NAME	MUHAMMAD FURQAN
ID	7802
SEMESTER	6th
SECTION	"A"
INSTRUCTOR:	Prof. Dr. JAHANGIR DURRANI
SUBJECT:	IRRIGATION ENGINEERING
EXAM:	FINAL TERM EXAMINATION:

QUESTION: 01

PART: a

ANTI-WATER LOGGING MEASURES: The anti water logging measures include the following.

1 **LINING OF CANALS & WATER COURSES:** By lining of canals and water courses the seepage of water is reduced.

2 **REDUCING INTENSITY OF IRRIGATION:** In this method only a small portion of land should recieve canal water in one particular season. Remaing areas can receive water in next season by rotation.

3. **OPTIMUM USE OF WATER:** Optimum amount of water gives best result Amount lesser or greater than that reduces the yield. Cultivators should be educated so that to avoid use of more water

4 **INTRODUCING CROP ROTATION:** In this method the crops are placed/planted in such a manner that high water requiring plants should be followed by low water requiring plants and then by one requiring no water.
Example: Rice followed by wheat and then by cotton.

5. **ECONOMICAL USE OF WATER:** Economical use of water according to need conserves water and prevent unnecessary water loss.

6. **IMPROVING NATURAL DRAINAGE AREA:** In this method;
Natural flow is provided by bush and Jungle cutting. Water should not be allowed to stay in one area.

7. **PUMPING or TUBEWELL or VERTICAL DRAINAGE:**
Canal Irrigation should be substituted by tube well irrigation. lift irrigation should be introduced to use GW.

8. **ADOPTATION OF SRRINKLER METHOD:** In this method only pre-determined amount of water is supplied to land and no percolation losses from water courses

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PART : b

	SALINE SOIL	ALKALINE SOIL
DEfinition:	Soil having pH in between 7 and 8.5 is called saline soil	Soil having pH greater than 8.5 is called alkaline soil.
pH	In between 7-8.5	Greater than 8.5
Exchangable Na+ %	Less than 15%.	Greater than 15%.
Most common ions	Sodium chloride, sodium sulphate calcium chloride calcium sulphate calcium bicarbonate Magnesium sulphate Magnesium bicarbonate	Mainly sodium bicarbonate, potassium carbonate, calcium carbonate Magnesium carbonate
Organic Matter content:	High	Low
colour:	White or light Grey	Black colour
Soluble salt concenteration	≥ 0.1 %	≤ 0.1%.
Known as	solan chalk	Solonetz

PART: C

RECLAMATION OF SALT AFFECTED LAND:

1 **AVOIDING EFFORESCENCE:** It is done by
- maintaining water table sufficiently below 100K
- all measures suggested for preventing water logging hold good for preventing salinity of soil/land.
- Efficient Drainage must be provided to lower water table in saline land.

2. **LEACHING:** In this process
1) Land is flooded with water
2) Alkaline salts are dissolved in water
3) Percolate to the ground water
4) Drained by sub-surface drains.

- High salt resistant crops are grown on leached land for 1 to 2 seasons e.g Rice
- Ordinary crops like wheat or cotton are grown
- Then land is said to have reclaimed

In addition, when sodium carbonate is present, gypsum is added before leaching. Sodium sulphate is formed which is leached out easily.

QUESTION: 02

PART: a

Kennedy's Procedure for Canal Design:-

Step: 01

Assume trial value of D and put it in equation $Q = AV$

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

Step # 02 Now in Equation $Q = AV$

$$A = Q/V$$

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

$$P = B + D\sqrt{5}/2$$

- for assumed D determine B.

Find $R = A/P$.

Step # 03

Substitute the value of R in Kutters and Chazys Equation to obtain V which will be actual velocity for assumed dimensions.

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

Step # 04 If velocity obtained from Eq 2 (Chazys Equation) agree with that obtained from Kennedy Equation. Then the assumed depth is correct otherwise repeat procedure with changed value of D.

PART: b

Given Data:

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

Crr(m) = 1

N = 0.0225

Bed slope = 1 in 5000

Depth (D) = 2.3 m

Solution:

Finding velocity:

We know by formula

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

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

$$\boxed{V_K = 0.930 m}$$

→ Now calculating Area of canal we know by formula

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

$$A = 30/0.930$$

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

→ Now calculating B by using formula

$$A = BD + D^2/2 \Rightarrow A = BD + 0.5D^2$$

puting values

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

$$32.25 - 2.645 = 2.3B$$

$$\boxed{B = 12.87}$$

→ Now we have to calculate welled perimeter. Using formula

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

puting values

$$P = 12.87 + \sqrt{5}\,(2.3)$$

$$\boxed{P = 18.01\ m}$$

⇒ Now we have to calculate hydraulic radius

$$R = A/P$$

$$R = 32.25 / 18.01$$

$$\boxed{R = 1.79\ m}$$

Now calculating mean velocity from chazys equation

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

where

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

puting values

$$C = \frac{1/0.0215 + \left(23 + \frac{0.00155}{(1/5000)}\right)}{1 + \left(23 + \frac{0.00155}{(1/5000)}\right) \times \left(\frac{0.0215}{\sqrt{1.79}}\right)}$$

$$C = \frac{75.19}{1.517} \Rightarrow C = 49.59$$

$$V_6 = 49.56\ (1.79(1/5000))^2$$

$$V_c = 0.93$$

$$\boxed{V_c = 0.93 m}$$

QUESTION: 03

PART: a

LACEY'S THEORY: According to Lacey even channel with no silting or scouring may actually not be in regime He differentiated b/w initial and Final Regime.

INITIAL REGIME	FINAL REGIME
- When only bed slope of channel changes but cross-section remains same then then also no silting or scouring takes place.	- if all parameters (perimeter, depth and slope) have equally free to vary and adjust according to discharge and silt grades then channel is said to have final regime
- This is rare	- In final regime cross section assumes semi ellipse shape.
- occurs immediately after constructing and putting channel under use by adjustment of bed form by silting or scouring.	- Final regime occurs after long time adjustment of bed width with banks.

PART: b

Given Data:

$Q = 30 m^3/sec$

$M = 0.56 mm$

Solution:

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

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

$$\boxed{f = 1.3}$$

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

so putting values

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

Now we have $Q = AV$

$A = Q/V$ (putting values)

$$A = \frac{30}{0.844} \Rightarrow \boxed{A = 35.54 m^2}$$

Now we know $P = 4.75\sqrt{Q}$

By putting values we get

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

Now

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

$$\boxed{R = 1.36}$$

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

putting values

$35.54 = BD + D^2/2$ — (I)

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

$26.01 = B + 2.236D$

$B = 26.01 - 2.236D$ — (II)

putting eq. (II) in eq. (I)

we get

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

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

$35.54 = 26.01D - 1.736D^2$

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

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

Now By Quadratic Equation

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

$\boxed{D = 1.52}$

putting D in eq. (II)

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

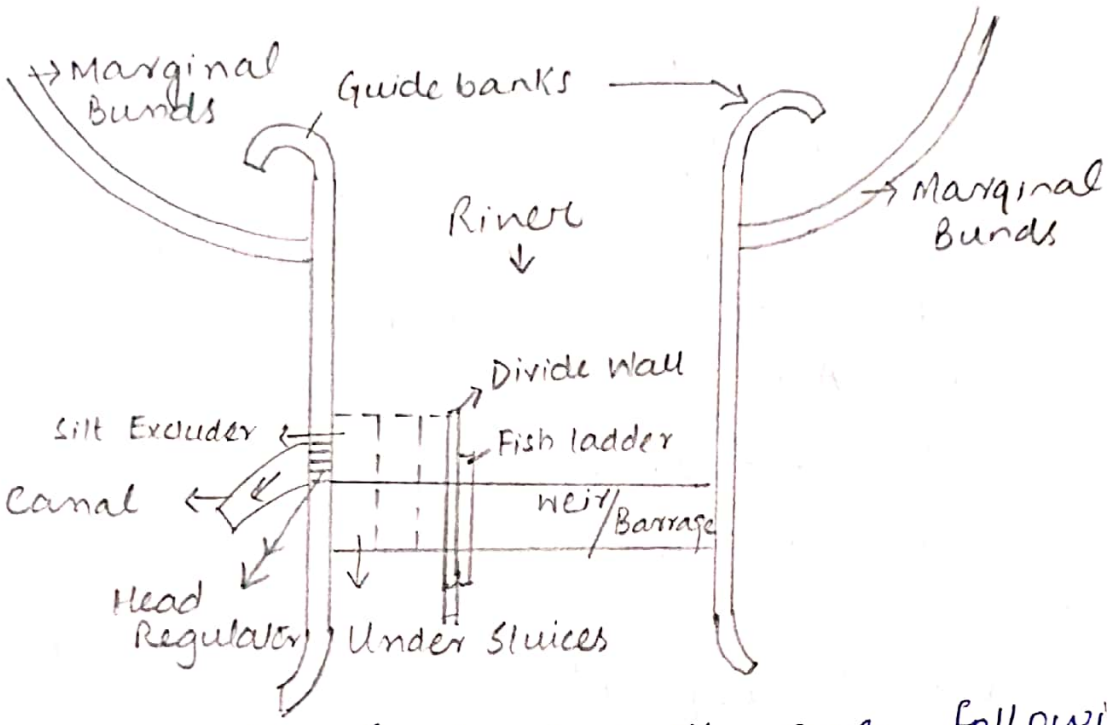
$\boxed{B = 22.611}$

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

$S = \frac{(1.3)^{5/3}}{(3340)(30)^{1/6}} \Rightarrow$ $\boxed{S = 0.00026}$

QUESTION: 04

PART: a



Components of head work are following

1. **WEIR / BARRAGE:-** Weir is constructed across river to raise the water level. when water level on upstream side
2. of weir is required to be raised at different levels, barrage is constructed.

2. **UNDERSLUICES:-** These are openings provided at base of weir or Barrage. They are also called scouring sluices.

3. **DIVIDE WALL:** It is a long wall constructed at rt. angle in weir or barrag. It may be constructed with stone masonry or cement concrete.

4. **FISH LADDER:** The fish ladder is provided just by side of divide wall to allow free movement of fish.

5. **CANAL HEAD REGULATOR:** Structure constructed at head of canal to regulate flow of water is known as canal head regulator.

6. **SILT EXCLUDERS:**

Silt excluder are those which are constructed on the bed of the river upstream of head regulator.

Silt ejectors also called silt extractors. They extract the silt from canal water after silted water has travelled a certain distance in off take canal

7. RIVER TRAINING WORKS:: (MARGINAL BUNDS and GUIDE BANKS).

→ River Training works are required near weir site in order to ensure smooth and axial flow of water.

→ Guide Banks must be constructed at both the approaches to protect structure from erosion.

→ Marginal Bunds are earthen embankments which are constructed parallel to river bank on one or both of the banks according to condition.

QUESTION: 04

PART: (b)

HEAD REGULATOR:

A structure which is constructed at head of canal to regulate flow of water is known as canal head regulator or simply head regulator.

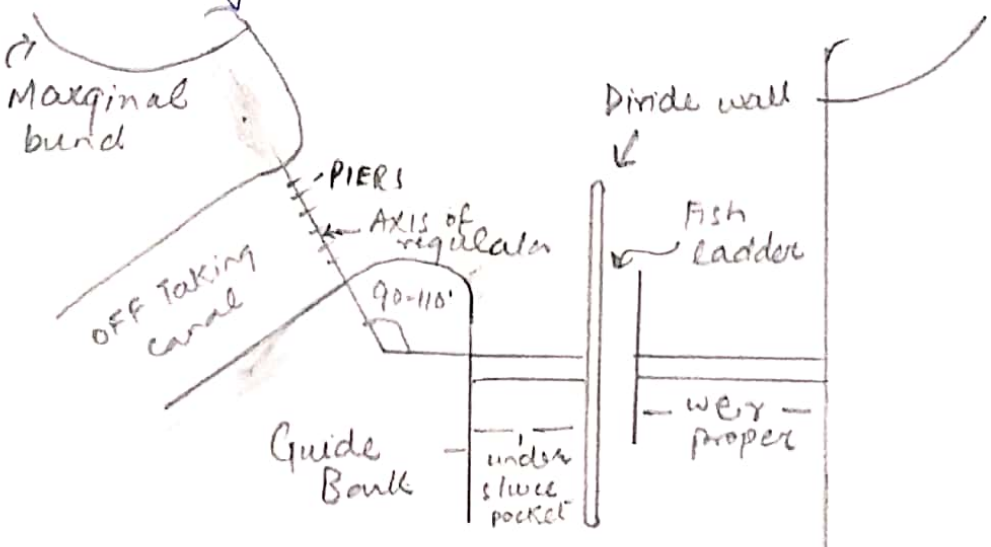
FUNCTIONS:

The functions of head regulator are following

(1) It regulates the supply of water entering the canal

(2) It controls entry of silt in the canal

(3) It prevents river floods from entering the canal.



Alignment of Canal head Regulator