IRRIGATION METHOD & WATER REQUIREMENTS

Chapter 1

Syllabus: Irrigation, Types Of Irrigation , Factors, Water Requirements Of Crops, Soil Moisture , Duty And Delta , Factors Affecting Duty Of Water , Potential Evapotranspiration (Pet) And Actual Evapotranspiration (Aet) , Irrigation Efficiencies , Irrigation Requirements Of Crops. **wieghtage= 25%**

Practice Problem Level -1

1. The ratio between the area of a crop irrigated and the quantity of water required during the entire period of the entire period of the growth is known as

(A) Base period (B) Delta

(C) Duty (D) None of these

2. The total depth of water required by a crop during the entire period the crop is in the field is known as

(A) Crop period (B) Delta

(C) Base period (D) None of these

3. Consumptive use of water by a crop is equal to

(A) The depth of water consumed by transpiration

(B) The depth of water consumed by evaporation and transpiration during crop growth including water consumed by accompanying weed growth

(C) The depth of water consumed by evaporation

(D) None of the above

4. The method of irrigation which is adopted in the case of steep land is

(A) Check flooding (B) Basin flooding

(C) Free flooding (D) None of these

5. The soil can be improved by

(A) Giving rest to the land

(B) Adding manures

(C) Crop rotation

(D) All

6. Flow duty of water for maturity of kharif crops is crops is

(A) Area irrigated per cumec of discharge delivered to the field

(B) Area irrigated per cumec of discharge from the head works

(C) Area irrigated per cumec of discharge released from dam

(D) None

7. Intensity of irrigation means

(A) Percentage of cultivable command area irrigated yearly

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(B) Percentage of gross irrigable area irrigated yearly
(C) Percentage of gross command irrigable area irrigated yearly
(D) None

8. Delta term is used for
(A) Net water depth in cm used by the crop to come to maturity
(B) Total water depth in cm used by the crop in one watering
(C) Total water depth in cm used by the crop to come to maturity
(D) None

9. The crop yield is reduced in water logged areas because of
(A) Lack of oxygen in the root zone
(B) Restriction in the root development due to well soil temperature
(C) Salinity
(D) All of the above

10. Which of the following method of applying water may be used in rolling land?
(A) Border flooding (B) Check flooding
(C) Furrow flooding (D) Free flooding

11. The duty is largest
(A) At the head of the water course
(B) On the field
(C) At the head of the main canal
(D) Same at all places

12. The water utilizing by plant is available in soil mainly in the form of
(A) Gravity water (B) Capillary water
(C) Hydroscopic water (D) Chemical water

13. The depth of the water required to bring the soil moisture content of a given soil up to its field capacity is called
(A) Hygroscopic water
(B) Equivalent moisture
(C) Soil moisture deficiency
(D) Pellicular water

14. Which of the following crop is not considered as light crop?
(A) Rice (B) Macca
(C) Maize (D) Potatoes

15. Virgin flow is :
(A) The flow in the river downstream of a gauging station
(B) The flow in the river upstream of a gauging station
(C) The flow unaffected by works of man
(D) None of the above

16. The maximum irrigation requirement of rice crop is exhibited by its :
(A) Maximum delta value
(B) Maximum duty value
(C) Minimum duty value
(D) None

17. Transpiration is measured by an instrument, called :
(A) Lysimeter (B) Anemometer
(C) Phytometer (D) None of these

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18. Which one of the following dose not contribute to water-logging?

(A) Inadequate drainage

(B) Seepage from unlined

(C) Frequent flooding

(D) Excessive tapping of groundwater

19. In a mildly water scarce area, the drip irrigation could be preferred for growing :

(A) Wheat (B) Fodder

(C) Rice (D) Fruits and vegetable

20. Available moisture for a crop is equal to:

(A) Field capacity moisture content – wilting point moisture content

(B) Field capacity moisture content – hygroscopic point moisture content

(C) Both (A) and (B)

(D) None of the above

21. Which of the following is not correctly matched?

(A) Rice-Kharif (B) Wheat-Rabi

(C) Barley-Kharif (D) Potato-Rabi

22. The discharge carried by a minor distributary is usually less than:

(A) 0.5cumecs (B) 1cumecs

(C) 2.5cumecs (D) None

23. Alkaline soils are best reclaimed by:

(A) leaching

(B) addition of gypsum to soil

(C) providing good drainage

(D) addition of gypsum to soil and leaching

24. Sodium Absorption Ratio (SAR) is defined as

(A) $\frac{Na^+}{\sqrt{Ca^{++}+Mg^{++}}}$ (B) $\frac{Na^+}{2\sqrt{Ca^{++}+Mg^{++}}}$

(C) $\frac{Na^+}{\sqrt{(Ca^{++}+Mg^{++})/2}}$ (D) $\frac{2Na^+}{\sqrt{Ca^{++}+Mg^{++}}}$

25. The relation between duty D in hectares/cumec, depth of water Δ in meters and base period B in days is given by

(A) $\Delta = \frac{1.98\ B}{D}$ (B) $\Delta = \frac{8.64\ B}{D}$

(C) $\Delta = \frac{5.68\ B}{D}$ (D) $\Delta = \frac{8.64\ D}{B}$

26. The "outlet discharge factor" is the duty at the head of

(A) Main canal (B) Branch canal

(C) Water course (D) Distributary

27. For supplying water to rabi crop, kharif crop and sugarcane, the channel is designed for a capacity equal to the greater of the water requirement of

(A) Rabi or kharif

(B) Rabi and kharif or sugarcane

(C) Rabi and sugarcane or kharif and sugarcane

(D) Rabi or kharif or sugarcane

28. High percentage of clay in the soil is preferred for

(A) Pulses, sesame crops

(B) Rice, sugarcane crops

(C) Wheat , maize crops

(D) Cotton and vegetable crops

29. Gravity dam can be

(A) Masonry dam (B) Concrete dam

(C) R.C.C dam (D) All

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30. The density of water is

(A) 800kg/m^3 (B) 1100kg/m^3

(C) 1200kg/m^3 (D) 1000kg/m^3

31. Permanent wilting point is

(A) A characterstic of the plant

(B) A soil characteristic

(C) A soil characteristic modified by the crop

(D) Dependent on soil water plant fertilizer interaction

32. In flood irrigation, the preferred method of applying irrigation water to the comparatively steeper rolling land, is:

(A) check flooding (B) boarder flooding

(C) wild flooding (D) basin flooding

33. The method of growing crops on ridges, running on the sides of water ditches, is known as:

(A) flood irrigation (B) furrow irrigation

(C) check irrigation (D) none of them.

34. Salinity in irrigation water is measured by:

(A) SAR value

(B) Electrical-conductivity value

(C) pH-value

(D) none of the above

35. The time required to irrigate a strip of area 0.203 hectare by a stream discharge of 0.043 cumec, to provide an average depth of 6.35 cm to the field, is: (assume average rate of infiltration to be 5 cm/h)

(A) 2.75 hour (B) 1.35 hour

(C) 1.5 hour (D) 1.90 hour

36. If the concentration of Na, Ca, and Mg in a water sample are 345, 60 and 18 mg/1, respectively, then the Sodium Absorption Ratio (SAR) of this water will be:

(A) 5 (B) 10

(C) 39 (D) 55

37. The maximum irrigation requirement of Rice crop is exhibited by its:

(A) maximum delta value

(B) maximum duty value

(C) minimum duty value

(D) none of the above

38. The crop among the following, which is expected to have the maximum duty, is

(A) Wheat (B) Rice

(C) Sugarcane (D) Cotton

39. Kor-Watering is the irrigation water supplied to a crop:

(A) at the time of its sowing

(B) just before harvesting

(C) about three weeks after sowing

(D) about three weeks before harvesting.

40. The duty at the end point of a canal minor, where the Govt. control usually ceases, is called:

(A) duty on field (B) outlet duty

(C) flow duty (D) storage duty.

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Answer key

1.	C	**10.**	A	**19.**	D	**28.**	B	**37.**	C
2.	B	**11.**	B	**20.**	C	**29.**	D	**38.**	A
3.	B	**12.**	B	**21.**	C	**30.**	D	**39.**	C
4.	D	**13.**	C	**22.**	C	**31.**	B	**40.**	B
5.	D	**14.**	A	**23.**	D	**32.**	C		
6.	B	**15.**	C	**24.**	C	**33.**	B		
7.	A	**16.**	C	**25.**	B	**34.**	B		
8.	C	**17.**	A	**26.**	C	**35.**	B		
9.	D	**18.**	D	**27.**	C	**36.**	B		

Explanations

Sol. 35. $t = \frac{y}{f}\ell n\left(\frac{Q}{Q - fA}\right)$

$$= \frac{6.35}{5}\ell n\left(\frac{0.043}{0.043 - \frac{0.05}{3600}\times 0.23\times 10^4}\right)$$

$= 1.35$ hr

Sol. 36. $[Na^+] = \frac{345}{23} = 15$, $[Ca^{2+}] = \frac{60}{20} = 3$

$[M_g^{2+}] = \frac{68}{12} = 1.5$

$$SAR = \frac{[Ma^+]}{\sqrt{\frac{1}{2}\left([Ca^{2+}] + [Mg^{2+}]\right)}} =$$

$$\frac{15}{\sqrt{\frac{1}{2}(3+1.5)}} = 10$$

RIVER TRAINING AND CANALS

Chapter 2

Syllabus: *River training,*objectives of river training, classification of river training works , marginal embankments or levees , guide banks , spurs or groynes , functions of groynes , types of alignment , canal irrigation, layout of a diversion head works and its components
Wieghtage= 15%

Practice Problem Level -1

1. Seepage losses in case of lined canal is
(A) > unlined canal
(B) Equal to unlined canal
(C) < unlined canal
(D) None

2. Lining of canal is required when
(A) Water table is above the FSL of canal
(B) Water table is below the canal bed
(C) Natural occurring imperviousness strata is below the canal bed
(D) None of the above

3. Drainage behind canal lining is required to
(A) To drain the canal water
(B) To release the excess pressure behind the lining
(C) To drain the subgrade
(D) All of the above

4. A canal which is reservoir below the minimum pool level is called
(A) Contour canal (B) Water canal
(C) Branch canal (D) Side slope canal

5. ISI recommendation for the shape of lined canal is
(A) Parabolic (B) Semicircular
(C) Triangular (D) Trapezoidal

6. A river training work is generally required when the river is
(A) Aggrading type (B) Meandering type
(C) Degrading type (D) Both (A) and (C)

7. Underdrainage arrangements in canals are necessarily required in :
(A) Unlined canals (B) Lined canals
(C) Both (A) and (B) (D) None

8. A canal head work has nothing to do with a :
(A) Weir (B) Guide bank
(C) Head regulator (D) Safety ladder

9. A breast wall is usually provided :
(A) In the weir section
(B) In the under-sluice section
(C) In the main canal section
(D) In the head regulator section

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10. The best alignment for a canal is when it is aligned along

(A) Ridge line (B) Valley line

(C) Stream line (D) Contour line

11. The river reach upstream of a newly built dam may behave as :

(A) Aggrading (B) Degrading

(C) Virgin (D) None of these

12. Guide bank are provided to

(A) Decrease the depth of river flow

(B) Confine the river width

(C) Reduce the peak flood

(D) Minimum depth of water in river

13. Head woks is a hydraulic structure

(A) As an appurtenant to the dam

(B) To make storage with a raised crest

(C) To make pond age with low set crest

(D) To serve as a safety valve to canal head regulator

14. A water shed canal

(A) Irrigates only on one side

(B) Is most suitable in hilly roads

(C) Avoids the cross drainage works

(D) Is generally aligned parallel to the contours of the area

15. A canal which is aligned at right angles to the contour is called

(A) Contour canal (B) Watershed canal

(C) Branch canal (D) Side slope canal

16. The meander pattern of a river is developed by

(A) Average discharge

(B) Dominant discharge

(C) Maximum discharge

(D) Critical discharge

17. The main cause of meandering is

(A) Presence of an excessive bed slope in the river

(B) Degradation

(C) The extra turbulence generated by the excess of river sediment during floods

(D) None of the above

18. Lining of irrigation channels

(A) Increases the waterlogging area

(B) Decreases the waterlogging area

(C) Does not change the water logging area

(D) None of the above

19. The bed of an alluvial channel along the flow will always be:

(A) Flat

(B) Wavy

(C) Duned and rippled

(D) All of the above are possible.

20. The critical shear stress τ,at which incipient motion of sediment takes place, is proportional to:

(A) $\sqrt{d}$ (B) d

(C) d^2 (D) d^3

where d is grain size

21. Permeable spurs are best suitable for rivers, which:

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(A) Carry heavy suspended load
(B) Carry large bed load, but light suspended load
(C) Needs permanent protection to dikes
(D) Needs attracting the river current, for providing deeper channel

22. Barrages constructed across alluvial rivers helps in:
(A) Controlling floods
(B) Restoring river regime
(C) Ensuring monsoon storage
(D) All of them

23. The repelling groynes which are largely constructed projecting from river embankments, as anti-erosionworks, are:
(A) Pointing upstream
(B) Pointing downstream
(C) Perpendicular to the bank
(D) None of these

24. Which one among the following is a correct choice in relation to a weir?
(A) It is helpful in diverting excess water to a river from a canal
(B) It does not cause any heading up of water on its upstream side
(C) It stores water by raised counter-balanced gates
(D) It increases the chances of floods in the upstream area

25. Pinpoint the incorrect statement:
(A) The old Okhla barrage near Delhi has recently been replaced by a new weir
(B) The cost of a barrage is usually higher than that of a weir
(C) A weir can pond up additional water on its upstream side, by using shutters on its top
(D) A barrage does not increase the susceptibility of flooding in upstream areas

26. In a barrage project, a divide wall is provided to:
(A) Separate the lower crest 'undersluice side' from the higher crest 'weir side'
(B) Separate the higher crest 'undersluice side' from the lower crest 'weir side'
(C) Keep the cross-currents away from the barrage body
(D) Serve none of the above purposes

27. The choice among the following, which does not control the discharging capacity to be provided for the undersluices, is:
(A) That is should be at least double the canal discharge
(B) That it should be about 10% to 15% of maximum flood discharge
(C) That it should be able to pass winter freshets and low floods.
(D) That it should be equal to the dominant discharge of the river

28. Anadromous fish often move large distances in rivers in India:
(A) To upstream only

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(B) To downstream only
(C) To downstream in winter, and upstream in summer
(D) To upstream in winter, and downstream in summer

29. A fish ladder is provided in a canal project:
(A) To catch the fish for commercial development
(B) To enable the fish to move freely in the river
(C) To serve the same purpose as a canal ladder
(D) Both (B) and (C).

30. Head sluices are the gate controlled openings, in:
(A) The entire length of the barrage
(B) The under-sluice length of the barrage
(C) The regulator of the main off taking canal
(D) None of them

31. Silt excluders are constructed:
(A) On the river bed downstream of the head regulator
(B) On the river bed upstream of the head regulator
(C) On the canal bed downstream of the canal head regulator
(D) None of them

32. The silt exclusion device, constructed on the bed of the main canal, taking off from a headwork, is called:
(A) Silt excluder (B) Silt ejector
(C) Both (A) and (B) (D) None of them

33. The tunnel openings provided in front of a canal head regulator at a Diversion headworks:
(A) Discharge sedimented water into the canal
(B) Discharge sediments load into the under sluices, from where it ejects out to the downstream river
(C) Discharge clear water into the canal
(D) None of the above

34. Retrogression is:
(A) The back water effect of a weir
(B) The raising of the river bed upstream of the weir, during initial years of its constructions
(C) The lowering of the river bed downstream of the weir, during initial years of its construction
(D) None of the above

35. The back water effect of a weir is best called:
(A) Retrogression (B) Afflux
(C) Back water curve (D) None of them

36. The gated regulator, which is constructed in the parent canal near the site of an offtaking canal, is called a:
(A) Canal head regulator
(B) Distributary head regulator
(C) Cross regulator
(D) None of the above

37. A cross regulator helps in:

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(A) Increasing supply in the parent channel downstream
(B) Increasing supply in the offtaking channel
(C) Increasing water depth in the parent canal, upstream
(D) Both (B) and (C)

38. The drainage water is sometimes allowed to join the canal water to augment canal supplies, through a hydraulic structure, called a:
(A) Canal outlet (B) Canal inlet
(C) Module (D) Level crossing

39. A cross-drainage work is called a siphon, when it carries the canal water:
(A) Below the drainage under pressure
(B) Below the drainage at atmospheric pressure
(C) Above the drainage at atmospheric pressure
(D) None of the above

40. If in a certain irrigation project, and in a given year, 72% and 56% of the culturable command remained unirrigated in Kharif and Rabi seasons, respectively; then the intensituy of irrigation for that year and for that project, would be:
(A) 36% (B) 64%
(C) 72% (D) 128%

Answer key

1.	C	**10.**	A	**19.**	D	**28.**	C	**37.**	D
2.	D	**11.**	A	**20.**	B	**29.**	B	**38.**	B
3.	B	**12.**	B	**21.**	A	**30.**	C	**39.**	A
4.	D	**13.**	D	**22.**	D	**31.**	B	**40.**	C
5.	D	**14.**	D	**23.**	A	**32.**	B		
6.	B	**15.**	D	**24.**	D	**33.**	B		
7.	B	**16.**	B	**25.**	C	**34.**	C		
8.	D	**17.**	C	**26.**	A	**35.**	B		
9.	D	**18.**	B	**27.**	D	**36.**	C		

EXPLANATIONS

1. IOI = (100 – 72) + (100 – 56) = 28 + 44 = 72%

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Chapter

3

CANAL FALLS

Canal falls, necessity and location of falls , types of falls , canal escapes, types of canal escapes, cross drainage works , types of cross-drainage works, aqueduct and syphon aqueduct , super-passage and syphon, level crossing, wieghtage = 20 %

Practice Problem Level -1

1. A sudden fall of level of ground along the alignment of a canal joined by an inclined bed is called a

(A) Cylinder fall (B) Hydraulic jump

(C) Rapid fall (D) None of these

2. In case of siphon aqueduct, the H.F.L of the drain is

(A) In level with canal bed

(B) Much higher above the canal bed

(C) Much below the bottom of the canal trough

(D) None of the above

3. In a super passage, the F.S.L of the canal is

(A) Above the bed level of the drainage trough

(B) Lower then the underside of the trough carrying drainage water

(C) In level with the drainage water

(D) None of the above

4. The bed of a canal is lowered in case of

(A) Level crossing (B) Canal siphon

(C) Siphon Aqueduct (D) None of these

5. The sarda type fall, rectangular crest is used for discharge up to

(A) 6 cumecs (B) 10 cumecs

(C) 14 cumecs (D) 20 cumecs

6. Gibbs module is

(A) Non-modular outlet

(B) Semi-modular outlet

(C) Open flume outlet

(D) Rigid-modular outlet

7. Canal drops are required to :

(A) Dissipate excess energy

(B) Dissipate inadequate land slope

(C) Dissipate excess land slope

(D) None

8. A device which ensures a constant discharge of water passing from one channel to another irrespective of the water level is each within certain specified limits, is called

(A) Meter (B) Flume

(C) Module (D) None of these

9. A ridge canal is also called a:

(A) Watershed canal (B) Contour canal

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(C) Side slope canal (D) None of these

10. Lining of irrigation channels:
(A) Increases water logging
(B) Increases channel cross section
(C) Increases command area
(D) Increases chances of breaching

11. A hydraulic jump involves;
(A) Subcritical flow (B) Super critical flow
(C) Critical flow (D) All of the flow

12. A hydraulic jump ensures:
(A) Change of subcritical flow to super critical flow
(B) Changes of super critical flow to subcritical flow
(C) Change of subcritical flow to critical flow
(D) Change of super critical flow to critical flow.

13. The safety of Hydraulic structure founded on pervious foundation can be ensured:
(A) By providing sufficient length of its concrete floor
(B) By providing sufficient depth of its concrete floor
(C) By providing a downstream cutoff of some reasonable depth
(D) All of the above

14. Point out the correct meaning of 'piping', as applied to the design of barrages:
(A) It refers to a network of pipes laid below the hydraulic structure to remove the seeping water
(B) It refers to the process of undetermining of foundation and creation of hollows therein
(C) It refers to the uplift force caused by seeping water on the floor of the hydraulic structure
(D) None of the above

15. The depth-discharge relationship of the upstream canal remains practically unaffected by the introduction of a fall of the type:
(A) Ogee fall
(B) Sarda type vertical fall
(C) Trapezoidal notch fall
(D) None of the above

16. The type of fall, which you may recommended for very high drops and very low discharge, is:
(A) Sarda type fall (B) Siphon well drop
(C) Straight glacis fall (D) Montague fall

17. The canal fall, involving parabolic glacis, is called:
(A) Straight glacis fall (B) Glacis fall
(C) Inglis fall (D) Montague fall

18. The energy dissipation in a sarda type canal drop is caused by:
(A) Hydraulic jump (B) Friction blocks
(C) Water pool (D) Baffle wall

19. The best energy dissipation on the down-stream side of a canal drop, is caused in:
(A) Sarda type fall (B) Glacis fall
(C) Ogee fall (D) Montague fall

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20. The energy dissipation in an Inglish fall is caused by:
(A) A pool of water (B) A hydraulic jump
(C) Neither (A) nor (B) (D) Both (A) and (B)

21. The canal regulator, which is constructed at a diversion head-works, is called a:
(A) Cross regulator
(B) Distributary head regulator
(C) Canal module
(D) Head Regulator

22. Canal outlets are also called:
(A) Canal escapes (B) Canal modules
(C) Canal offtakes (D) Canal openings

23. A good irrigation module is the one, which:
(A) Draws heavy silt from the canal
(B) Draws Clearwater from the canal
(C) Draws fair share of silt from the canal
(D) None of the above

24. If the rate of change of discharge from an irrigation outlet is equal to the rate of change of discharge in the distributary, then the outlet is called:
(A) Flexible (B) Proportional
(C) Sensitive (D) None of them

25. The rate of change of discharge through an irrigation outlet becomes equal to the rate of change of water depth in the channel, when its:
(A) Flexibility is 1 (B) Sensitivity is 1
(C) Setting is 1 (D) Sensitivity is zero

26. For a wide trapezoidal channel, the channel index is:
(A) 2/3 (B) 5/3
(C) 1/3 (D) None of these

27. A free pipe outlet is a:
(A) Rigid module (B) Flexible module
(C) Non-modular module (D) All of these

28. A lined alluvial canal is best designed on the basis of :
(A) Lacey's formula
(B) Kennedy's formula
(C) manning's formula
(D) Continuity equation.

29. Lining of irrigation channels:
(A) increase water logging
(B) increases channel cross section
(C) increase command area
(D) increases chances of breaching.

30. A triangular lined canal section with corners rounded by a radius equal to the full supply depth of 4 m, is likely to have its hydraulic radius, as :
(A) 4 m
(B) 3 m
(C) 2 m
(D) cannot be ascertained, as side slopes are not given.

31. Safety ladders are provided in large irrigation canals, to :
(A) enable the fish to pass from one place to another
(B) enable the cattle to cross the canal
(C) enable to swimmers to get out of the canal

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(D) provide safe exit to avoid accidental drowning.

32. The minimum recommended free-board for lined canals carrying discharge of more than 10 cumecs is

(A) unlined canals

(B) lined canals

(C) both (A) and (B)

(D) lined canals constructed on sandy soils alone.

33. Under-drainage arrangements in canals are necessarily required in :

(A) unlined canals

(B) lined canals

(C) both (A) and (B)

(D) lined canals constructed on sandy soils alone.

34. Canal drops are required to :

(A) dissipate excess energy

(B) dissipate inadequate land slope

(C) dissipate excess land slope

(D) none of the above.

35. A trapezoidal notch fall can maintain normal water depth in the upstream channel:

(A) at any one given value of the design discharge

(B) at all the discharges

(C) at any two values of the design discharges

(D) at no discharge at all.

36. The depth-discharge relationship of the upstream canal remain practically unaffected by the introduction of a fall of the type:

(A) Ogee fall

(B) Sarda type vertical fall

(C) Trapezoidal notch fall

(D) none of the above.

37. The type of fall, which you may recommend for very high drops and very low discharge, is:

(A) Sarda type fall

(B) Siphon well drop

(C) Straight glacis fall

(D) Inglis fall.

38. The canal regulator, which is constructed at a diversion head-works, is called a :

(A) cross regulator

(B) distributary head regulator

(C) canal module

(D) none of the above.

39. The gated regulator, which is constructed in the parent canal near the site of an offtaking canal, is called a :

(A) canal head regulator

(B) distributary head regulator

(C) cross regulator

(D) none of the above.

40. A cross regulator helps in

(A) increasing supply in the parent channel downstream

(B) increasing supply in the offtaking channel

(C) increasing water depth in the parent canal, upstream

(D) both (B) and (C)

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41. when an irrigation canal is taken over a drainage channel , the crossing is called:

(A) an aqueduct (B) a super passage

(C) a level crossing (D) none of them.

42. An irrigation canal, freely flowing under a drainage channel, is specifically called a :

(A) canal junction (B) canal crossing

(C) canal siphon (D) super passage.

43. An irrigation canal flowing freely above a drainage, which is turn is flowing under pressure, is specifically, called a :

(A) canal siphon (B) canal aqueduct

(C) siphon aqueduct (D) super passage.

44. A cross-drainage work is called a siphon, when it carries the canal water:

(A) below the drainage under pressure

(B) below the drainage at atmospheric pressure

(C) above the drainage at atmospheric pressure

(D) none of the above.

45. In a syphon aqueduct, the worst condition of uplift on the roof occurs, when:

(A) the canal and drainage are flowing full

(B) the canal is flowing full and there is no drainage discharge

(C) the canal is empty and drainage is flowing full

(D) none of the above.

Answer key

1.	C	**10.**	C	**19.**	D	**28.**	C	**37.**	B
2.	B	**11.**	D	**20.**	D	**29.**	C	**38.**	D
3.	B	**12.**	B	**21.**	D	**30.**	D	**39.**	C
4.	B	**13.**	D	**22.**	B	**31.**	D	**40.**	D
5.	C	**14.**	C	**23.**	C	**32.**	C	**41.**	A
6.	D	**15.**	C	**24.**	B	**33.**	B	**42.**	D
7.	C	**16.**	B	**25.**	B	**34.**	C	**43.**	C
8.	C	**17.**	D	**26.**	B	**35.**	C	**44.**	A
9.	A	**18.**	A	**27.**	B	**36.**	C	**45.**	C

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DAMS AND SPILLWAYS

Chapter 4

Syllabus: Types of dams , spillway, requirements , types of spillways, forces acting on gravity dam , modes of failure & criteria for structural stability of gravity dams. **Weightage= 15%**

Practice Problem Level -1

1. A solid obstruction put across the river to raise its water level and divert the water in to the canal, is known as

(A) Weir (B) Dam

(C) Outlet (D) None of these

2. In Bligh's creep theory, it is assumed that the percolation water creep

(A) In a straight path under the floor

(B) In a straight path under the foundation

(C) Along the contact of the base profile of the apron with the subsoil

(D) None of the above

3. In Lane's weighted creep theory, he proposed a weight of

(A) Three for horizontal creep and one for vertical creep

(B) Three for vertical creep and one for horizontal creep

(C) Two for vertical creep and Two for horizontal creep

(D) None of the above

4. According to khosla's theory, the critical hydraulic gradient for alluvial soil is approximately is equal to

(A) 1.5 (B) 1

(C) 2 (D) None of these

5. The "safety valve" of a dam is its :

(A) Drainage gallery (B) Inspection gallery

(C) Spillway (D) Out let sluices

6. The most economical arch dam is

(A) Constant center arch dam

(B) Constant radius arch dam

(C) Variable radius arch dam

(D) Constant angle arch dam

7. A check dam is a

(A) Flood control structure

(B) Soil conservation structure

(C) River training structure

(D) Water storage structure

8. The elementary profile of a dam is

(A) A rectangle

(B) A trapezoidal

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(C) An equilateral triangle
(D) A right angled triangle

9. Which of the following spillway is least suitable for an earthen dam?
(A) Ogee spillway
(B) Chute spillway
(C) Side channel spillway
(D) Shaft spillway

10. In a chute spillway, the flow is usually
(A) Uniform (B) Subcritical
(C) Critical (D) Super critical

11. Garret's diagrams are base on
(A) Kennedy's theory (B) Lacey's theory
(C) Khosla's theory (D) Bligh's theory

12. According to Lacey's theory, the silt supporting eddies are generated from
(A) Bottom of channel only
(B) Sides of channel only
(C) Bottom as well as sides of channel
(D) None of the above

13. The aqueduct or super-passage type of works are generally used when
(A) High flood drainage discharge is small
(B) High flood drainage discharge is large and short lived
(C) High flood drainage discharge is large and continues for a long time
(D) None of the above

14. A dam reservoir, not provided with gate controls on its spillway and other sluices, is called a
(A) Detention basin (B) Storage reservoir
(C) Retarding basin (D) All of these

15. A dam reservoir, catering to flood control, irrigation, and water supply, although basically designed for irrigation alone, is a:
(A) Multipurpose reservoir
(B) Single purpose reservoir
(C) Distribution reservoir
(D) None of these

16. A hydel power project has been envisaged to serve the water supply and irrigation needs of the area at its inception stage. The dam reservoir, so constructed, will be known as:
(A) Multipurpose reservoir
(B) Single purpose reservoir
(C) Both (A) and (B)
(D) None of them

17. The 'surcharge storage' in a dam reservoir is the volume of water stored between:
(A) Minimum and maximum reservoir level
(B) Minimum and normal reservoir levels
(C) Normal and maximum reservoir levels
(D) None of these

18. The 'useful storage' in a dam reservoir is the volume of water stored between:
(A) Minimum and maximum reservoir levels
(B) Minimum and normal reservoir levels
(C) Normal and maximum reservoir levels
(D) None of the above

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19. The 'dead storage' in a dam reservoir, is the available volume for collection of silt and sediment, between:

(A) Bed level of the reservoir and minimum reservoir level

(B) Bed level of the reservoir and the silt level in the reservoir

(C) Bed level of the reservoir and the normal pool level

(D) None of them

20. 'Bank storage' in a dam reservoir :

(A) Increases the computed reservoir capacity

(B) Decreases the computed reservoir capacity

(C) Sometimes increases and sometimes decreases the computed reservoir capacity

(D) Has no effect on computed reservoir capacity

21. The water stored in a reservoir below the minimum pool level is called:

(A) Valley storage (B) Bank storage

(C) Surcharge storage (D) Dead storage

22. For a flood control reservoir, the effective storage is equal to:

(A) Useful storage + valley storage

(B) Useful storage + surcharge storage – valley storage

(C) Useful storage + surcharge storage + valley storage

(D) Useful storage - valley storage

23. A gravity dam is subjected to hydro dynamic pressure, caused by:

(A) The rising waters of the reservoir when a flood wave enters into it

(B) The rising waves in the reservoir due to high winds

(C) The increase in water pressure, momentarily caused by the

(D) The increase in water pressure, momentarily caused by the horizontal earthquake, acting towards the dam.

24. In concrete gravity dam with a vertical upstream face, the stabilizing force is providing by the:

(A) Weight of the dam

(B) The water supported against the upstream slope

(C) Both (A) and (B)

(D) None of them

25. An arch dam behaves as:

(A) A cantilever vertical retaining wall, standing up from its base

(B) An arch, transferring loads at the two ends by horizontal arch action

(C) Both (A) and (B)

(D) None of them

26. A constant angle arch dam, when compared to compared to constant radius arch dam, utilizes concrete quantity of about:

(A) 43% (B) 130%

(C) 230% (D) None of these

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27. A V-shaped valley with strong foundations can suggest the choice of an arch dam of the type:

(A) Constant radius arch dam

(B) Variable radius arch dam

(C) Constant angle type

(D) None of them

28. The most accurate method to design arch dams is based upon:

(A) The thin cylinder theory

(B) The theory of elastic arches

(C) The trial load method

(D) All of them

29. The thin cylinder theory for designing arch dams, ignores:

(A) Temperature stresses

(B) Ice pressure

(C) Yield stresses

(D) All of them

30. The only force considered in the design of arch dams by thin cylinder theory is:

(A) Water pressure (B) Ice pressures

(C) Yield stresses (D) All of these

Answer key

1.	B	**7.**	A	**13.**	C	**19.**	A	**25.**	B
2.	C	**8.**	D	**14.**	C	**20.**	A	**26.**	A
3.	D	**9.**	A	**15.**	B	**21.**	D	**27.**	C
4.	B	**10.**	D	**16.**	A	**22.**	B	**28.**	C
5.	C	**11.**	A	**17.**	C	**23.**	C	**29.**	D
6.	B	**12.**	C	**18.**	B	**24.**	A	**30.**	A

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DESIGN THEORY

Chapter 5

Syllabus: Regime Channels, Kennedy's Theory ,Drawbacks , Design Procedure, Kutter's Formula, Manning's Formula, Chezy's Formula , Lacey's Theory , Design Procedure , Drawbacks **Weightage= 15%**

Practice Problem Level -1

1. Manning's rugosity coefficient is proportional to:

(A) $\sqrt{d}$ (B) d

(C) $d^{1/6}$ (D) $d^{2/3}$

where d is representative grain dia of bed surface.

2. The Lacey's and Kennedy's empirical silt theories for designing irrigation channels in Indian non-cohensive alluvial soils, are meant to ensure:

(A) No scouring in the channel

(B) No silting from out of the sedimented water entering the channel from the headworks

(C) Both (A) and (B)

(D) Neither (A) nor (B)

3. Lacey's silt factor is proportional to:

(A) $\sqrt{d}$ (B) d

(C) d^2 (D) d^3

where d is the grain size

4. The wetted perimeter P of a stable channel is proportional to:

(A) Q (B) $\sqrt{Q}$

(C) Q^2 (D) None of these

Where Q is the discharge

5. In Lacey's regime theory, the flow velocity is proportional to:

(A) $(Q f^2)^{1/2}$ (B) $\frac{Q}{f^2}$

(C) $(Q f^2)^{1/6}$ (D) None of these

6. Lacey's regime theory is not applicable to a canal in:

(A) True regime (B) Initial regime

(C) Final regime (D) None of them

7. The Garret's diagrams are based on:

(A) Lacey's theory (B) Khosla's theory

(C) Bligh's theory (D) Kennedy's theory

8. The critical velocity ratio was introduced in Kennedy's equation of critical velocity to take into account the effect of:

(A) Channel cross-section

(B) Climatic conditions

(C) Silt grade

(D) Roughness of bed

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9. The most important shape parameter in sediment analysis is:

(A) Sphericity (B) Shape factor

(C) Roundness (D) Form factor

10. Hydraulic depth is the ratio of:

(A) Wetted area to wetted perimeter

(B) Wetted area to top width

(C) Wetted area to bottom width

(D) Wetted perimeter to top width

11. The Unit of Chezy's coefficient C in Chezy's formula, is:

(A) $\sqrt{m}/s$ (B) m/s

(C) m (D) nil

12. For a most economical trapezoidal channel section:

(A) Hydraulic mean radius equals the depth of flow

(B) Hydraulic mean radius equal half the depth of flow

(C) Bottom width is twice the depth of flow

(D) Bottom width is half the depth of flow

13. A lined alluvial canal is best designed on the basic of:

(A) Lacey's formula

(B) Kennedy's formula

(C) Manning's formula

(D) Continuity equation

14. Aggrading rivers are:

(A) Silting rivers (B) Scouring rivers

(C) Rivers in regime (D) Meandering river

15. The river reach upstream of a newly built dam may behave, as:

(A) Aggrading (B) Degrading

(C) Virgin (D) None of these

16. When sand and gravel foundation strata is available at a proposed dam site of moderate height, the dam may be of the type:

(A) Earthen dam or rockfill dam

(B) Masonry gravity dam

(C) Double arch dam

(D) Concrete gravity dam

17. The critical shear stress τ, at which incipient motion of sediment takes place, is proportional to :

(A) $\sqrt{d}$ (B) d

(C) d^2 (D) where d is grain size

18. If τ_c is the critical shear stress on a channel bed, thenthe critical shear on the side slopes (nH: IV) of this channel (τ_c) is given by

(A) $\tau_c' = \tau_c \cdot \sqrt{1 - \frac{sin^2\theta}{sin^2\phi}}$

(B) $\tau_c' = \tau_c \cdot \sqrt{1 + \frac{sin^2\theta}{sin^2\phi}}$

(C) $\tau_c' = \tau_c \cdot \sqrt{1 - \frac{sin^2\phi}{sin^2\theta}}$

(D) $\tau_c' = \tau_c \cdot \sqrt{1 + \frac{sin^2\phi}{sin^2\theta}}$

where ϕ = angle of repose of sioil

$\theta = tan^{-1}\left(\frac{1}{n}\right)$

19. The Lacey's and Kennedy's empirical silt theories for designing irrigation channels in

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Indian non-cohesive alluvial soils, are meant to ensure:

(A) no scouring in the channel

(B) no silting from out of the sedimented water entering the channel from the head works

(C) both (A) and (B)

(D) neither (A) nor (B)

20. The critical velocity V_0 = 0.55 m . $y^{0.64}$, as suggested by Kennedy for design of trapezoidal irrigation channels, is :

(A) the maximum permissible velocity

(B) the minimum permissible velocity

(C) both (A) and (B)

(D) neither (A) nor (B)

21. Critical velocity Ratio for use in Kennedy's theory, is :

(A) less than 1 (B) more than 1

(C) equal to 1 (D) all of the above.

22. The boundary shear stress, τ_0 in an open channel is given by:

(A) $\frac{\gamma^2}{2}$

(B) γ RS

(C) $\frac{1}{n} R^{2/3} S^{1/2}$

(D) where h = depth

R = hydraulic radius

S = Slope

γ = Specific weight of fluid

n = Manning's roughness factor

23. In an irrigation canal, berms are provided at:

(A) NSL (B) FSL

(C) Bank level (D) none of the above.

Answer key

1.	C	**6.**	D	**11.**	A	**16.**	A	**21.**	D
2.	C	**7.**	D	**12.**	B	**17.**	B	**22.**	B
3.	A	**8.**	C	**13.**	C	**18.**	A	**23.**	A
4.	B	**9.**	A	**14.**	A	**19.**	C		
5.	C	**10.**	A	**15.**	A	**20.**	C		

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Chapter

6

MEANDERING

Syllabus: Rivers , types of rivers and their characteristics, classification of rivers in flood plains, meanders, aggrading, degrading type, merits and demerits of river training **wieghtage= 10%**

Practice Problem Level -1

1. The bed form, which is not expected in an alluvial channel with sediment motion, is:

(A) Rippled (B) Meandered

(C) Duned (D) Anti duned

2. The bed of an alluvial channel carrying silted water at a high velocity is expected to be

(A) Rippled (B) Duned

(C) Flat (D) Wavy

3. The anti-dunes develop on beds of alluvial streams, when Froude number is:

(A) 0 (B) 0.5

(C) 1 (D) 1.2

4. The 'meander length' for an alluvial river is:

(A) The total channel length along its looped course

(B) The total channel length minus the direct straight length

(C) The axial length of one meander

(D) The looped length of one meander

5. The 'meander belt' for an alluvial river is:

(A) The total river width between embankments

(B) The width between the outer edges of fully developed meander loop, measured perpendicular to river axis

(C) The same as meander width

(D) Both (B) and (C)

6. For a meandering alluvial river, the ratio of its 'channel length' to direct axial length' is always :

(A) 1

(B) >1

(C) <1

(D) May be less or more than 1, depending upon the river

7. Tortuosity in a meandering river, is:

(A) 1 (B) <1

(C) >1 (D) None of these

8. Meandering ratio in an alluvial meandering river is given by:

(A) $\frac{meand\ er\ lengt\ h}{meander\ \ widt\ h}$

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(B) $\frac{meander\ \ widt\,h}{meander\ \ lengt\,h}$

(C) $\frac{meander\ \ widt\,h}{meander\ \ lengt\,h} \times 100$

(D) None of these

9. An alluvial river increases its length by meandering due to;

(A) Variation of discharge

(B) Variation in land topography

(C) Both (A) and (B)

(D) None of these

10. The secondary factor, which is responsible for meandering in an alluvial river, is:

(A) Inadequate land gradient

(B) Deficient silt load

(C) Constant discharge

(D) None of them

11. A land is said to be water-logged, when :

(A) the land is necessarily submerged under standing water

(B) there is a flowing water over the land

(C) the pH value of the soil becomes as high as 8.5

(D) the soil pores in the root zone get saturated with water, either by the actual watertable or by its capillary fringe.

12. Water-logging of cropped land leads to reduced crop yields, due to :

(A) II-aeration of root zone, causing lack of oxygen to plants

(B) growth of water-loving plants interfering with the sown crop

(C) surrounding of the rot zone by the resultant saline water, which extracts the good water from plant roots by osmosis

(D) all of the above.

13. Alkaline soils are best reclaimed by:

(A) leaching

(B) addition of gypsum to soil

(C) providing good drainage

(D) addition of gypsum to soil and leaching.

14. A recently reclaimed alkaline soil should preferably be sown with a salt resistance crop, like:

(A) wheat (B) cotton

(C) barseem (D) any of the above.

15. The soil becomes practically infertile when its pH value is about:

(A) 0 (B) 7

(C) 11 (D) none of them.

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Answer key

1.	B	**4.**	C	**7.**	C	**10.**	B	**13.**	D
2.	B	**5.**	D	**8.**	B	**11.**	D	**14.**	C
3.	D	**6.**	B	**9.**	C	**12.**	D	**15.**	C

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