TWO MARKS AND QUESTIONS AND ANSWERS

1. How do you classify canals?

Ans: Canals are classified based on different

a. Based on the nature of source of supply,

b. Based on their function,

c. Based on Discharge or capacity or distribution system

d. Based on nature of the soil through which the canal is constructed

e. Based on the lining

f. Based on alignment, canals

2. Classify canals based on capacity.

Ans: Canals can also be classified as: (*i*) main canal, (*ii*) branch canal, (*iii*) major distributary, (*iv*) minor distributary, and (*v*) watercourse (vi) field channel

3. What are types of canal based on alignment?

Ans: (i) Ridge Canal or Water shed Canal (Watershed is the dividing line between the catchment areas of two drains) (*ii*) Contour Canal (iii) Side Slope Canal.

4. What are impounding structures?

Ans: Impounding Structures are man-made hydraulic structures constructed temporarily or permanently to store water for the purpose of long time, diversion for irrigation or detention for short duration. Such hydraulic structures are dams, weirs and barrages.

5. Explain the factors to be considered for selecting the site for a dam.

Ans: The following points should be considered while selecting the site for a dam :

- Width of the river is minimum
- Impervious stratum at reasonable depth
- Adequate catchment area
- To be constructed on a high ground
- Materials available easily
- Silting is minimum
- Suitable for locating spillways
- Easy diversion of river water while constructing

6. Explain the various types of dam.

Ans: Based on Purpose or Function

a. Storage Dam or Impounding Dam
b. Detention Dam
c. Diversion Dam
d. Coffer Dam

Based on Material of Construction

Rigid Dam

It is constructed with rigid material such as stone, masonry, concrete, steel, or timber. Steel dams (steel plates supported on inclined struts) and timber dams (wooden planks supported on a wooden framework) are constructed only for small heights.

Non-Rigid Dam (Embankment Dams)

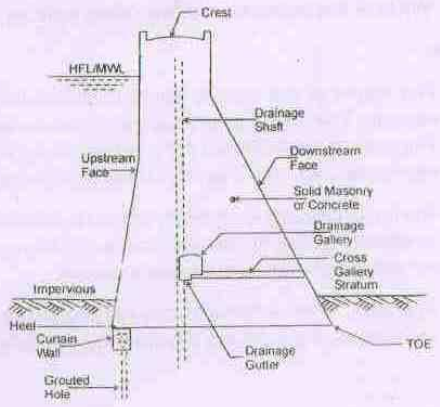
It is constructed with non-rigid material such as earth, clay, rockfill etc.

Based on Structural Behaviour

a. Gravity Dam
b. Arch Dam
c. Buttress Dam
d. Embankment Dam

7. Draw the sectional details of gravity dam and mark all the components.

Ans:



8. What is the use of drainage gallery?

Ans: ***Drainage gallery:*** It is an opening provided along the length of the dam for the purpose of draining the water seeping through the foundation under the pressure. This arrangement reduces the uplift on the base of the dam.

9. What are spillways?

Ans: ***Spillways:*** It is a waterway provided in dam or separately for discharging the surplus water that cannot be stored safely in the dam.

10. Explain the use of energy dissipaters.

Ans: ***Energy Dissipators:*** A curved bucket shape of the spillway avoids the impact of the falling water at the toe of the dam. Stilling basin with Chute block, baffle block and end sill is provided to dissipate the energy of the water and effect smooth horizontal flow. Protective aprons are laid to protect the bed from getting eroded.

11. What is sluice way?

Ans: ***Sluice way:*** An opening in the dam near the ground level, which is used to release the water during normal period and clear the silt accumulation in the reservoir side.

12. Why cut off wall is constructed in the dam?

Ans: Cut off: It is a wall constructed at the heel of the dam to the required depth below the base of the dam to reduce the uplift on the base of the dam.

13. What is the necessity of providing spillways in a dam?

Ans:

(a) The height of the dam is always fixed according to the maximum reservoir capacity. The normal pool level indicates the maximum capacity of the reservoir. The water is never stored in the reservoir above this level. The dam may fail by over turning so, for the safety of the dam the spillways are essential.

(b) The top of the dam is generally utilized by making road. The surplus water is not be allowed to over top the dam, so to stop the over topping by the surplus water, the spillways become extremely essential.

(c) To protect the downstream base and floor of the dam from the effect of scouring and erosion, the spillways are provided so that the excess water flows smoothly.

14. List the forces acting on a gravity dam.

Ans: The forces that try to destabilize the dam include:

1. Reservoir water pressure
2. Uplift
3. Forces due to waves in the reservoir
4. Ice pressure
5. Temperature stresses
6. Silt pressure
7. Seismic forces
8. Wind pressure

15. How do you calculate the force exerted by the silt?

Ans: Silt gets deposited against the upstream face of the dam. If 'h_s' is the height of the silt deposited, then the force exerted by the silt is given by Rankhine's formula:

$$P_{silt} = \frac{1}{2}\gamma_s h_s^2 K_a \text{ acting at } \frac{h_s}{3} \text{ from base,}$$

where K_a = the coefficient of active earth pressure of silt

$$= \frac{1-\sin\phi}{1+\sin\phi} \text{ (Neglecting cohesion)}$$

γ_s = submerged unit weight of silt,

ϕ = angle of internal friction of soil.

16. Write the equation to findout the pressure intesnity due to waves and total force due to wave pressure.

Ans: The pressure intensity due to waves is given by :

$$P_w = 2.4\gamma\, h_w \ \left(t/m^2\right)$$

where p_w is the maximum unit pressure which occurs at (1/8)*h_w above the still wate surface.

The total force due to the wave pressure (P_w) is given by:

$$P_w = \left(\frac{1}{2}\right) * (2.4\, h_w) * \left(\frac{5}{3}\right) h_w = 2\gamma h_w^2 \ (t/m)$$

and this acts at a distance of *(3/8)*h_w* above the reservoir surface.

17. What are the causes for the failure of gravity dams.

Ans: The solid gravity dam may fail because of the following reasons:

a. By Over Turning:

b. By Sliding

c. By Over Stressing

d. By Cracking

18. What is meant by diversion head works?

Ans: The works, which are constructed at the head of the canal in order to divert the river water towards the canal, so as to ensure a regulated continuous supply of silt free water with a certain minimum head into the canal, are known as diversion heads works.

19. What are the objective of diversion head works?

Ans: The works, which are constructed at the head of the canal in order to divert the river water towards the canal, so as to ensure a regulated continuous supply of silt free water with a certain minimum head into the canal, are known as diversion heads works.

Objective of Diversion Head Works

- To rise the water level at the head of the canal.
- To form a storage by constructing dykes or embankments on both the banks of the river so that water is available throughout the year
- To control the entry of silt into the canal and to control the deposition of silt at the head of the canal
- To control the fluctuation of water level in the river during different seasons

20. Differentiate weir and barrage.

Ans:

Sl.	Barrage	Weir
1.	Low set crest	High set crest
2.	Ponding is done by means of gates	Ponding is done against the raised crest or partly against crest and partly by shutters
3.	Gated over entire length	Shutters in part length
4.	Gates are of greater height	Shutters are of smaller height, 2 m
5.	Gates are raised clear off the high floods to pass floods	Shutters are dropped to pass floods
6.	Perfect control on river flow	No control of river in low floods
7.	Gates convenient to operate	Operation of shutters is slow, involve labour and time
8.	High floods can be passed with minimum afflux	Excessive afflux in high floods

21. Mention the main function's of under sluices.

Ans: The main functions of under-sluices are

- To maintain a well defined deep channel approaching the canal head regulator.
- To ensure easy diversion of water into the canal through the canal head regulator even during low flow.
- To control the entry of silt into the canal
- To help scouring and of the silt deposited over the under-sluice floor and removing towards the downstream side.

22. List the main functions of divide wall.

Ans: The main functions of the divide walls

- It separates the 'under-sluices' with lower crest level from the 'weir proper' with higher crest level.

- It helps in providing a comparatively less turbulent pocket near the canal head regulator, resulting in deposition of silt in this pocket and, thus, to help in the entry of silt-free water into the canal.
- It helps to keep cross-current, if any, away from the weir.

23. What is meant by fish ladder?

Ans: Fish Ladder

It is device by which the flow energy can be dissipated in such a manner as to provide smooth flow at sufficiently low velocity, not exceeding 3 to 3.5 m/s.

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.

24. Explain the functions of canal head regulator.

Ans: Functions of Canal Head Regulator

- 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

25. Differentiate Spur and Grouyne.

Ans:

S.No.	Spur	Groyne
1.	It is a temporary structure.	It is a permanent structure.
2.	It is permeable.	It is impermeable.
3.	It is constructed with bamboo pile, timber pile, sand bag, boulders etc.	It is constructed with rubble masonry with cement mortar.
4.	It requires repair works.	It does not require any repair work.
5.	It is recommended for small rivers.	It is recommended for large rivers.
6.	It is useful for low or medium velocity of flow	It is suitable for high velocity of flow.

26. Compare Silt Excluders with Silt Ejectors.

Ans: Silt Excluders

Silt excluders are those works which are constructed on the bed of the river at the upstream of the head regulator. The clearer water enters the head regulator and silted water enters the silt excluder. In this type of works, the silt is removed from the water before in enters the canal

Silt Ejectors

Silt ejectors, also called silt extractors, are those devices which extract the silt from the canal water after the silted water has traveled a certain distance in the off-take canal. These works are, therefore, constructed on the bed of the canal, and little distance downstream from the head regulator.

27. Why canal drop or fall is constructed?

Ans: A fall or drop is an irrigation structure constructed across a canal to lower down its water level and destroy the surplus energy liberated from the falling water which may otherwise scour the bed and banks of the canal.

28. What is the necessity of canal drop/fall?

Ans: Canal drops are necessary when the following cases occur.

a. When the slope of the ground suddenly changes to steeper slope, the permissible bed slope cannot be maintained. It requires excessive earthwork in filling to maintain the slope. In such a case falls are provided to avoid excessive earth work in filling.

b. When the slope of the ground is more or less uniform and the slope is greater than the permissible bed slope of canal as shown in Figure 4.26. In that case also the canal falls are necessary.

c. In cross-drainage works, when the difference between bed level of canal and that of drainage is small or when the F.S.L of the canal is above the bed level of drainage then the canal fall is necessary to carry the canal water below the stream or drainage.

29. Enumerate the types of canal fall.

Ans: 1. Ogee fall
2. Rapid fall
3. Stepped fall
4. Trapezoidal Notch fall
5. Vertical drop fall/Sarda type fall
6. Glacis fall
7. Well type fall/Syphon well drop

30. Explain the Rapid fall and Stepped fall.

Ans: The rapid fall is suitable when the slope of the natural ground surface is even and long. It consists of a long sloping glacis with longitudinal slope which varies from 1 in 10 to 1 in 20.

- Curtain walls are provided on the upstream and downstream side of the sloping glacis.
- The sloping bed is provided with rubble masonry

31. What are cross drainage works?

Ans: Stepped fall consists of a series of vertical drops in the form of steps. This fall is suitable in places where the sloping ground is very long and requires long glacis to connect the higher bed level with lower bed level.

- This fall is practically a modification of the rapid fall.

32. What is the necessity of cross drainage works?

Ans: These are the structures provided for crossing canals across natural streams.

- The water-shed canals do not cross natural drainages. But in actual orientation of the canal network, this ideal condition may not be available and the obstacles like natural drainages may be present across the canal. So, the cross drainage works must be provided for running the irrigation system.
- At the crossing point, the water of the canal and the drainage get intermixed. So, far the smooth running of the canal with its design discharge the cross drainage works are required.
- The site condition of the crossing point may be such that without any suitable structure, the water of the canal and drainage cannot be diverted to their natural directions. So, the cross drainage works must be provided to maintain their natural direction of flow.

33. Mention the types of cross drainage works.

Ans: ***(1) Type I (Irrigation canal passes over the natural drainage***

(a) Aqueduct

(b) Siphon aqueduct

(2) Type II (Natural Drainage passes over the irrigation canal

(a) Super passage

(b) Siphon super passage or syphon

(3) Type III (Natural drainage and canal intersection each other of the same level)

(a) Level Crossing

(b) Inlet and outlet

34. Compare Aqueduct and Super Passage.

Ans: When the High Flood Level (HFL) of the natural drainage like river and stream is sufficiently below the bottom of the canal so that the drainage water flows freely under gravity, then the type of structure provided for cross drainage work is known as aqueduct.

Super Passage. The super passage is the structure where waterway of the natural drainage is carried above the water in the canal and it is just opposite of the aqueduct. When the Full Supply Level (F.S.L) of the canal is sufficiently below the bottom of the natural drainage so that the canal water flows freely under gravity, then the structure is known as super passage.

35. What is meant by Syphon Aqueduct?

Ans: When the HFL of the natural drainage like river and stream is higher than the canal bed and the water passes through aqueduct under syphonic action, then the aqueduct is known as Syphon aqueduct.

36. List the advantages and disadvantages of Syphon Super passage.

Ans: Advantages of Syphon Super passage are:

1. Used in large drainage cases
2. Canal section can be economically designed.
3. Damage to the canal is rare due to floods.

Disadvantages of Syphon Super passage are:

1. Inspection road cannot be provided along the canal
2. Separate bridge is required for the roadway.
3. Designed levels of canals are disturbed.
4. Foundation cost is more due to dewatering.

37. What type of Cross drainage works are constructed when natural drainaged canal intersects each other at the same level?

Ans: ***(3) Type III (Natural drainage and canal intersection each other of the same level)***

(a) Level Crossing

(b) Inlet and outlet

38. What are canal regulation works?

Ans: The works which are constructed in order to control and regulate discharges, depths, velocities etc. in canals are known as canal regulation works. These structures ensure the efficient functioning of a canal irrigation system. These structures are:

(a) Canal fall (b) Canal regulators

(c) Canal escape (d) Canal outlets

39. Explain the main functions of cross regulator.

Ans: Main Functions of a Cross Regulator

- To control the entire Canal Irrigation System.
- To help in heading up water on the upstream side and to fed the off-taking canals to their full demand.
- To help in absorbing fluctuations in various sections of the canal system, and in preventing the possibilities of breaches in the tail reaches.
- Cross regulator is often combined with bridges and falls, if required.

40. What are canal outlet or modules?

Ans: A canal outlet or a module is a small hydraulic structure built at the head of the water course so as to connect it with a minor or a distributary channel.

41. Mention the types of canal outlets.

Ans: There are three types of canal outlets namely non modular outlets, flexible modules and rigid modules.

42. Define canal lining.

Ans: Though irrigation canals may be constructed in natural or compacted earth, these suffer from certain disadvantages, like the following :

- Maximum velocity limited to prevent erosion
- Seepage of water into the ground
- Possibility of vegetation growth in banks, leading to increased friction
- Possibility of bank failure, either due to erosion or activities of burrowing animals

43. List the advantages of canal lining.

Ans: The following are the advantages of canal lining.

1. Seepage Control
2. Prevention of Water Logging
3. Increase in Channel Capacity
4. Increase in Commanded Area
5. Control the growth of weeds
6. Elimination of Flood Dangers
7. Reduced maintenance

44. Classify different types of lining.

Ans: Mainly there are two types of canal linings:

1. Earthen Type Lining
2. Hard Surface Lining

1. Earthen Type Canal Linings

It is sub-divided into 2 major types namely

(a) Compacted earth lining and

(b) Soil cement lining

Hard Surface Canal Linings

It is sub divided into

(a) Cement concrete lining (b) Brick lining

(c) Plastic lining and (d) Boulder lining

45. Define regime channel.

Ans: When the character of the bed and bank materials of the channel are same as that of the transported materials and when the silt charge and silt grade are constant, then the channel is said to be in its regime and the channel is called regime channel. This ideal condition is not practically possible.

46. State Kennedy thory.

Ans: After long investigations, R.G Kennedy arrived at a theory which states that, the silt carried by flowing water in a channel is kept in suspension by the vertical component of eddy current which is formed over the entire bed width of the channel and the suspended silt rises up gently towards the surface.

47. Discuss the draw backs of Kennedy's theory.

Ans: Drawbacks of Kennedy's Theory

- The theory is limited to average regime channel only.
- The design of channel is based on the trial and error method.
- The value of m was fixed arbitrarily.
- Silt charge and silt grade are not considered.
- There is no equation for determining the bed slope and it depends on Kutter's equation only.
- The ratio of 'b' to 'y' has no significance in his theory.

48. State Lacey's regime theory.

Ans: Lacey's theory is based on the concept of regime condition of the channel.

- The channel flows uniformly in unlimited incoherent alluvium of the same character which is transported by the channel.
- The silt grade and silt charge remains constant.
- The discharge remains constant.

The regime theory postulates that a channel with erodible boundaries tends to adjust the dimensions viz., width, depth and slope in order to attain a state of equilibrium called REGIME STATE. Lacey stated that the dimensions width, depth and slope of a regime channel to carry a given water discharge loaded with a given sediment discharge are all fixed by nature.

49. List the drawbacks in Lacye's theory.

Ans: Draw backs in Lacey's theory

- The concept of true regime is only theoretical and cannot be achieved practically.
- The various equations are derived by considering the silt Factor of which is not at all constant.
- The concentration of silt is not taken into account.
- The silt grade and silt charge are not clearly defined.
- The equations are empirical and based on the available data from a particular type of channel.
- The characteristics of regime of channel may not be same for all cases.

50. Compare Kennedy's and Lacey's theory.

	Kennedy Theory	Lacey's Theory
1.	It states that the silt carried by the following water is kept in suspension by the vertical component of eddies which are generated from the bed of the channel.	1. It states that the silt carried by the following water is kept in suspension by the vertical component of eddies which are generated from the entire wetted perimeter of the channel.
2.	Relation between 'V' and 'y'.	2. Relation between 'V' and 'R'.
3.	Critical velocity ratio 'm' is introduced to make the equation applicable to different channels with different silt grades.	3. Silt factor 'f' is introduced to make the equation applicable to different channels with different silt grades.
4.	Kutter's equation is used for finding the mean velocity.	4. This theory given an equation for finding the mean velocity.
5.	This theory gives no equation for bed slope.	5. This theory gives an equation for bed slope.
6.	In this theory, the design is based on trial error method.	6. This theory does not involve trial and error method.

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