Day: M T W T F S Date: __/__/__

# Final term Exam

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Section : B

Subject : Irrigation engineering

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Q 1
Part A Anti water logging measures:-

1) Lining of canals and water courses:-
It is reduce seepage of water

2) Reducing Intensity of Irrigation:-
. only small portion of land should recieve canal water in one particular season
. Remaining area can recieve water in next season by rotation.

3) By introducing Crop rotation:-
. High Water requiring crop should be following by one requiring less water
. And also then by one requiring almost no water.

Example:-
. Rice following 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:

- What should not be allowed to stay in one area
- Natural flow is provided by bush and jungle cutting.

6) Vertical drainage:-

- Life irrigation should be introduce to use GW
- Canal Irrigation may be substitude by tube well Irrigation

7) Adoption of Sprinker method of Irrigation:-

- Only predetermine amount of water is supplied to land
- No precolation loses from water course

Q 1 part B

| Saline Soil | Alkaline Soil |
|---|---|
| • Mainly $Cl^-$ & $SO_4^{2-}$ of $Na^+$ and also $Cl^-$ $SO_4^{2-}$ and $HCO_3^-$ of $Ca^{2+}$ and $Mg^{2+}$ in small amount | • Mainly $CO_3^{2-}$ of $Na^+$ but also $CO_3^{2-}$ of $K^+$ $CO_3^+$ and $Mg^{2+}$ in small amount |
| • Soluble salt concentration is equal to or more than 0.1% | • Soluble salt concentration is less than 0.1%. |
| • Exchangable Sodium percentage is less than 15% | • Exchangable Sodium percentage is greater than 15% |
| • In rainy season some natural vegetation is grown. | • No any Natural vegetation except some grass. |
| • Easy to manage because physical condition of soil is good. | • Such soil can be managed because physical condition not so good |
| • O.M or humans is always found in soil. | • O.M or humans or even absent. |

Q 1 Part c

## Reclamation of Salt Affected land:-

In the arid regions of the world and along coastal areas subjected to periodic inundation by sea water. Soil may have such a high content of soluble salt that production of economic plants is not possible. The salts found in soil are generally the chlorides, carbonate, bicarbonates and sulfates of sodium with lesser amount of potassium, magnesium and calcium salts.

The salt in soil dissolves in the soil water and damage plant growth by preventing to plants from getting needed water from the soil. Since the energy required to remove a given quantity of water from a soil solution increases as the salt concentration of the solution increases.

Q 2
Part A

## Kennedy procedure for irrigation canal design:-

Following are steps to considered

**Step # 01 :-** Assume the trail value of D and put it in equation (1) and determine.

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

**Step # 02 :-** In equation

$$Q = AV$$

$$A = Q/V$$

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

$$P = B + 0 D$$

$$S^{1/2}$$

For assumed D determine B Find

$$R = A/P$$

**Step # 03 :-** Subtitle the value of R in equ (2) (Kutter & chazys equ) to obtain V which will be actual velocity for assumed dimensions

Step#04:- If the velocity worked out from equ (2) agreed with that of obtained with the equ (1) (Kennedy equ). Then the assumed depth is Correct. other wise repeat the procedure with changed value of D

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Q 2
Part b

Given data

$Q = 30$ ounce
$N = 0.0225$
$m = 1$
$S = 1$ in 5000

Step#01

$D = 2.3m$
$V_o = 0.546\, m D^{0.64}$
$V_o = 0.546\,(1)(2.3)^{0.64}$
$V_o = 0.930$ m/s

Step#02

$A = Q/V_o$

$A = 30/0.930 = 32.25\ m^2$

For horizontal section

$A = BD + D^2/2$
$A = B(2.3) + \frac{(2.3)^2}{2}$

$$32.25 = B(2.3) + \frac{(2.3)^2}{2}$$

$$32.25 = \frac{2B(2.3) + (2.3)^2}{2}$$

$$B = 12.87$$

Now, $P = B + DS^{1/2}$

$$P = (12.87) + (2.3)S^{1/2}$$

$$P = 18.01m$$

Now, $R = \frac{A}{P} = \frac{32.25}{18.01}$

$$R = 1.790$$

Step # 03

$$V_0 = C\sqrt{RS} \quad - (i)$$

First to find C

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

$$C = \frac{\frac{1}{0.0225} + 23 + 0.00155/1 \times 5000}{1 + (23 + \frac{0.00155}{1} \times 500)\frac{0.0225}{\sqrt{1.790}}}$$

$$C = 49.918$$

Putting (ii) in (i)

$$V_0 = 49.918\sqrt{\frac{1.790 \times 1}{5000}}$$

$V_0 = 0.944$

Now, Ratio of Velocities $= \frac{V_0}{V} = \frac{0.930}{0.944}$

$= 1.00 = 1$

It means assumed depth was correct

Q 3
Part (A)
Ans He differentiated between initial regime and final Regime but this theory is applicable to final regime

* Initial Regime:- When only bed slope of channel change 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 grade then the channel is said to have final regime.

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

Q 3
Part (b)

Given data:-

$a = 30$ Cumec

(M) Silt factor $= 0.56$ mm

Solution:-

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

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

$f = 1.3$

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

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

$$\boxed{V_m = 0.844}$$

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

$$\boxed{A = 35.54\ m^2}$$

Now,

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

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

$$P = 26.01$$

Now for R,

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

$$\boxed{R = 1.36}$$

$$B = 26.01 - 2.236[152]$$

$$\boxed{B = 22.611}$$

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

$$S = \frac{(13)^{5/3}}{3340\,(30)^{1/6}}$$

So,

$$\boxed{S = 0.00026}$$

Q 4
Part A Components of a diversion headwork:-

- Weir or barrage
- Undersluices
- Divide Wall
- Fish ladder
- Canal head regulator
- Silt excluders / Silt prevention devices
- River training works (Marginal bund and guide banks)

* Weir or barrage:-

-> 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.

-> Barrage:-

- When water level on the up stream side of the weir is required to be raised to different level at different time.
- Barrage is an arrangement of adjustable gates a different times.

* Under sluices:-
  - Also known as Scaring Sluices
  - Under sluices are opening provided at base of barrage
  - Those opening provided adjustable gates
  - Suspended silt goes on depositing in front of canal head regulator

* Divide wall:-
  - Dividing wall is a long wall.
  - Constructed at right angle in weir.
  - It is constructed with cement concrete
  - It is extended upto the launching apron see on Fig (a)

Functions:-
- To form a still water pocket in front of canal.
- To cleaned through the scouring sluices from time to time.
- It control the eddy current
- It resist overturning effect on weir.

* Fish ladder:-
  - The fish ladder is provided just by the side of the divided wall for free movement fishes.
  - Rivers are important source of fishes.
  - This movement is essential for their survival
  - Length, width and height of it

depend on river and type of barrage or weir on Fig (b).

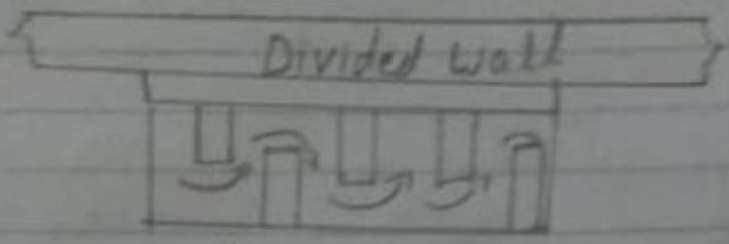


Fig (a)

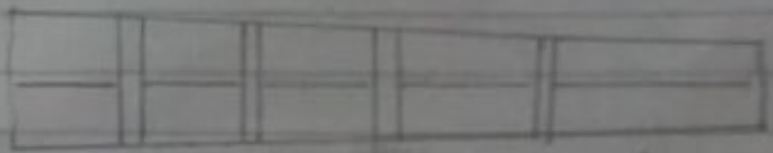

Fig (b) Fish ladder

## * Canal head regulator:-

. A structure which is constructed at the head of canal to regulate flow of water

. Consists number of piers.
. Some piers are constructed on down stream.
. It support the roadway

## * River training works:-

. River training works required near the dam site in order to ensure a smooth and an axial flow of water

. For their work required Guide bank, marginal and spars

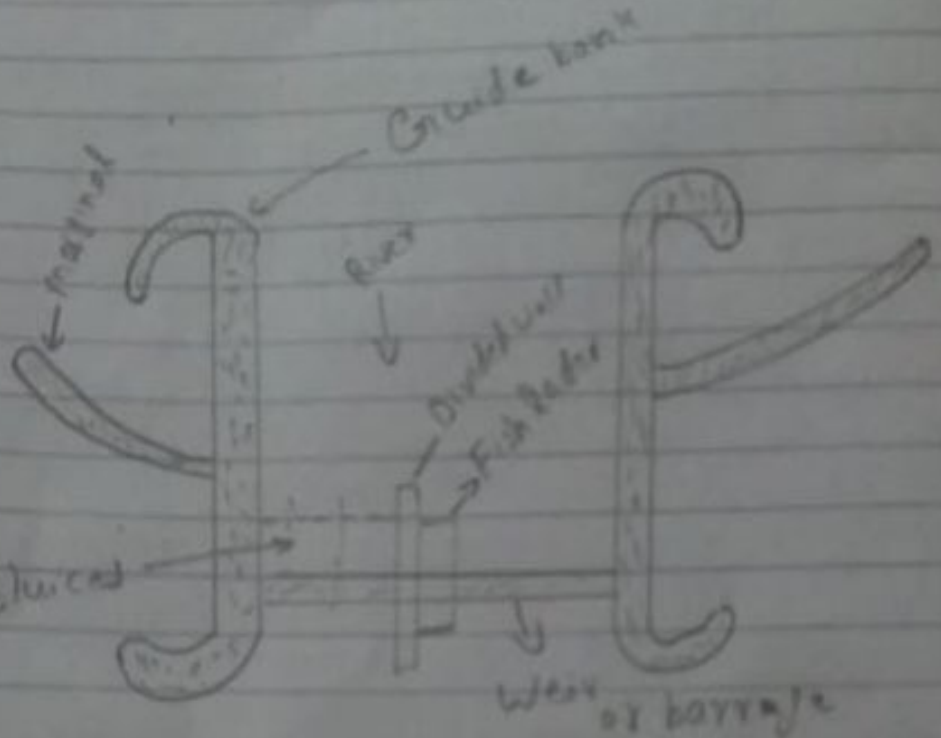


Diagram of head work

Q4

Part (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 the canal.

Silt regulation works:-

The entry of silt into a canal, which take 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.

(a) Silt excluders.
(b) Silt Ejectors.

* Silt excluders:-

These works are constructed on the bed of the river.

* Silt Ejector:-