FINAL PAPER

SUBJECT : IRRIGATION ENGINEERING

SECTION : B

MODULE : 6th.

SUBMITTED BY: AQIB ULLAH 7857

SUBMITTED TO : Dr. JAHANGIR DURRANI

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QUESTION 01(a):

Explain anti water logging measure.

ANTI WATER LOGGING MEASURE:

Following are the methods of anti water logging measure.

1. Lining Of Canals And water courses:

- It reduces spee seepage of water

2. Reducing intensity Of irrigation:

- Only small portion of land should recieve canal water in one particular season.
- Remaining areal can recieve water in next season by rotation.
- High water requiring crop should be followed by one requiring less water and then by one requiring almost no water.

3. Optimum Use Of Water:

Certain amount of water gives the best result. less or more water reduce the yeild cultivators should be educated so that not to use more water.

- Revenue should be charged on the basis of quantity of water rather then the area of land.

5. Improving natural drainage Of Area:

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

6. Pumping or Tubewells or Verticle Drainage:

- Lift irrigation should be inhoduced to use GW.
- Canal irrigation may be substituted by tubewell irrigation.

7. Economical use of water according to need.

8. Adoption Of Sprinkles method of irrigation:

- Only predeteemind amount of water is supplied to land.
- No percolation losses from water courses.

QUESTION Q1 (b):

Differentiate blw saline and alkaline soils

SALINE SOIL

- Saline soil have higher levels of soluble salts such as sulfate, carbonate and chloride which interfere with the seed germination process and causes reduction in germination.
- Soluble salt concentration is equal to or more than 0.1%.
- Exchangeable sodium is less than 15%.
- PH is less than 8.5
- White/light grey colour hence called white alkali
- Easy to manage because physical condition of soil is good

ALKALINE SOIL

- Alkaline soil is referred to to by some gardeners as sweet soil, it usually contains sodium, calcium, magnesium Because alkaline soil is less soluble than neutral soil.
- Soluble salt concentration is less than 0.1%.
- Exchangeable sodium is greator than 15%.
- PH is greator than 8.5
- Black colour hence called black alkali
- Such soils can't be manage because physical condition is not so good.

QUESTION 01 (c)

How do you reclaim salt affected land?

ANS:

Following are the major aspect to reclaim salt affected land.

- Maintain the water table sufficiently below the roads
- An efficient drainage (surface and subsurface) must be provided to lower the water table in saline salt.
- The practice of crop reversal is necessary to reduce the establishment of salt or efforsence.
- Land should be flooded with water so that alkaline salt will be disolved in water.
- High salt resistance crops like rice are grown on leached land for 1 and 2 seasons.

QUESTION 02 (a):

Explain the procedure of designing of an irrigation canal by Kennedy's theory?

KENNEDY'S THEORY:

RG 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 depends upon quantity of silt.

Kennedy's Procedure For Canal Deign:

STEP 01:

Assume the trail value of D and put in equation 1 and determine.

$V_o = 0.546 m D^{0.64}$

STEP 02:

In equation 1 : $Q = AV$

$A = Q/V$

$A = BD + D^2/2$

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

For assumed D determine B

Find $R = A/P$

STEP 03:

Subsitute the value of R in eq 2 (Kuttees and Chazy's Equation) to obtain V which will be the actual velocity for assumed dimensions.

STEP 04:

If the velocity worked out from Eqn-2 agrees with that of obtained with the eqn-3 (Kennedy's Eqn) Then the assumed depth is correct. Other wise repeat the procedure with changed value of D.

QUESTION 02 (b)

SOLUTION:

GIVEN DATA:

$D = 2.3\,m$

$Q = 30\,cumic$

$C.V.R = m = 1$

$N = 0.0225$

$S = 1/5000 = 0.0002$

As $Q = AV$

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

Using formula to compute "V"

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

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

$$\boxed{V_o = 0.935\ m/s}$$

Putting value of V in eq (1)

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

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

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

$B = 12.77\ m$

Put the value of m below equation

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

$$= 12.77 + 2.33\sqrt{5}$$

$$= 17.9\ m$$

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

Subsituting the value of "R" in kutter's and chazy's Eqn.

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

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

$$C = \frac{\frac{1}{n} + \left(23 + \frac{0.00155}{0.0002}\right)}{1 + \left(23 + \frac{0.00155}{0.0002}\right)\frac{1}{\sqrt{1.76}}} = 49.526$$

Put the value in eq (a)

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

$$V = 0.93\ m/s$$

This is equal to Vo thus no more trails are required.

QUESTION 03 (a)

Differentiate b/w initial and final regime in accordance to laceys theory?

- Laceys differentiate initial and 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 (peimeter, depth, and slope) have equally free to vary and adjust according to discharge and silt grades than the channel is said to have final regime.

QUESTION 03 (b):

Design a regime channel by Lacey's theory for discharge of 30 cumecs and mean diameter of silt particle of 0.56mm.

GIVEN DATA:

$Q = 30 \text{ cumecs}$

$m = 0.56 \text{ mm}$

SOLUTION:

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

$= 1.76 (0.56)^{0.5}$

$f = 1.3$

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

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

$$\boxed{V_m = 0.844}$$

As $Q = AV$

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

$$\boxed{A = 35.54}$$

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

$= 4.75\sqrt{30}$

$\boxed{P = 26.01}$

$\Rightarrow R = \frac{5}{2} \times \frac{V^2}{f}$

$= \frac{5}{2} \times \frac{(10.844)^2}{1.3}$

$\boxed{R = 1.36}$

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

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

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

$26.01 = B + 2.236D$

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

Put eq (2) in eq (1)

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

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

$35.54 = 26.01D - 1.736D^2$

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

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

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)

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

$$\boxed{B = 22.611}$$

Now

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

$$\boxed{S = 0.00026}$$

QUESTION 04 (a):

Explain components of headwork with neat diagram.

Components Of Headworks:

Following are the components of headworks.

1. WEIR :

Normally the water level of any perennial river is such that it cannot be diverted to the irrigation canal. The bed level of canal may be higher then 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. Adjustable shutters are provided on the crest to raise the water level to some required height.

2. 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 barriage. 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.

4. DIVIDE WALL:

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

Function :

The function of Divide wall is to form a still water pocket in front of canal head so that the suspended silt can be settle down.

5. FISH LADDER:

The fish ladder is provided just by the side of the divided 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 winters and vice versa

in monsoon. This movement is essential for their seerival. Due to construction of weir or barrage, this movement gets obstructed and is detrimental to the fishes.

6. CANAL HEAD REGULATOR:

A structure which is constructed at a 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 into a number of spans which are known as bays. The piers consist of number tiers on which the adjustable gates are placed.

Function:

It regulates the supply of water entering the canal. It control the entry of silt in the canal. It prevent the river-floods from entering the canal.

7. SILT REGULATION WORKS:

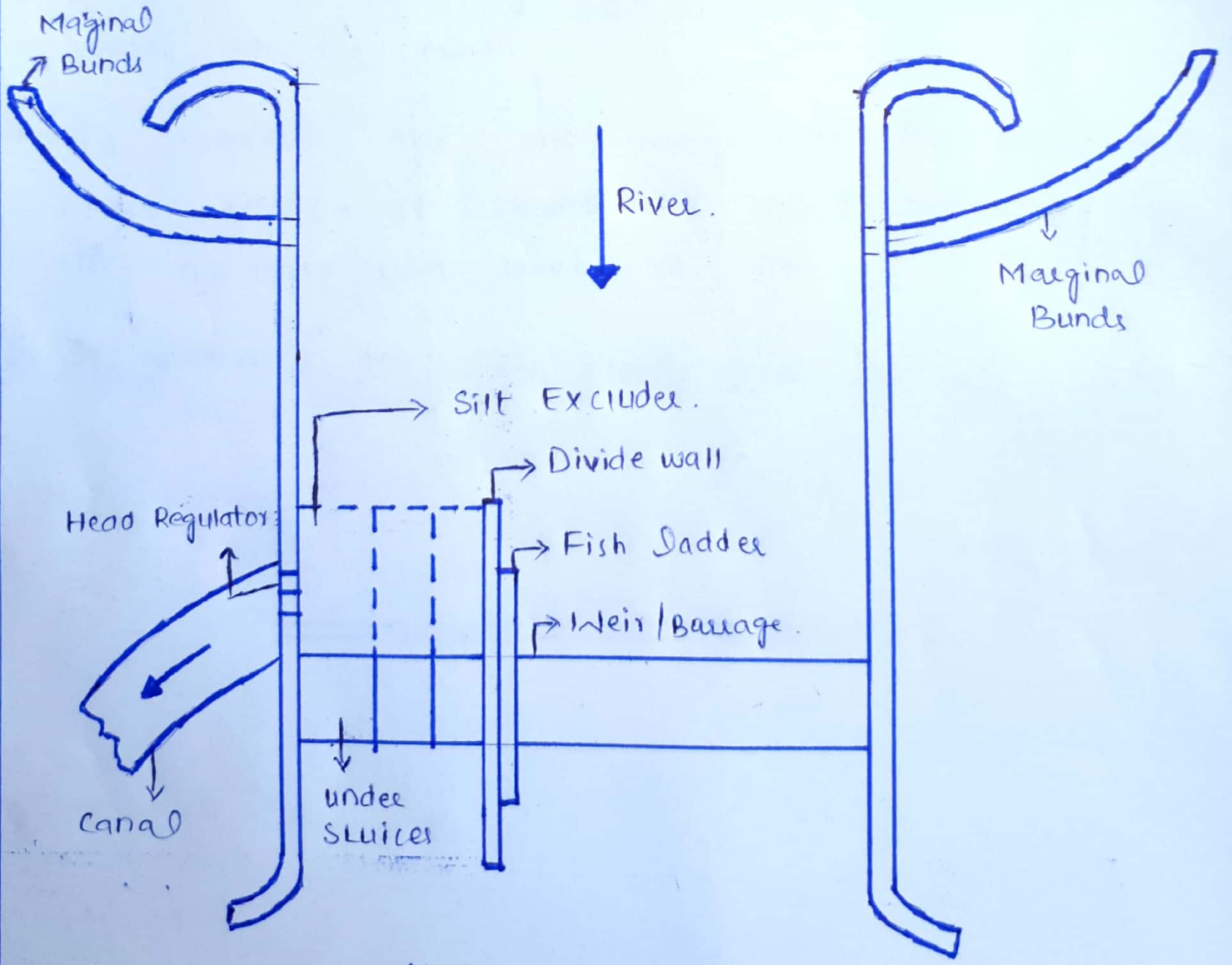
The entry of silt into a canal, which takes off from a head work, can be reduced by constructed certain special works called silt control works. These works may be classified into the following types.

- Silt Excluders
- Silt Ejectors.

8. 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 training work required on a canal headwork are

- Guide banks
- Marginal bunds
- Spurs or groynes.



HEAD WORK

QUESTION 04 (b)

What are the function of head regulators

Function Of Head Regulators:

The function of canal head regulators are:

1. To admit water into the off taking canal.
2. To regulate the supplies into the canal.
3. To indicate the discharge passed into the canal from design discharge formula and observed head of water on the crest.
4. To control the silt entry into the canal. During heavy floods, it should be closed. otherwise high silt quantity will leave to canal.
5. It prevents the river-floods from entering canal.