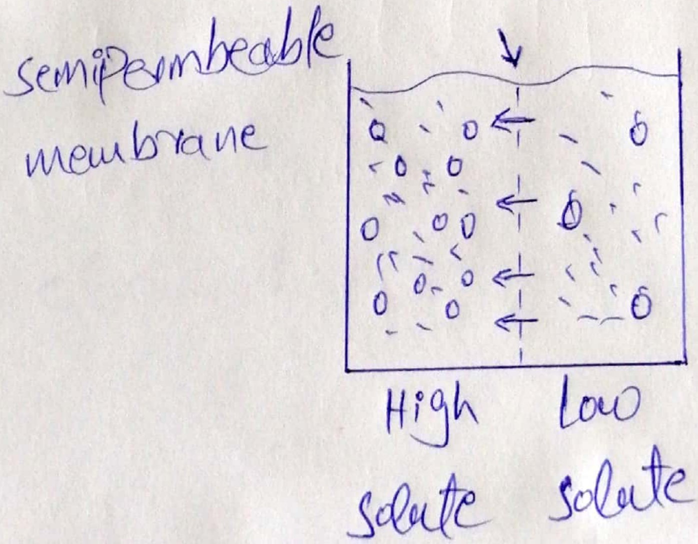
$NaCl$ → Least harmful.

Na_2SO_4 → Medium harmful.

Na_2CO_3 → Most harmful.

→ The above salts are soluble in water.

→ when W.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.



-> By principle of osmosis, the pure water from root flows outwards in a plant die due to lack of water.

-> Such soil is unproductive and is called saline soil.

-> If the salt efflorescence continues for a longer period, a base exchange reaction with clay take place, thus sodiumizing the clay, making it impermeable ieleaerated and highly unproductive.

-> Such soil are called alkaline soils.

x ———— x ———— x ———— x ————

Part C:

Salt affected lands can be reclaimed by the following methods.

1) Avoiding Efflovesence:

-> 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 drainge (surface & subsurface) must be Provided to lower The water table in saline soils.

2) Leaching Process:-

In This Process;

-> Land is flooded with water.

-> Alkaline salts will be dissolved in water.

-> Percolation to The ground water.

-> Drained by sub surface drains.

→ High salt resistant crops like rice are grown on leached land for 1 or 2 seasons.

→ Then ordinary crops like wheat or cotton are grown.

→ Then the land is said to have reclaimed.

→ Sodium sulphate is formed which is leached out easily.

$$Na_2CO_3 + CaSO_4 \longrightarrow Na_2SO_4 + CaCO_3$$

X ———— X ———— X ———— X

Q2:- Part (a)

The equations choosen by Kennedy are:

1. $Q = AV$

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

3) $V_0 = 0.546 m D^{0.64}$

MKS system.

Following data should be Known:

1) Design Discharge (Q).

2) Slope (S).

3) Rugosity coefficient : n.

4) C.V.R = m = V/Vo.

Kennedy Procedure for canal design:

step 1:- Assume The trial value of D and Put in eqn. 1 and detemine.

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

step 2:- in Eqn. 1: $Q = AV$.

$$A = Q/V$$

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

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

For Assumed D determine B.

Find $R = A/P$

step3:- subtitute 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. otherwise repeat The Procedure with changed value of D.

x ———— x ———— x ———— x

Q2:- Part (b)

Given Data:

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

$C.V.V\ (m) = 1$

$N = 0.0225$

Bed slope = 1 in 5000

Depth = d = 2.3m

Solution:-

Finding velocity by formula.

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

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

$$=$$

$VK = 0.930 \; m/sec$

Now calculating area of canal.

By formula.

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

$A = 30/0.930$

$A = 32.25 \; m^2$

Now we have to calculate B,

By using formula.

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

By Putting values.

$A = BD + 0.5 D^2$

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

$32.25 = 2.645 = 2.3 (B)$

$B = 12.87 m$

=> Now we have to calculate welted Perometer.

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

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

$P = 18.01 m$

→ Now we have to calculate hydraulic Radius.

$$R = A/P$$
$$= 32.25/18.01 \Rightarrow R = 1.79\,m$$

→ Now calculate mean velocity from check by equation.

$$V_c = C\,(Rs)^{1/2} \rightarrow ①$$

where;

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

$$= \frac{\frac{1}{0.0225} + \left(23 + \frac{0.00155}{1/5000}\right)}{1 + \left(23 + \frac{0.00155}{(1/5000)}\right) \times \left(\frac{0.0255}{\sqrt{1.79}}\right)}$$

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

$C = 49.56$ Put This value in eq ①

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

$$V_c = 0.93\ m/sec$$

As; $V_{Kennedy}$ (0.93 m/sec) = V_{Chazy} (0.93 m/sec)

so The depth D = 2.3m is Okay

& Design is Okay.

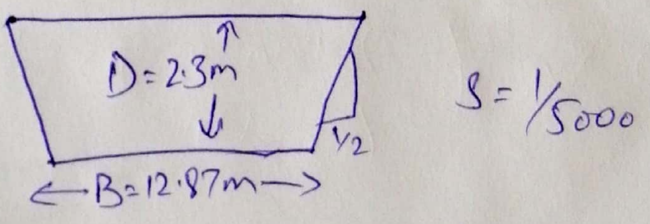
Result:

Full supply Depth = D = 2.3m

Bed width = B = 12.87m

Sides slopes = $\frac{1}{2}$: 1

Bed slope = 1/5000



Q3 : Part (a)

→ 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.

Intial 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 (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.

The channel is said to be regime when The following conditions are satisfied.

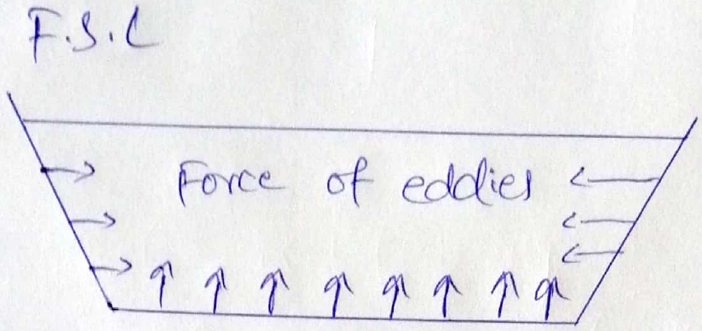
1: The channel is flowing in unlimited, in coherent alluvium of same character (grade).

2: Silt grade and silt charge is constant.

3: Q is constant.

→ a: Lacey argued That silt is supported by The eddies generated from bottom as well as side so he considered "R" as variable instead of D.

→ Lacey: Grain size is important He introduced Lacey's silt factor F.



According to
Lacey's

x —————— x —————— x

Q 3: Part (B)

Given Data:

$Q = 30\ m^3/sec$

$M = 0.56\ mm$

Sol:-

silt factor $= f = 1.76 \times M^{0.75}$

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

$f = 1.3$

$V_m \left(\frac{Qf}{140}\right)^{1/6} \Rightarrow \left(\frac{30 \times 1.3}{140}\right)^{1/6}$

$V_m = 0.844\ m/sec$

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

$A = 35.54\ m^2$

$P = 4.75\sqrt{Q}$

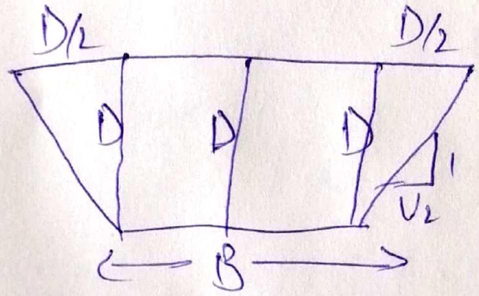
$P = 4.75\sqrt{30}$

$P = 26.01\ m$

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

$R = 1.36\ m$

For Trapezoid Section



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

$35.54 = BD + \frac{D^2}{2} \rightarrow (1)$

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

$26.01 = B + 2.236D$

$B = 26.01 - 2.236D \rightarrow (2)$

Put eq (2) in (1)

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

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

$$35.54 = 26.01D - 1.736D$$

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

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

by Quadratic equation.

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

$D = 1.52m$

Put in eq (2)

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

$$\boxed{B = 22.611 m}$$

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

$$\boxed{S = 0.00026}$$

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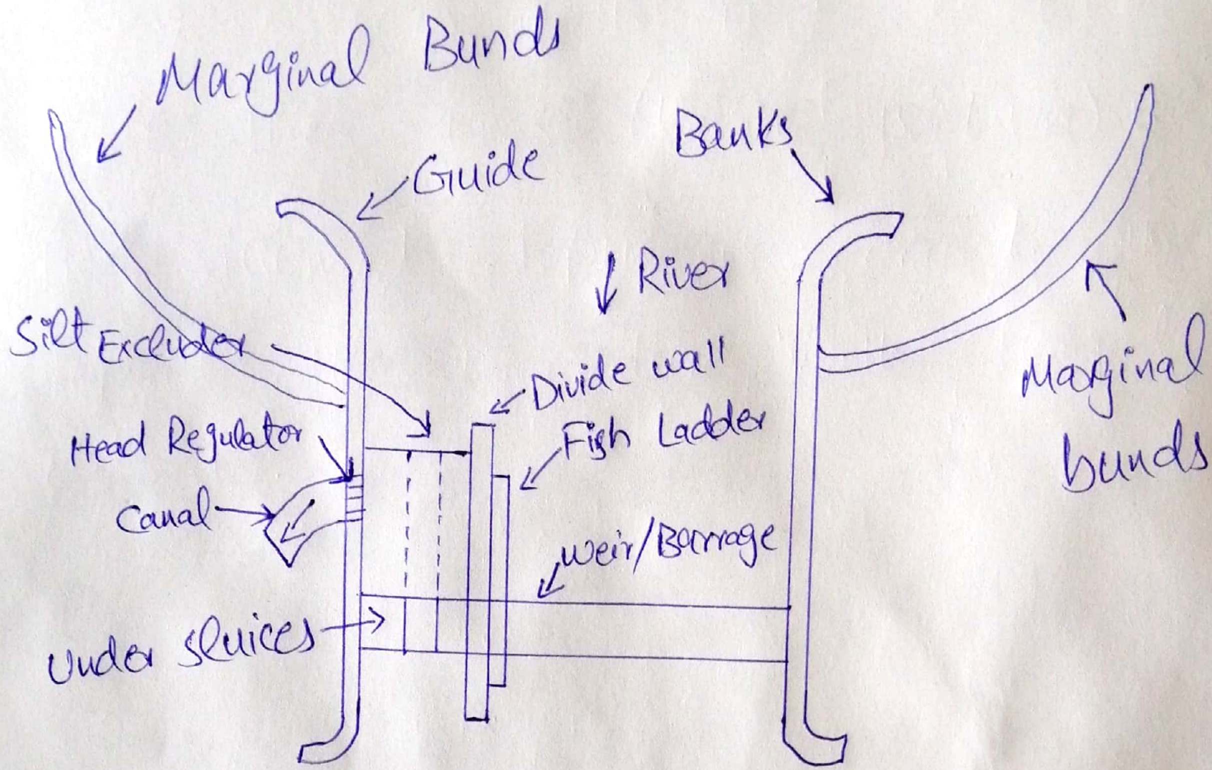
QNo. 4

Part (a)



Ans:- Head work:-

-> Any hydraulic structure which supplies water to The off taking cannal is called headwork.

=> Head work may be divided into two.

1) Storage headwork.

2) Diversion head work.

Components of head work :-

⇒ weir or barrage:-

weir is a structure constructed across river to raise The water level and divert The water into The canal. weir aligned at right angles to The direction flow. Shutters are Provides at The crest of The weir so That part of raising up to water is carried out by shutters.

⇒ Divide wall:-

long wall constructed at right angle in The weir or barrage with stone mansory or cement concrete.

→ on The upstream side, The wall is extended Just to cover The canal head regulator and on The down stream side, It is extended upto The launching.

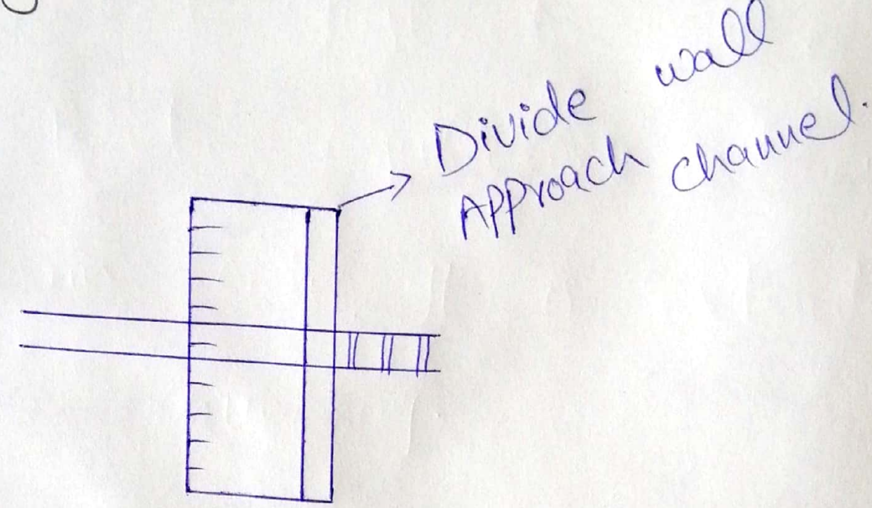
Function:-

-> Form 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 The canal head.

-> Provides a straight approach in front of The canal head.

Diagram:-

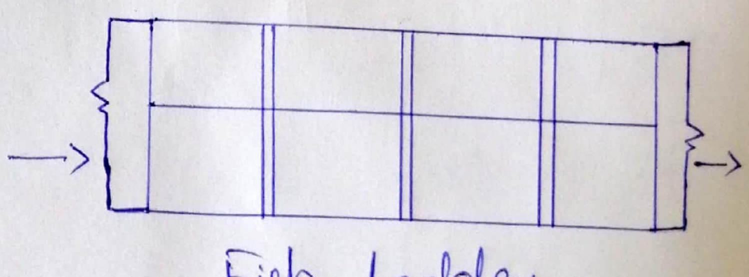


Fish ladder:-

→ 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:-



Fish Ladder

Silt excluder:-

-> Device to exclude silt from water entering The canal.

-> consists of a number of rectangular tunnels.

-> The tunnels are of different length.

-> The length of The tunnels gradually decreases as The distance of The head regulator.

canal head regulator:-

-> A structured which is constructed at The head of The canal to regulate flow of water as Known as canal head regulator.

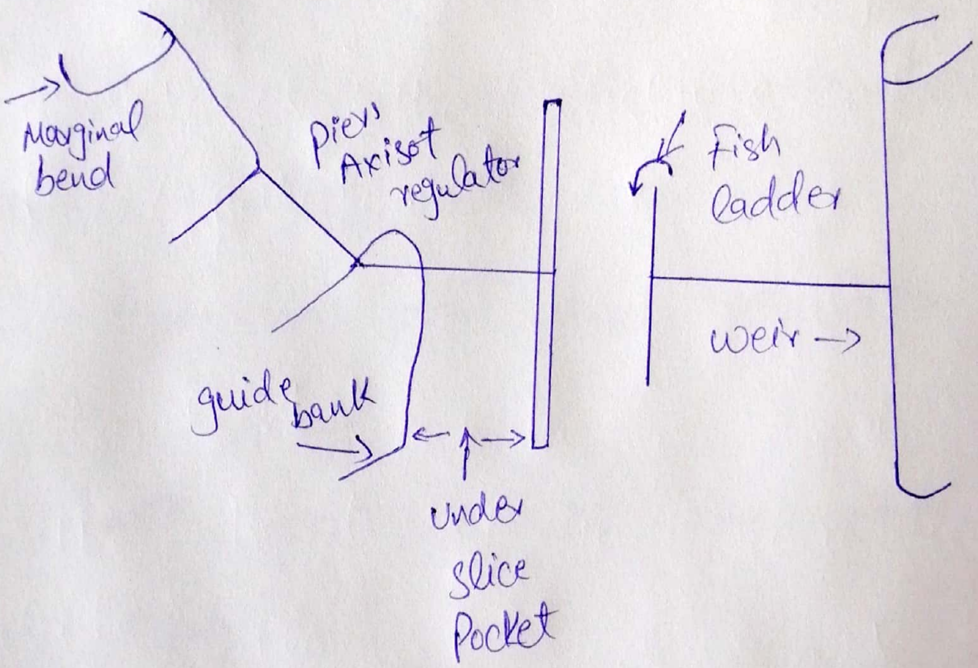
-> It consists of no of Piers which divide The total width of a canal into a number of span which are Known as bays.

Function:-

-> It regulate The supplies of water entering The canal.

-> It controls The entry of silt in The canal.

Diagram:-



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Q4:- Part (b)

Head Regulator:

Structure at The head of canal taking off from a reservior may consists of number of spans separated by Piers and operated by gates. Regulators are normally aligned at 90° to The weir. up to 10° are considered Preferable for smooth entry into canal.

The functions of head regulator are;

1) To admit water into The off taking canal.
2) To regulate The supplies into The canal.
3) To Prevent The river floods from entering into The canal.

4) To indicate The dischage Passed into The canal from design dischage formula and observed head of water on The Crest.

5) To Control The silt entery into The canal During heavy floods, it should be closed otherwise high silt quantity will leave to The canal.