Name : Malak Miraj Qadir

ID : 7829

Semester : 6th

Section : A

Subject : Irrigation Engineering

Instructors Name : Dr MAK Jahangir Durani

Exam : Final Term.

Scanned with CamScanner

Q.No(01)

a) Explain anti water-logging measures.

Ans:- Water-Logging Control:

- Quantity of water into soil below is reduced.
- Inflow into underground reservoir is reduced and outflow should be increased.

Methods of Control of Water logging.

1. Reducing Intensity of Irrigation:

. Only small portion of land should receive canal water in one particular season.

. Remaining areas can receive water in next season by rotation.

2. Lining of Canals and water Courses.

It reduces seapage of water.

Scanned with CamScanner

3. By Introducing Crop rotation:
. High water requiring crop should be followed be 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 amout 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 one area.
- Natural flow is provided by bush and Jungle cutting.

Scanned with CamScanner

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.

Q.No1 (b)

Differentiate b/w ~~salt~~ saline and alkaline soils?

Ans: b:- Saline Soils:-
By principle of osmosis, the pure water from root flows outwards, in a plant due to lack of water. Such soil is unproductive and is called saline soil.

Alkaline Soils:
If the salt efflorescence continues for a ~~longer~~ longer period a base exchange reaction with.

Scanned with CamScanner

clay takes place, thus sodiumizing the clay, making it impermeable, illeasated and highly unproductive. Such soil are called alkaline soils.

Q.No(01)C):-
How do you reclaim salt affected lands?

Ans:-
Reclamation of Salt affected lands:

How to 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 and subsurface) must be provided to lower the water table in saline soils.

Scanned with CamScanner

leaching:

In this process;

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.

. 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.

. When Sodium carbonate is present in the soil, gypsum is added before leaching.

. Sodium sulphate is formed which is leached out easily.

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

Scanned with CamScanner

Land drainage:
1. Surface drainage
2. Subsurface drainage/Tile drainage

Surface drainage:-
. Removal of excess of water using open ditches, field drain, land grading etc.
. Open drain which remove excess of irrigation and storm water are broad and shallow are called shallow ~~su~~ surface drains.
. Shallow surface drains: carry runoff to point of entrance to outlet-ditches. These large and deep outlet ditches are called deep surface drains.

Q.No(02) a)

Ans:- Assumptions of Kennedy:

1. Vertical component of eddies support the silt particles.
2. The silting power of a channel depends upon its velocity, which controls the eddies.
3. The slit transporting power depends upon its depth.
4. The silt transporting power of a channel is independent of a bed width

Kennedy:

1. Arbitrary fixed the ratio B/D.
2. Used Chazys and Kutter Equations to find V.
3. N = 0.0225.

The equations choosen by Kennedy are

1. $Q = AV$
2. $V = C(RS)^{1/2}$ --- chazys equation.

Scanned with CamScanner

$$C = \frac{\frac{1}{n} + \left(23 + \frac{0.00155}{S}\right)}{1 + \left(23 + \frac{0.00155}{S}\right)\frac{n}{\sqrt{R}}} \qquad C = \frac{41.65 + \frac{0.00281}{S} + \frac{1.811}{n}}{1 + \frac{n}{\sqrt{R}}\left(41.65 + \frac{0.00281}{S}\right)}$$

MKS System   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 $= m = V/V_0$

Kennedys Theory:

- R.G Kennedy studied straight reaches of upper Bari Doab Canal which are stable for 30 years.
- $V_0 = CD^n$

where V_0 is critical velocity (non-silting or non-scouring)

C is constant depends upon quantity of silt.

Scanned with CamScanner

Sediment is kept in suspension solely by the vertical component of eddies.

- Weight of sediment vertically acts downwards.
- Vertical component of eddies acts upwards.
- Result: The sediment is in suspension
- $V_0 = 0.84 D^{0.64}$ FPS system.
- $V_0 = 0.546 D^{0.64}$ MKS System, D is depth.
- $V_0 = 0.546 m D^{0.64}$ where $m = V/V_0$ = critical velocity ratio (C.V.R), depends upon silt grade.
- V = critical velocity for all sizes of sediment, V_0 is @ V_{cr} for upper Bari Doab canal only.

Kennedy Procedure for Canal design:

Step 1: Assume the trial value of D and put in eqn. 1. and determine

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

Scanned with CamScanner

Step2: In Eqn. 2: $Q = AV$

$A = Q/V$

$A = BD + D^2/2$

$A = BD + D^2/2$

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

For assumed D determine R.

Step#3.

Substitute 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. other wise repeat the procedure with changed value of D.

Scanned with CamScanner

Q.No(02) b).

Given Data: $Q = 30\,m^3/sec$

$C.V.R = m = 1$

$N = 0.0225$

$S = 1/5000$

Sol:- First assume the depth $d = 2.4m$

Step#01:- Trial#1:-

$V_0 = 0.55\,m\,D^{0.64}$

$V_0 = 0.55 \times (2.4)^{0.64}$

$V_0 = 0.963$

Step#02: $Q = AV$

$A = Q/V$

$A = 30/0.963$

$A = 31.153\,m^2$

$A = BD + D^2/2$

$31.153 = B \times 2.4 + \frac{(2.4)^2}{2}$

$B = 11.78\,m$

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

$P = 11.78 + 2.4\sqrt{5}$

$P = 17.146\,m$

Scanned with CamScanner

$R = \frac{A}{P} = \frac{31.153}{17.146}$

$R = 1.82$

Step#3:- $V = C(\sqrt{RS})$ → kutter to chezy eqn)

$$C = \frac{\frac{1}{0.0225} + \left(23 + \frac{0.00155}{0.0002}\right)}{1 + \left(23 + \frac{0.00155}{0.0002}\right) \times \frac{0.00255}{\sqrt{1.82}}}$$

$C = \frac{75.194}{1.513}$

$C = 49.703$

$V = 49.703$

$V = C(\sqrt{RS})$

$V = 49.703 \times \sqrt{1.82 \times 0.0002}$

$V = 0.948$

which are less than $V = 0.963$

Than decrease the depth

$d = 2.3m$

Trial 2:- This second trial are directly calculated value $D = 2.3m$.

Step#1: $V_0 = 0.55 \times 1 \times (2.3)^{0.14}$

$V_0 = 0.937 \ m/sec$

Scanned with CamScanner

Step#2:- $A = Q/V = 30/0.937$

$\boxed{A = 32.017 m^2}$

$A = BD + D^2/2$

$\boxed{B = 12.77 m}$

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

$\boxed{P = 17.913} m$

Step#3:-

$C = \frac{75.195}{1.518}$

$\boxed{C = 49.535}$

$R = A/P$

$\boxed{R = 1.787}$

$V = C \times \sqrt{RS}$

$V = 49.535\sqrt{1.787 \times 0.0002}$

$\boxed{V = 0.93 m/sec}$ which are equal to the V_o

Scanned with CamScanner

Q.No(03) a)

Ans:- According To Lacey's Theory:

. 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.

. He differentiated between initial regime and final regime but this theory is applicable to find 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.

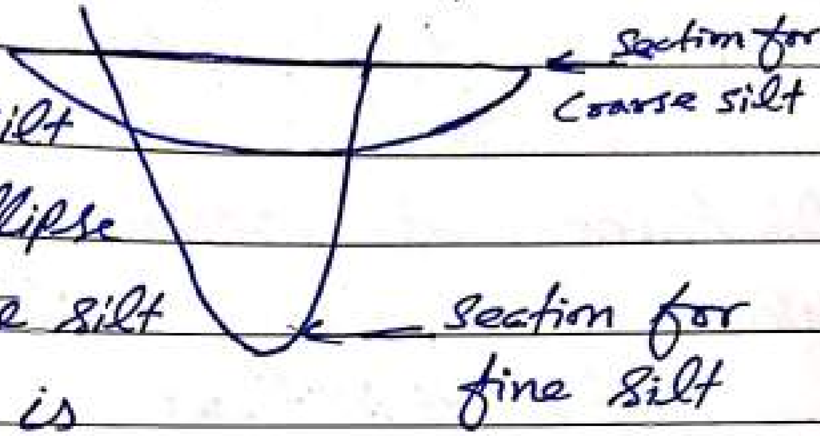
· Final Regime:-

. If all the (parameter, depth and slope) have equally free to vary and adjust according to discharge and silt grades then the channel is

Scanned with CamScanner

~~Sail~~ said to have final regime.

. In final regime the cross-section assumes semiellipse shape.



Coarser the silt flatter the ellipse ~~Find~~ Finer the silt the section is semi circle (greater the depth).

Scanned with CamScanner

Q3 Part B :- Given data :-

$Q = 30\ m^3/sec$

$M = 0.56\ mm$

Sol :- Silt factor = $f = 1.76 \times M^{0.5}$

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

$f = 1.3$

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

$$= \left(\frac{30 \times (1.3)^2}{140}\right)^{1/6} \Rightarrow \boxed{V_m = 0.844}$$

$Q = AV$, $A = Q/V = 30/0.844 = \boxed{A = 35.54}$

$P = 4.75\sqrt{Q}$

$P = 4.75\sqrt{30} \Rightarrow \boxed{P = 26.01}$

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

$$\boxed{R = 1.36}$$

$A = BD + D^2/2$

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

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

$26.01 = B + 2.236\,D$

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

Scanned with CamScanner

Putting eq(2) in eq(1)

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

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

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

$35.54 = 26.01D - 1.736D^2$

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

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

By Quadratic Equation

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

$\boxed{D = 1.52}$ → Put in eq(2)

$B = 26.01 - 2.236(1.52)$

$\boxed{B = 22.611}$

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

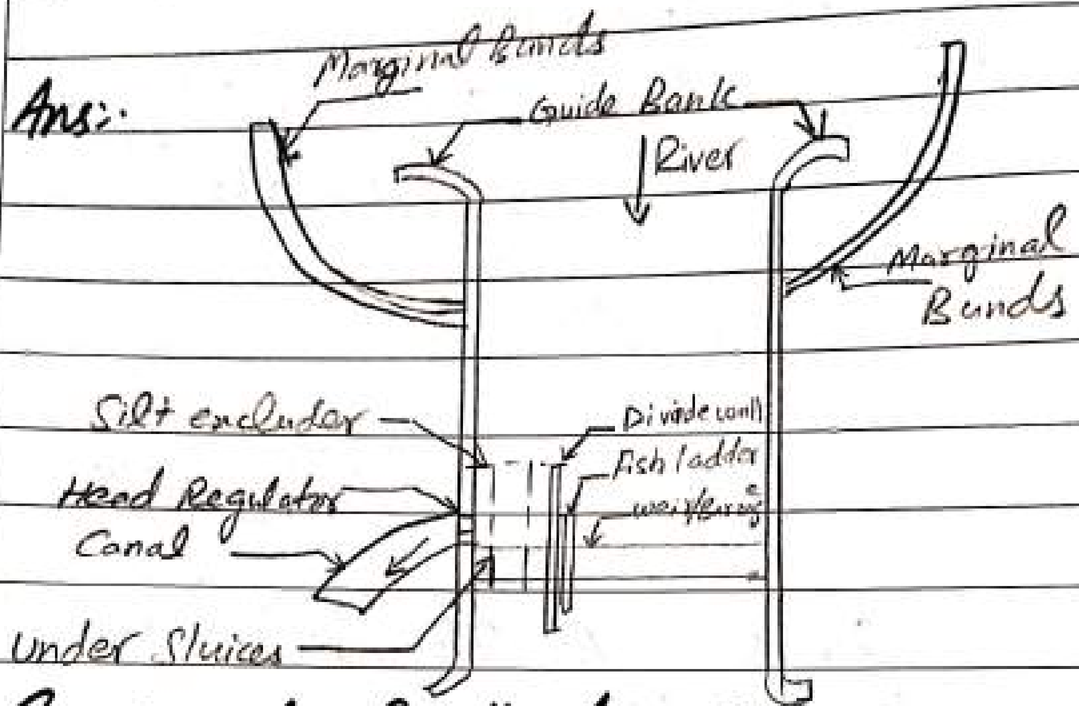
$$S = \frac{(1.3)^{5/3}}{3340(30)^{1/6}}$$

$\boxed{S = 0.00026}$

Scanned with CamScanner

Q.No(04)(a)

Ans:



Components of Headwork:-

Any hydraulic structure which supplies water to the off-taking canal is called a headwork.

Headwork may be divided into two.

1. Storage headwork
2. Diversion headwork.

Storage headwork: Dam is constructed across a river valley to form storage reservoir, known as storage head works. Water is supplied to to the canal from this reservoir through canal regulator. These serves for multipurpose function like hydro-electric power generation, flood control, Fishery.

· Diversion head works:-

weir or barrage is constructed across a perennial river to raise water level and to divert the water to canal, is known as diversion head work. Flow of water in the canal is controlled by canal head regulator.

Q.No(4)

Ans. **Head Regulator:-** Function:

→ It regulates the supply of water entering the canal.

→ It controls the entry of silt in the canal

→ It prevents the river-floods from entering the canal.

→ to indicate the discharge passed into the canal from degin discharge formula and observed head of water on the crest.

→ **Silt Exclude:-**

→ Device to exclude silt from water entering the cannal.

→ Consists of a number of rectangular tunnels.

→ The tunnels are of different lengths.

Scanned with CamScanner

→ The length of the tunnels gradually decreases at the distance of the head regulator.

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.

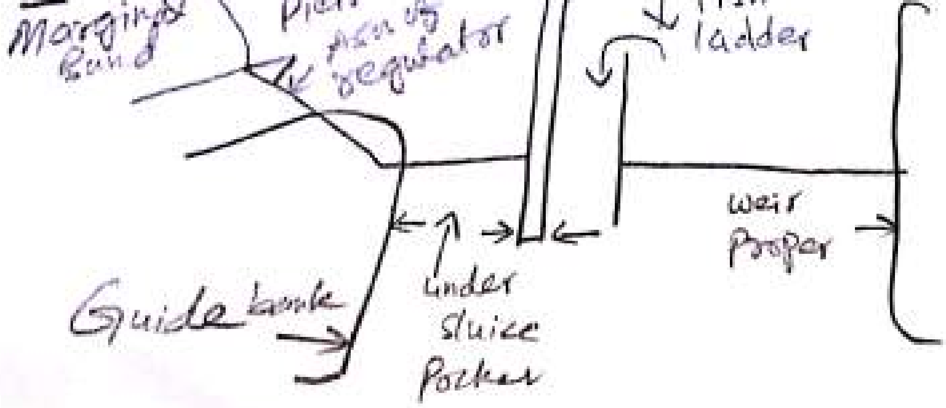
→ It consists of no. of piers which divide the ~~th~~ total width of the cannel into a number of span which are knowns as bays.

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

Function:-

→ It regulates the supply of water entering the canal.

→ It controls the entry of silt in the canal.



Scanned with CamScanner