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Question # 1 (a)

Anti-water-logging measures:

Some of the measures use to control water logging are

⇒ **Control of Cannal Seepage:**

Cannal seepage is major source of water losses, and water logging in irrigated areas and it can be control by

→ Linning of Cannel with impervious material like clay, concrete to control seepage

→ Convert water system from cannal to piped system.

⇒ **Reducing Intensity Of Irrigation:**

The most important aspect to avoid water logging is to provide the water to small portion of land. where necessary.

→ Applying only the required amount of water so that all the water applied used by plants.

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→ use efficient irrigation method i.e drip irrigation

⇒ **Rotation of crop:**

we should plant crop in such away that it present the land from ~~the~~ water logging.

→ crops which uses large amount of water should be followed by those plants which use less water or no water.

ex: Rice followed by wheat and then by cotton.

⇒ **Improving Natural Drainage of Area:-**

The water should not be allowed to stay in crops for long time therefore proper drainage system should be provided.

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Question #01 (b)

Saline Soil	Alkaline Soil
1- Saline Soils are the soil that have a pH in between 7 & 8.5 an exchangeable Sodium percentage below 15%.	Alkaline soil are the soil that have a pH greater then 8.5 and an exchangeable Sodium % greater then 51%.
2- Electricity conductivity is 4 or more mmhos/cm.	usually less then 4 mmhos/cm.
3- organic matter content is high in Saline soil.	organic matter content is low in alkaline soil.

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Question #01 (c)

SALT AFFECTED LANDS:

Salt affected lands can be reclaimed by the following methods.

1- Avoiding Efflorescences:

-> By maintaining water table sufficiently below the roots.

-> Hence all the measures which ~~a~~ were suggested for percentage water logging hold good for preventing salinity of lands

-> An efficient drainage must be provided to lower the water table in saline soils.

2- Leaching process:

In this process

1- Land is flooded with water.

2- Alkaline salts will be dissolve in water

3- Precolation to the ground water.

4- Drainage by sub surface drains.

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-> High salt resistant crop ex: rise are grown on leached land for one or two seasons.

-> Then ordinary crop like wheat or cotton are grown, then the land is said to have reclaimed.

-> when sodium carbonate is present in soil gypsum is added before leaching.

-> Sodium sulphate is formed which is leached out easily

$Na_2CO_3 \; CaSO_4 \longrightarrow Na_2SO_4 + CaCO_3$

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Question#02 (a)

Design irrigation canal by Kenedy theory:-

⇒ **Data should be known,**

1) Design discharge (Q)
2) slope (S)
3) Rugosity Coefficient: (n)
4) $C.V.R = m = V/V_0$.

Procedure of Designing:-

Step#1:- Assume the trail value of D and put in eqn 1. and determine.

$V_0 = 0.546 m D^{0.64}$

Step#2:- In Eqn:1: $Q = AV$.

$A = BD + D^2/2$

$P = B + D5^{1/2}$

for assumed D determine B.

Find $R = A/P$

Step#3:- Subtitute the value of R in eqn:2 (kutter and chezy eqn) to obtain V which will be actual velocity for assumed dimensions.

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Step#4:- If the velocity worked out from eqn 2 agrees with that ~~eqn~~ of obtained with eqn (3) (Kennedy's eqn) then the assumed depth is correct otherwise repeat the procedure with change value of D.

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Question # 02 (b)

Given Data:-

Discharge $(Q) = 30\,m^3/sec$

CVR = (m) = 1

N = 0.0225

Bed slope = 1 in 5000

Depth (D) = 2.3m

Solution:-

Finding velocity.

By formula.

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

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

$$\Rightarrow \boxed{V_k = 0.930\,m}$$

Calculating Area of canal By formula.

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

$$A = 30/0.930$$

$$\boxed{A = 32.25\,m^2}$$

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Now calculating B using formula.

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

Putting values.

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

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

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

$$29.605 = 2.3(B)$$

$$\boxed{B = 12.87m}.$$

Now calculating wetted perimeter By formula.

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

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

Now calculating Hydraulic Raddius.

$$R = A/P.$$

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

Now calculating mean velocity from chezy equation

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

where

$$C = \frac{\frac{1}{n} + \left(23 + \frac{0.00155}{S}\right)}{1 + \left(23 + \frac{0.00155}{S}\right)\frac{n}{\sqrt{R}}} \Rightarrow \frac{\frac{1}{0.225} + \left(23 + \frac{0.00155}{(1/5000)}\right)}{1 + \left(23 + \frac{0.00155}{(1/5000)}\right) \times \left(\frac{0.0225}{\sqrt{1.79}}\right)}$$

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

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

$V_c = 0.93$

$V_c = 0.93m$

Question #03(a)

THEORY:-

According to Kennedy, a channel is regime (No silting No Scouring) but according to lacey even through Channel with no silting or scouring may eventually be not regime.

He differentiated between initial 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 the same then also no silting or scouring take place. But this is false.

Final Regime:-

If all the parameter (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, incoherent alluvium of same character (grade).

2) silt grade and silt charge is constant.

3) Q is constant.

lacey argued that silt is supported by the eddies generated from bottom as well as sides so he considered "R" as variable instead of D.

lacey Grain size is important. He introduced lacey's silt factor f.

Question # 3 (b)

Given data:-

$Q = 30$ cumsec

$m = 0.56mm.$

Solution:-

Silt factor $= f = 1.76 \times m^{0.5}$

$= 1.76(0.56)^{0.5}$

$f = 1.3$

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

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

$\boxed{V_m = 0.844}$

As $Q = AV$

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

$\boxed{A = 35.54}$

$\Rightarrow P = 4.75\sqrt{Q} = 4.75\sqrt{30}$

$\Rightarrow \boxed{P = 26.01}$

$R = 5/2 \times \frac{v^2}{F}$

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

$\boxed{R = 1.36}$

$A = BD + D^2/2$

$35.54 = BD + D^2/2 \longrightarrow (1)$

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

$26.01 = B + 2.236D$

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

Put eq (2) in eq (1)

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

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

$35.54 = 26.01D - 1.736D^2$

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

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

By Quadratic eqn.

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

$$\boxed{D = 1.52}$$

Put in eq (2)

Put in eq (2)

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

$$\boxed{B = 22.611}$$

Now

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

$$\boxed{S = 0.00026}$$

Question # 04 (a)

COMPONENTS OF HEADWORK

Following are the components of headwork.

1. **Weir or Barrage:**

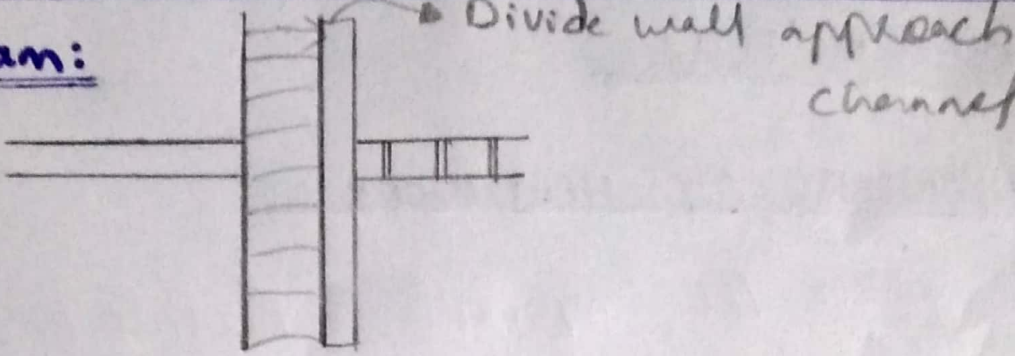
weir is a structure constructed across river to raise the water level and divert the water into the cannal. weir alligned at right angles to the direction flow. Shutters are provided at the crest of the weir so that part of raising upto water is carried out by shutters.

2. **Divide Wall:**

-> Long wall constructed at right angles in the weir or barrage, with stone masonary or cement concrete.

-> on the upstream side, the wall is extended just to cover the cannal head regulator and on the down stream side, It is extended upto launching apron.

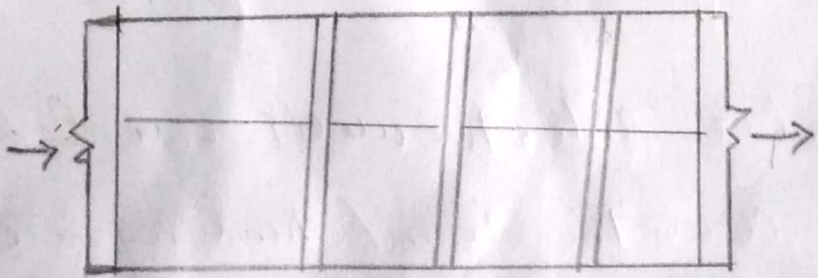
Diagram:



3 Fish ladder:-

Consists of an inclined channel with a slope not exceeding 1in10.
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

4 Silt Excluder:

A Device used to exclude silt from water entering the cannal.
Consist of a number of rectangular tunnel.

The tunnels are of different lengths.

The length of the tunnels gradually decreases as the distance of the head regulator

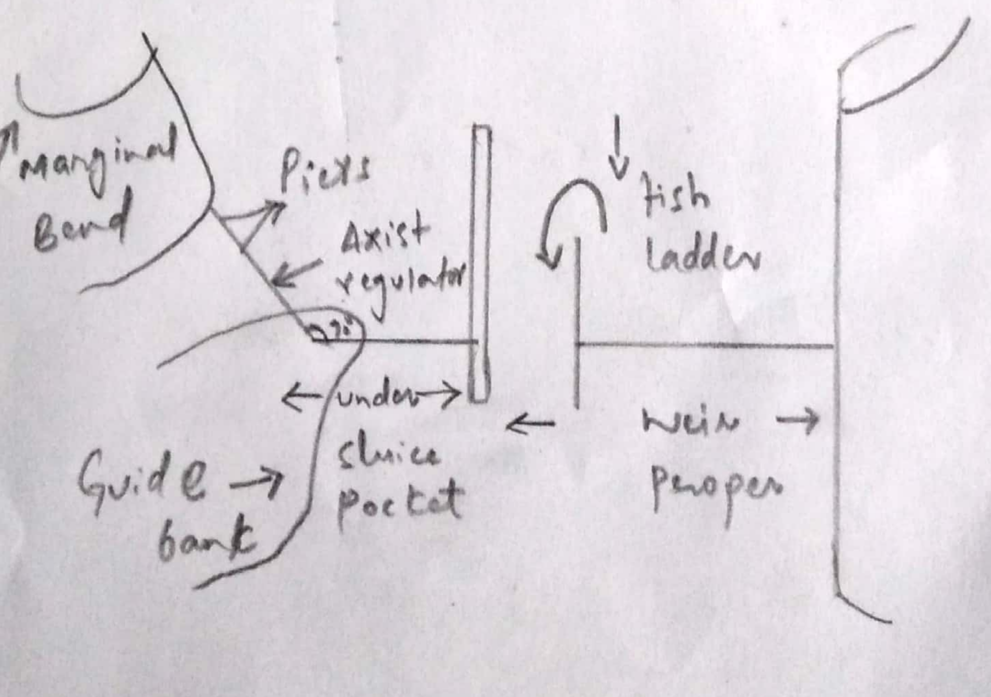
5 Canal Head Regulator:

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 no of piers which divide the total width of the cannel into a number of span which are known as bays.

The piers consists of number of tiers on which the adjustable gates are placed.

Diagram:



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Question #04 (B):

Function Of Head Regulator:-

It regulates the supply of water entering the cannals

It controls the entry of silt in the cannel.

It prevents the river-floods from entering the canal.

To indicate the discharge passed into the cannel from design discharge formula and observed head of water on the crest.
