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Name # Aimal Khan

ID # 7510

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(2)

Question # 1

(a)

Explain anti water-logging measures.

Ans) Methods of Control of
Water logging

① Lining of Canals and water sources:-

Its reduces seepage of water.

② 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.

③ By Introducing Crop rotation:-

High water requiring crop should
be followed by one requiring
less water, and then by
one requiring almost no water.

Example:-

Rice followed by wheat
and then by Cotton.

(3)

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 :-

* Water should not be allowed to stay in one area.

* Natural flow is provided by bush and jungle cutting.

⑥ Pumping or Tubewells or Vertical Drainage :-

Lift irrigation should be introduced to use G.W. Canal Irrigation may be substituted by tubewell irrigation.

* Economical Use of Water according to need.

⑦ Adoption of sprinkler method of irrigation.

* Only predetermined amount of water is supplied to land.

* No percolation losses from water sources.

(4)

Part

(B)) Differentiate between saline and alkaline soils.

Saline Soils

* Saline soils are the soils that have PH in between 7 and 8.5 and an exchangeable sodium percentage below 15%.

* Electrical conductivity 4 or more mmhos/cm.

* Mainly Sodium chloride and sodium sulfate. Also calcium chloride. Calcium bicarbonate. Magnesium sulfate and magnesium bicarbonate in small amounts.

* Organic matter Content is high

* White or light gray in colour

Alkaline Soils

* Alkaline soils are the soils that have a PH greater than 8.5 and an exchangeable sodium percentage greater than 51%.

* Electrical Conductivity is usually less than 4 mmhos/cm.

* Mainly Sodium Carbonate, Potassium Carbonate. Calcium carbonate and magnesium carbonate in small amount.

* Organic matter Content is low.

* Black colour.

⑤

Question # 1

Part C)

How do you reclaim salt affected lands?

Sol: Ans)

Reclamation of Salt affected lands:

- * 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.



6

Question #2

Part a)

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

Ans)

Kennedy procedure for canal designing:-

Step #1

Assume the trial value of "D" and put in eq ① and determine

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

Step #2

In eq 1 $Q = AV$

$$A = Q/V$$

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

$$P = B + D^{5/2}$$

Assumed D & Fine B $\therefore R = A/P$

Step #3

Substitute the value of R in eq 2 (Kutters & Chazys eq) to obtain V which will be the actual velocity for assumed dimension.

(7)

Step #4

If the velocity worked out from Eq 2 agrees with that of obtained with the Kennedy's Eq. Then the assumed depth is correct otherwise repeat the procedure with changed value of "D".

Quest #2 Part B)

Given data:

$$\text{Discharge (Q)} = 30 \text{ m}^3/\text{sec}$$

$$V_r(\text{m}) = 1$$

$$N = 0.0225$$

$$\text{Bed slope} = 1 \text{ in } 5000$$

$$\text{Depth (D)} = 2.3 \text{ m}$$

Sol:-

Finding Velocity,
By formula,

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

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

$$\Rightarrow V_k = 0.930 \text{ m}$$

Now Calculating
By formula,

area of Canal,

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

$$A = 30 / 0.930$$

$$\text{Area} = 32.25 \text{ m}^2$$

(8)

Now we have to calculate B, by using formula

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

\Rightarrow By putting values,

$$A = BD + 0.5 D^2$$
$$32.25 = B(2.3) + 0.5 (2.3)^2$$
$$32.25 - 2.645 = 2.3(B)$$
$$29.605 = 2.3 B$$
$$\Rightarrow \boxed{B = 12.87 \text{ m}}$$

\Rightarrow Now we have to calculate wetted perimeter,

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

\Rightarrow Now we have to calculate hydraulic Radius,

$$R = A/P$$
$$= 32.25 / 18.01 \quad \boxed{R = 1.79 \text{ m}}$$

\Rightarrow Now calculating mean velocity from Chezy eqn,

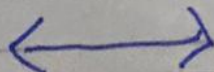
$$V_c = C (R_s)^{1/2}$$

Wht

$$C = \frac{\frac{1}{n} + \left(23 + \frac{0.00155}{5}\right)}{1 + \left(\frac{23 + 0.00155}{5}\right) \frac{n}{\sqrt{R}}} \Rightarrow \frac{\frac{1}{0.0225} + \left(23 + \frac{0.00155}{(1/5000)}\right)}{1 + \left(23 + \frac{0.00155}{1/5000}\right) \times \left(\frac{0.0225}{\sqrt{1.79}}\right)}$$

$$C = 75.19 / 1.517 = 49.56$$
$$V_c = 49.56 (1.79 (1/5000))^{1/2}$$

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



9

Question # 3)

Part a)

Differentiate b/w initial regime and final regime in accordance to Lacey's theory?

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 (perimeter, depth and slope) have equally free to vary and adjust according to discharge and silt grades then the channels is said to have final regime.

(10)

Question #3 Part (B)

Given data:-

$$Q = 30 \text{ m}^3/\text{sec}$$

$$M = 0.56 \text{ mm}$$

Sol:-

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

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

$$[f = 1.3]$$

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

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

$$[V_m = 0.844]$$

$$Q = AV$$

$$A = Q/V = 30/0.844$$

$$[A = 35.54]$$

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

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

$$[P = 26.01]$$

$$R = \frac{5}{2} \times \frac{V^2}{f} = \frac{5}{2} \times \frac{(0.844)^2}{1.3} = [1.36]$$

(11)

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

$$35.54 = BD + D^2/2 \rightarrow \textcircled{1}$$

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

$$26.01 = B + 2.236D \rightarrow \textcircled{2}$$

Put eq $\textcircled{2}$ in eq $\textcircled{1}$

$$35.54 = (26.01 - 2.236D)D + D^2/2$$

$$35.54 = 26.01D - 2.236D^2 + D^2/2$$

$$35.54 = 26.01D - 2.236D^2 + 0.5D^2$$

$$35.54 = 26.01D - 1.736D^2$$

$$-1.736D^2 + 26.01D - 35.54 = 0$$

$a \qquad b \qquad c$

$$a = -1.736$$

$$b = 26.01$$

$$c = 35.54$$

By quadratic eq

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

$$\boxed{D = 1.52} \quad \text{put in eq } \textcircled{2}$$

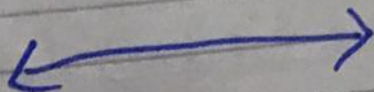
$$B = 26.01 - 2.236(1.52)$$

$$\boxed{B = 22.611}$$

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

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

$$\boxed{S = 0.00026}$$



(12)

Question #4

Part (a)

Explain the components of headwork with neat diagram.

Components of headwork:-

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 maybe higher than the existing water level of river. Surplus water pass over the crest of weir.

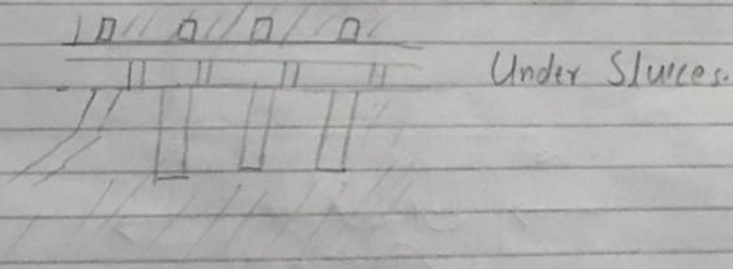
Barrage:-

When the water level on the up stream side of the river weir is required to be raised to different level at different time, barrage is constructed. Barrage is arrangement of adjustable gates or shutters at different times over the river weir.

(13)

Under sluices:-

Also known as scouring sluices. The under sluice are the openings provided at the base of weir or barrage. 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. The muddy water flows towards the downstream through the scouring sluices. The gates are closed. But at the period of flood, the gates are kept opened.



Divide wall:-

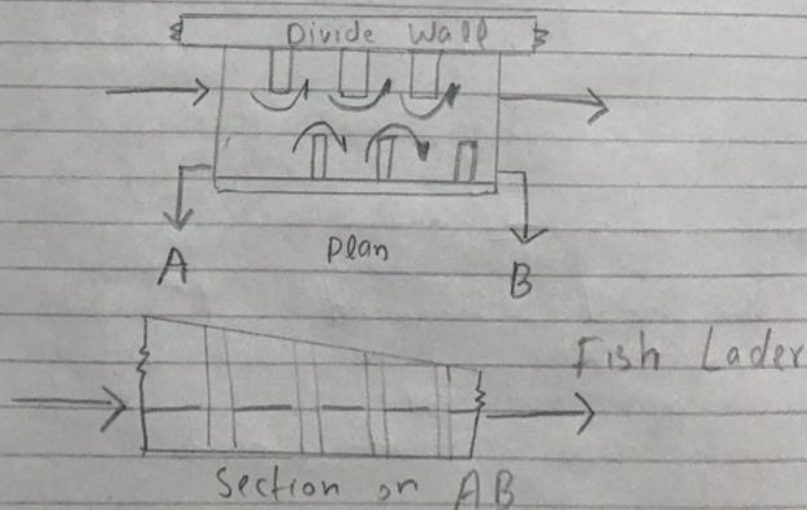
The divide wall is a long wall constructed at right angles in the weir or barrage. It may be constructed with stone masonry or cement concrete.

(14)

On the upstream the wall is extended just to cover the canal head regulator. & on the downstream side it is extended up to the launching apron.

Fish ladder:-

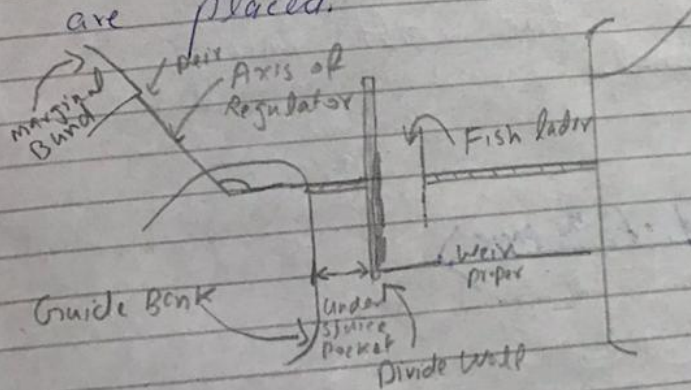
The fish ladder is provided just by the side of the divide wall for the free movement of fishes. Rivers are important sources of fishes. The tendency of fish is to move from upstream to downstream in winter from downstream movement to upstream in moonsoons. This movement is essential for their survival.



(15)

* Canal head Regulator:-

Structure which is constructed at the head of the canal to regulate flow of water is known as canal head regulator. It consists of numbers of piers which divide the total width of the canal into a number of spans which are known as bays. The piers consist of no. of tiers on which the adjustable gates are placed.



* Built Prevention device:-

The entry of silts into Canal.

(16)

Q#(4)

Part #(B)

What are the functions of head regulators?

Ans) Function of head Regulator

- * To regulate supplies into the canal.
- * To indicate the discharge passed into the canal from design discharge formula and observed head of water on the crest.
- * To control the silt entry into the canal.

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