

Civil Engg.-VI

BIHAR PUBLIC SERVICE COMMISSION  
**B P S C**

Question paper  
and  
solutions



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1. A chamber made of concrete, fibre glass, PVC or plastic, through which domestic waste water, sewage flows for primary treatment is called
  - (a) Drainage tank
  - (b) Septic tank
  - (c) Pit latrine tank
  - (d) Water harvesting tank
2. Septic tank is usually consists of brick wall in cement not less than
  - (a) 20 cm
  - (b) 100 cm
  - (c) 80 cm
  - (d) 200 cm
3. The BOD after the filtration of sewage from the low-rate trickling filter is
  - (a) 40-50%
  - (b) 80-90%
  - (c) 70-80%
  - (d) 90-99%
4. The organic loading in a trickling filter is measured in
  - (a)  $m^3 / \text{day}$
  - (b)  $\text{gm} / m^2 / \text{day}$
  - (c)  $\text{kg} / \text{hectare-meter day}$
  - (d)  $\text{kg} / \text{hectare} / \text{day}$
5. The recirculation factor in a low-rate trickling filter is
  - (a) 0
  - (b) 1
  - (c) 10
  - (d) 100
6. The diameter of a domestic sewer pipe laid at a gradient 1 in 100 is recommended as
  - (a) 100 mm
  - (b) 150 mm
  - (c) 210 mm
  - (d) 400 mm
7. Which of the following is not a requirement for site selection of hydroelectric power plant?
  - (a) Availability of water
  - (b) Large catchment area
  - (c) Rocky land
  - (d) Sedimentation
8. The amount of electrical energy that can be generated by a hydroelectric power plant depends upon
  - (a) Head of water
  - (b) Quantity of water
  - (c) Specific weight of water
  - (d) Efficiency of alternator
9. Hydroelectric power plant is
  - (a) Non-renewable source of energy
  - (b) Conventional source of energy
  - (c) Non-conventional source of energy
  - (d) Continuous source of energy
10. What type of flow can be taken for granted in a pipe of uniform cross-section?
  - (a) Steady
  - (b) Unsteady
  - (c) Uniform
  - (d) Non-uniform
11. What is the most common medium for sediment transport?
  - (a) Ice
  - (b) Human
  - (c) Wind
  - (d) Water
12. How many types of weirs are there based on the shape of the crest?
  - (a) 6
  - (b) 4
  - (c) 5
  - (d) 3
13. Triangular weir is also called
  - (a) Trigonometric
  - (b) Ogee
  - (c) V-notch
  - (d) Isolated
14. Weirs are normally used to calculate
  - (a) Volume
  - (b) Headloss
  - (c) Discharge
  - (d) Velocity
15. Bearings are provided in the bridges to
  - (a) Allow translation and rotation in bridges
  - (b) Transfer forces from super-structure to substructure
  - (c) Isolate superstructure from Substructure
  - (d) All of the above





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16. Which of the following loads contributes to longitudinal forces in bridges?
- (a) Dead load  
(b) Wind load  
(c) Temperature load  
(d) Both (B) and (C)
17. Development of surges in open channel is
- (a) Gradually varied flow  
(b) Rapidly varied flow  
(c) Steady flow  
(d) Normal flow
18. Irrigation canals are generally aligned along
- (a) Contour line (b) Watershed  
(c) Straight line (d) Valley line
19. Which of the following is suitable for small discharge and high heads?
- (a) Centrifugal pump  
(b) Axial-flow pump  
(c) Mixed-flow pump  
(d) Reciprocating pump
20. A hyetograph is a graphical representation of
- (a) Rainfall intensity and time  
(b) Rainfall depth and time  
(c) Discharge and time  
(d) Cumulative rainfall and time
21. Kirpich equation is used to determine which one of the following?
- (a) Runoff from a given rainfall  
(b) Base time for unit hydrograph  
(c) Time of concentration in runoff hydrograph  
(d) None of the above
22. The top of the ground on which foundation of road rests is called
- (a) Soling  
(b) Base  
(c) Either (a) or (b)  
(d) None of the above
23. According to IRC recommendations, absolute minimum radius of curve for safe operation for a design speed of 100 kmph is
- (a) 100 m (b) 200 m  
(c) 300 m (d) 400 m
24. Critical load position in a rigid pavement design is taken as
- (a) interior loading  
(b) edge loading  
(c) corner loading  
(d) interior, edge and corner loading
25. The most suitable material for highway embankments is
- (a) Granular soil (b) Organic soil  
(c) Silt (d) Clay
26. According to Indian standards, the number of rain gauge stations for an area of 5200 km<sup>2</sup> in planes should be
- (a) 10 (b) 15  
(c) 20 (d) 40
27. The maximum superelevation on hill roads should not exceed
- (a) 7% (b) 8%  
(c) 9% (d) 10%
28. End of speed limit is
- (a) Regulatory sign (b) Warning sign  
(c) Informatory sign (d) None of the above
29. The stopping sight distance (S) of a vehicle for Indian highways is given by
- (a)  $S = 0.28V.t + \frac{0.01V^2}{\eta}$   
(b)  $S = 0.28V.t + \frac{0.01\eta}{V^2}$   
(c)  $S = 0.01V.t + \frac{0.28V^2}{\eta}$   
(d)  $S = 0.01V.t + \frac{0.28\eta}{V^2}$
- Here V is the speed of vehicle, t is the brake reaction time and η is the efficiency of brakes.

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30. The perimeter discharge (P-Q) relation is given by the equation
- (a)  $P = 2.25Q^{1/2}$   
(b)  $P = 2.25Q^{3/2}$   
(c)  $P = 4.75Q^{1/2}$   
(d)  $P = 4.75Q^{3/2}$
31. Dy between two streamlines represents
- (a) Velocity (b) Discharge  
(c) Head (d) Pressure
32. A block of wood 2 m long, 2 m wide and 1 m deep is floating horizontally in water. If density of wood is  $800 \text{ kg/m}^3$ , then the volume of water displaced will be
- (a)  $3.2 \text{ m}^3$  (b)  $2.6 \text{ m}^3$   
(c)  $2 \text{ m}^3$  (d)  $6 \text{ m}^3$
33. The rate of filtration of a slow sand filter ranges from
- (a) 10 to  $100 \text{ L/h/m}^2$   
(b) 10 to  $200 \text{ L/h/m}^2$   
(c) 200 to  $400 \text{ L/h/m}^2$   
(d) 400 to  $1000 \text{ L/h/m}^2$
34. In designing Imhoff tanks, the usual retention period is
- (a) 2 hours (b) 8 hours  
(c) 14 hours (d) 20 hours
35. The maximum spacing of laterals in a rapid sand filter can be
- (a) 10 cm (b) 30 cm  
(c) 50 cm (d) 100 cm
36. If W is total BOD, V is filter volume and F is recirculation factor in a trickling filter, then unit organic loading is obtained by
- (a)  $u = \frac{WF}{V}$  (b)  $u = \frac{VF}{W}$   
(c)  $u = \frac{WV}{F}$  (d)  $u = \frac{W}{VF}$
37. In water supply pipes, wrought iron and cast iron pipes have relationship as
- (a) Life of wrought iron pipes > life of cast iron pipes  
(b) Life of cast iron pipes > life of wrought iron pipes  
(c) Both life spans are equal  
(d) Life of wrought iron pipes = 2 (life of cast iron pipes)
38. When the bed level of canal is higher than the highest flood level (HFL) of discharge, then the cross discharge work is said to be
- (a) Aqueduct (b) Super-passage  
(c) Canal syphon (d) Under tunnel
39. The bed of canal is lowered in case of
- (a) Syphon aqueduct  
(b) Canal syphon  
(c) Level crossing  
(d) All of the above
40. Which of the following hydraulic units is used for transmitting increased or decreased torque to the driven shaft?
- (a) Hydraulic ram  
(b) Hydraulic intensifier  
(c) Hydraulic torque converter  
(d) Hydraulic accumulator
41. When the length of bodywall of a fall is less than the normal width of a canal, it is called
- (a) Notch fall (b) Sarda fall  
(c) Flumed fall (d) Ogee fall
42. Cross regulators are provided
- (a) To rise the water level to its upstream during the periods of low discharge in parent channel  
(b) To help in closing the supply to downstream of the parent channel  
(c) To absorb fluctuations in various sections of the channel systems  
(d) All of the above



43. When the reservoir is full, the maximum compressive forces in a gravity dam is produced
- At the toe
  - At the heel
  - Within the middle third of the base
  - At the centre of base
44. Sewage treatment units are normally designed for
- 5-10 years
  - 15-20 years
  - 30-40 years
  - 40-50 years
45. In water supply for public, threshold odour should be
- 1
  - Between 1 and 3
  - 3
  - More than 3
46. Septic tank is a
- Setting tank
  - Digestion tank
  - Both (A) and (B)
  - None of the above
47. The pipe which is used to carry the discharge from sanitary fittings like bathrooms, kitchen etc. is called
- Waste pipe
  - Soil pipe
  - Vent pipe
  - Anti-siphonage pipe
48. The pipes for water supply are tested for
- Pressure
  - Leakage
  - Dimensions
  - All of the above
49. In rapid sand filters, the depth of tank varies in between
- 1 m to 2 m
  - 2.5 m to 3.5 m
  - 3 m to 3.5 m
  - 0.6 m to 0.9 m
50. Seepage through embankment in a earth dam is controlled by
- Drainage filters
  - Drain trench
  - Relief wells
  - Provision of downstream berms



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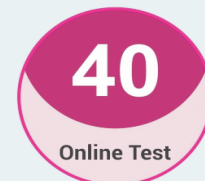
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## ANSWERS KEY

1. **Ans. (b)**

2. **Ans. (a)**

3. **Ans. (b)**

The BOD after the filtration of sewage from the low-rate trickling filter is 80-90%

4. **Ans. (c)**

$$\text{Organic loading} = \frac{\text{kg BOD}}{\text{m}^3 - \text{day}}$$

$$= \frac{\text{kg}}{\text{hectare} - \text{meter} / \text{day}}$$

$$\text{hydraulic loading} = \text{m}^3 / \text{m}^2 - \text{d}$$

5. **Ans. (b)**

$$\text{Recirculation factor (F)} = \frac{1+R}{(1+0.1R)^2}$$

$$\text{for lowrate T. F.} \Rightarrow R = 0$$

$$F = 1$$

6. **Ans. (b)**

Dia	gradient
100 mm	1 in 60
150 mm	1 in 100
200 mm	1 in 120

7. **Ans. (d)**

8. **Ans. (b)**

Potential energy of large quantity of stored water is used by hydroelectric power plant to generate electrical energy head of water is important to get kinetic energy from that potential energy. efficiency of alternator represents that what percentage of input mechanical power it can convert into electrical power.

9. **Ans. (b)**

10. **Ans. (c)**

11. **Ans. (d)**

Most common medium for sediment transport is water

12. **Ans. (b)**

(i) Sharp crested weir

(ii) Broad crested weir

(iii) Narrow crested weir

(iv) Ogee crested weir

13. **Ans. (c)**

Triangular weir is also called

V-notch

14. **Ans. (c)**

15. **Ans. (d)**

16. **Ans. (c)**

17. **Ans. (b)**

Development of surges in open channel is rapidly varied flow. (unsteady)

18. **Ans. (b)**

Irrigation canals are generally aligned along water shed.

19. **Ans. (d)**

Small discharge and high heads – Reciprocating pump

20. **Ans. (a)**

hyetograph – "Rainfall intensity vs time"

hydrograph – "Rate of flow (discharge) vs time"

21. **Ans. (c)**

22. **Ans. (d)**

- The top of the ground on which the foundation of road rests is called "sub-grade"

- The foundation of road is also called "soling or base"

- The super structure of road is called "wearing layer" or "wearing course" or "road surfacing"

23. **Ans. (b)**

$$e + f = \frac{v^2}{127R}$$

Generally for plain terrain

$$f = 0.15$$

$$f = 7\% \cong 0.07$$

$$0.15 + 0.07 = \frac{100^2}{127 R}$$

$$R = \frac{100^2}{127 \times 0.22}$$

$$R \cong 357 \text{ m}$$

take min. radius r 400 m

[for safety purpose]

24. **Ans. (d)**

25. **Ans. (a)**

Most suitable material for highway embankments is granular soil

26. **Ans. (a)**

For plain areas 1 rainguage is covered 520 Km<sup>2</sup>

So no. of required Rainguage

$$= \frac{\text{total Area}}{520}$$

$$= \frac{5200}{520} = 10$$

27. **Ans. (d)**

Plain → 7%

hilly → 10%

28. **Ans. (a)**

When you see the "end of limit" signs. that means you are leaving a controlled speed area and going into and area that's regulated by the basic rule.

29. **Ans. (a)**

We know that

$$SSD = 0.278 V t_r + \frac{v^2}{254(f \pm S)\eta}$$

put  $f = 0.15$

$s = 0.07$

Take upward slope

$$SSD = 0.28 V t_r + \frac{v^2}{254(0.15 + .07)\eta}$$

Put  $f = 0.15$

$s = 0.07$

Take upward slope

$$SSD = 0.28 V t_r + \frac{v^2}{254(.015 + .07)\eta}$$

$$SSD = 0.28 V t_r + \frac{0.01v^2}{\eta}$$

30. **Ans. (c)**

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

31. **Ans. (b)**

$$|\Delta\psi_1 - \Delta\psi_2| = \text{discharge}$$

32. **Ans. (a)**

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

assume density of water =  $1000 \frac{\text{kg}}{\text{m}^3}$

$$800 \times (\text{volume})_{\text{wood}} = 1000 \times (\text{volume})_{\text{water}}$$

$$800 \times (2 \times 2 \times 1) = 1000 \times v_{\text{water}}$$

$$8 \times 4 = 10 v_{\text{water}}$$

$$v_{\text{water}} = 3.2 \text{ m}^3$$

33. **Ans. (b)**

Usually operate at slow sand filter

$$\text{rate} = 0.1 - 0.3 \text{ m}^3/\text{h}/\text{m}^2$$

$$\approx 100 - 300 \text{ lt}/\text{hr}/\text{m}^2$$

34. **Ans. (a)**

35. **Ans. (b)**

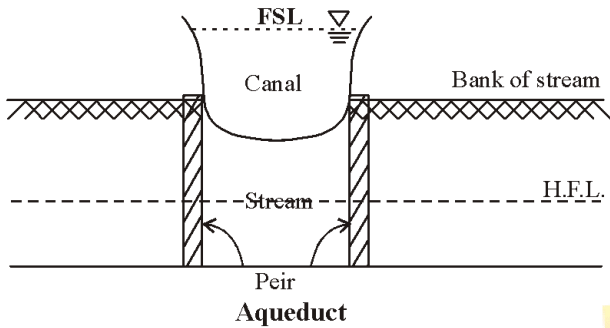
36. **Ans. (d)**

$$\text{organic loading rate} = \frac{W}{\sqrt{F}}$$

37. *Ans. (b)*

life of cast iron pipes > life of wrought iron pipes

38. *Ans. (a)*



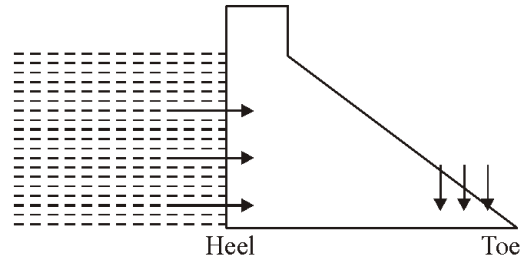
39. *Ans. (b)*

40. *Ans. (c)*

41. *Ans. (c)*

42. *Ans. (d)*

43. *Ans. (a)*



Types of crosses drainage works

Type [Irrigation canal passes over the drainage]

(a) aqueduct

(b) Siphon aqueduct

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

(Drainage & canal intersection each other of the same level)

(a) level crossing

(b) Inlet & outlet

44. *Ans. (b)*

45. *Ans. (b)*

46. *Ans. (c)*

47. *Ans. (a)*

48. *Ans. (d)*

Water supply pipes are tested for –

(i) Pressure

(ii) Leakage

(iii) dimension

49. *Ans. (b)*

50. *Ans. (a)*

seepage through embankment in a earth dam is controlled by "drainage filters"

○○○

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