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Q No 1 a => what is meant by irrigation. Briefly explain advantages of irrigation.

Ans: **Irrigation**: Irrigation is defined as the science of artificial application of water in accordance with the crop requirements, throughout their growth period, for full fledged nourishment of the crop

Advantages of irrigation

- Increase in food prodution.
- optimum Benefits optimum utilization of water yields maximun crop yield.
- Elimination of mixed cropping - mixed croopping means sowing together more crops.
- Genral prosperity - Revenue returns are quite high and helps in development of country.
- Generation of Hydroelectric power - cheaper paver genaration from dams and canals falls etc.
- domestic water supply.
- facilities of communication
- Inland Navigation
- Afforestation - trees are generally grown on the banks of canals.

(b) => What are the techniques of water distribution in the farm.

Ans: Techniques of water Distribution in the farm

1 > Free flooding
2 > Border flooding
3 > check flooding
4 > Basin flooding
5 > Furrow irrigation method
6 > Porous hose method
7 > spray method.

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1 > Free flooding: Ditches excavated in the field either on the contour or up & down The slope. water from these ditches flows across the field. contour ditches called lateral or subsidiary ditches spaced at about 20-50 m apart depending upon slope of soil crop.

2> Border Flooding: Land is divided in to number of strips, separated by low levees called borders. the land area confined in each step is of the order of 10-20m in ~~which~~ width and 100-400 m in length. Ridges b/w should be sufficiently high to prevent overtopping.

3> Check Flooding: It is similar to ordinary flooding except that the water is controlled by surrounding the check area with low and flat levees are constructed along the contours having the vertical interval of about 5-10 cm. these levees. the confined plot area varies from 0.2-0.8 ha. the check is filled with water at fairly high rate and allowed to stand until the water infiltrates. It is suitable for more permeable and less permeable soils.

4> Basin Flooding :> special types of check flooding for orchard trees. one or more trees are generally placed in the basin, the surface is flooding as in check method by ditch water.

5> Furrow Irrigation Method:. In flooding method water covers the entire surface while in furrow method, only 1/5 to 1/2 of land surface is wetted by water. causes less evaporation and permits sooner cultivation depth: 8-30 cm length: 400m.

6> Porous Hose Irrigation Method: ★ A porous hose canvas is used for throwing water over the land.
★ water is pumped in to the hose, it oozes through the canvas walls and falls on the ground.
★ This is used where there scarcity of water.
★ It is a cheep method but the draw back is that the porous pipe lasts for a shorter life (2-3 years)

7> Spray irrigation Method: water is applied to the ~~the~~ soil in the from of a spray through a network of pipes and widely used in USA. It can be used for all types of soils and for different to prographies and slopes. this method is used in desert areas where other types of surface or subsurface irrigation are very different.

Question # 2 5

What is meant by headwork. Briefly describe types of headwork.

Ans Headworks

Headworks is a civil engineering term for any structure at the head or diversion point of a waterway. It is smaller than a barrage and is used to divert water from a river into a canal or from a large canal into a smaller canal.

Historically the phrase "headworks" derives from the traditional approch of diverting water at the start of an irragation network and the location of these processes at the "head of the works."

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

1) storage headwork.
2) Diversion headworks.

1) STORAGE HEAD WORKS :-

Dam is constructed across a river valley to form storage reservoir known as storge head works.

water is supplied to the canal from this reservoir through canal regulator.

These serves for multipurpose function like hydro-electric power generation, flood control, fishery.

2) DIVERSION HEAD WORKS :

weir or barrage is constructed across a perennial river to raise 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.

(b) Explain in detail (7) the Components of a diversion headwork.

Ans) Components of a diversion headwork :-

The various Components of diversion headworks are as follows : Weir or Barrage.
Divide wall or divide groyne.
Fish ladder.

The various Components of diversion headworks are as follows :

1) Weir or Barrage
2. Divide wall or divide groyne
3). Fish ladder
4) Undersluices or Scouring sluices
5) Silt excluder
6) Canal head regulator
7) River training works such as Marginal bunds and Guide bunds.

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 accross 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.

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 arrangment of Adjustable gates or shutters at different tires over the weir.

Divide Wall or (9) divide groyne

A divide wall is a long masonry or Concrete wall or groyne (an embankment protected on all sides by stone or Concrete blocks) which is Constructed at right angles to the axis of the weir to separate the undersluices from the rest of the weir. if two undersluices from the rest of the weir.

If two canal take off one on either side of the river. than two divide walls are required one an each side.

The top width of the divide wall is about 1.5 to 2.5m. The divide wall extends on the upstream side up to a distance little beyond the beginning of the Canal head regulator and on the downstream side up to the end of the loose protection.

FISH LADDER

The fish ladder is provided just by the side of the divide 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 from downstream to upstream in monsoons. This movement is essential for their survival.

UNDERSLUICES OR SCOURING SLUICES

The undersluices are the openings provided in the weir wall with their crest at a low level. These openings are fully controlled by gates. They are located on the same side as the off taking canal. If two canals take off, one on either side of the river then it would be necessary to provide on either side of the canal.

(iii)

SILT EXCLUDERS :-

Silt excluders are those works which are constructed on the bed of the river upstream of the head regulator. The cleaner water enters the silt excluder.

In this type of works, the silt is therefore removed from the water before in enters the canal.

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 a number of piers which divide the total width of the canal into a number of spans which are knows as bays.

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

RIVER TRAINING WORKS

River training works are required near the weir site in order to ensure a smoth and an axial flow of water and thus, to prevent the river from outflanking the work due to a change in its course.

The river training works required on a canal headwork are:

a) Guide banks
b) Marginal bunds
c) Spurs or groynes

a) GUIDE BANK

When a barrage is Contructed accross a river which flows through the alluvial soil, the guide bank most be constructed on both the approaches to protect the structure from erosion.

It Controls the velocity of flow near the structure

b) MARGINAL BUNDS (13):-

The marginal bunds are earthen embankments which are constructed parallel to the river bank on one or both the banks according to the condition. The top width is generally 3 m to 4m. The side slope on the river side is generally 1.5 : 1 and that on the country side 2 : 1.

Q3: a-> State the assumptions of Kennedy. write down the steps of Kennedy procedure for design of canal.

Ans:) Assumptions of Kennedy:

* vertical component of eddies supports the silt particles.
* The silting power of a channel depends upon its velocity, which controls the eddies.
* The silt transporting power depends upon its depth.
* The silt tranporting power of a channel is independent of bed width.

Kennedy Procedure for canal Design

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

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

Step #2: In Eqn. 1: $Q = AV$

$$A = Q/V$$

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

$$P = B + D\,S^{-1/2}$$

For assumed D determin B
Find $R = A/P$

Step #3: substitute the value of R in eq. 2 (kutters & chazys Eqn) to obtain V which will be the actual velocity for assumed dimensions.

Step #4: If the velocity worked out from Eqn. 2 ~~the~~ 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.

Ans(b): Elaborate Lacey theory. Give a comparision b/w Kennedy and Lacey theory.

Ans b: 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.

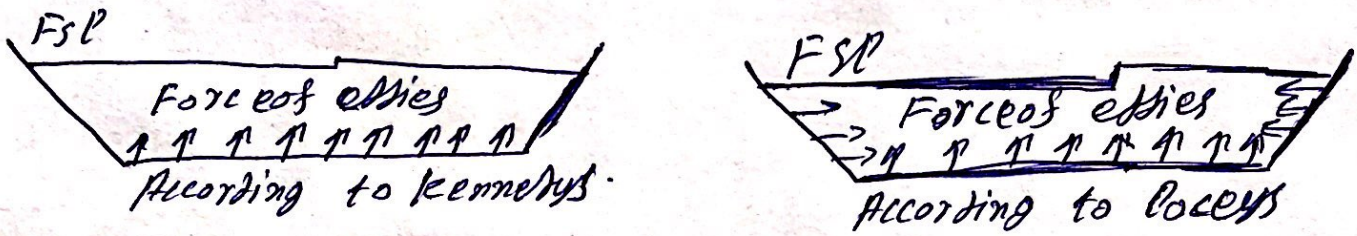
* He differentiated between initial regime and final regime but this theory is applicable to final regime.

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

Comparison of Lacey's & Kennedy Theories.

1> Both (K & L) considered that the vertical eddies are responsible for holding silt in suspension. But kennedy neglected the eddies gererated by sides. Lacey considered the sides (so he includes R instead of D).



2> kennedy: All channels which are not silting or scouring are in regime. But Lacey differentiated between initial and final regime.

3> Lacey: Grain size is important

silt factor $F = 1.76 * M^{0.5}$

The End.