

## CIVIL ENGINEERING

1. If the width of a carriage way is 55 m, then what is it called?
  - a. Single lane
  - b. Two lanes
  - c. Intermediate lane
  - d. Multi-lane
2. Which one of the following represents the basic capacity of a single lane road?
  - a.  $\frac{1000V}{s}$
  - b.  $\frac{1000V}{h}$
  - c.  $\frac{1000V}{V}$
  - d.  $\frac{1000V}{h}$

Where V = speed in kmph. s = Average centre to centre spacing of vehicles in m. h = Average time headway between two vehicles in seconds
3. What is the maximum number of passenger cars that can pass a given point on a lane or roadway during one hour under ideal roadway and traffic conditions known as?
  - a. Practical capacity
  - b. Possible capacity
  - c. Basic capacity
  - d. Road capacity
4. In highway geometric design, once the cumulative speed distribution is drawn, the design adequacy is checked at which percentile?
  - a. 85th percentile
  - b. 75th percentile
  - c. 90th percentile
  - d. 99th percentile
5. What is the number of cycles to pavement failure, proportional to?
  - a.  $P^{-1}$
  - b.  $P^{-2}$
  - c.  $P^2$
  - d.  $P^3$

Where, P is the individual applied load.
6. Consider the following different stages of pavement conditions during life span of a road.
  1. End of service life.
  2. End of optimum life
  3. End of useful life.
  4. End of ultimate life.

Which one of the following is the correct sequence of the above time scale?

  - a. 1 - 2 - 3 - 4
  - b. 3 - 1 - 4 - 2
  - c. 2 - 1 - 3 - 4
  - d. 1 - 2 - 4 - 3
7. The weight of coarse aggregate having specific gravity 2.65, which is completely filled into a cylinder of volume 0.003 m<sup>3</sup>, is 5.17 gm. What is the shape of this aggregate?
  - a. Angular
  - b. Rounded
  - c. Irregular
  - d. Flaky
8. Which of the following are the purposes for use of steel bar reinforcement in cement concrete pavements?
  1. To increase the flexural strength of concrete.
  2. To prevent the onset of cracks
  3. To allow wider spacing of joints.

Select the correct answer using the code given below:

  - a. 1 and 2 only
  - b. 2 and 3 only
  - c. 1 and 3 only
  - d. 1, 2 and 3
9. By what percentage is length of a runway increased for every 300 m rise above the M.S.L.?
  - a. 3%
  - b. 4%
  - c. 6%
  - d. 7%
10. Consider the following statements:
  1. Mastic asphalt has self-healing property

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2. Mastic asphalt contains more percentage of bitumen.
3. Synthetic geotextile is used to make mastic asphalt
4. Mastic asphalt is used in heavy duty areas

Which of the statements given above are correct?

- a. 1,2 and 3
- b. 3 and 4 only
- c. 1,2 and 4
- d. 2,3 and 4

11. What is the prime objective of providing a point lock?

- a. To ensure that each switches correctly set
- b. To ensure that the point may not be operated while the train is on it
- c. To detect any obstruction between stock rail and tongue rail
- d. To limit the riding of the conical exterior circumference of the wheels

12. Match List-I with List-II and select the correct answer using the code given below the Lists:

List I (Force/Stress on rail)

- A. Vertical loads
- B. Lateral forces
- C. Longitudinal forces
- D. Contact stresses

List II (Cause)

1. Braking forces
2. Wheel and rail contact
3. Shunting operations
4. Impact due to speed and rail vibration

	A	B	C	D
a.	3	4	2	
b.	2	1	3	
c.	1	2	4	3
d.	4	3	1	2

13. What is the full width of the land acquired before finalizing highway alignment, known as?

- a. Width of formation
- b. Right of way
- c. Carriage way
- d. Road way

14. Which one of the following methods is usually adopted for site welding of rails?

- a. Gas pressure welding
- b. Electric arc welding
- c. Thermit welding
- d. Flash butt welding

15. Which one of the following measures the stiffness of a track?

- a. Tractive effort
- b. Tractive resistance
- c. Track modulus
- d. Load capacity

16. A 'roaring rail' has which one of the following defects?

- a. Split on head of rail
- b. Minute depression and waves on the surface of rails
- c. Split on web portions of rail
- d. Square cracks on the surface of rail

17. Which one of the following tools is required to bend the rails for track maintenance?

- a. Rail tong
- b. Jim crow
- c. Crowbar
- d. Wire claw

18. The phenomenon of reflection cracking is observed in which one of the following?

- a. Bituminous overlays provided over cracked cement concrete or bituminous pavements.
- b. Cement concrete overlays provided over cracked bituminous pavements.
- c. Bituminous overlays constructed in cold weather.
- d. Cement concrete overlays provided over cement concrete pavements.

19. A given two-dimensional flow is continuous and irrotational. The velocity component  $u$  is given by  $u = 8xy$ . Which one of the following expresses its  $v$ -component?

- a.  $4x^2 + 4y^2$
- b.  $4y^2 - 4x^2$
- c.  $4x^2 - 4y^2$
- d.  $4x^2y - 4y^2x$

20. Which one of the following is not essential to derive the formula used in constructing a synthetic unit hydrograph?

- a. Time to peak
- b. Peak flow

- c. Interflow
- d. Time base

21. An open channel carrying super critical flow is provided with a smooth expansion along the direction of flow. When no other considerations interfere, then the water surface

- a. Before transition will rise
- b. After transition will rise
- c. Before transition will drop
- d. After transition will drop

22. Normal hydraulic jump has a sequent depth ratio of 8.0. The initial depth is 0.5 m. What is the approximate head loss in the jump?

- a. 32 Nm/N
- b. 7.5 Nm/N
- c. 5.4 Nm/N
- d. 12.9 Nm/N

23. Match List-I with List-II and select the correct answer using the code given below the Lists:

List I

- A. Flow downstream of a sluice gate with mild bed slope of channel.
- B. Flow upstream of an overflow weir with critical bed slope of channel.
- C. Flow downstream of a sluice gate with critical bed slope of channel.
- D. Flow upstream of a free spillway with mild bed slope of channel.

List II

- 1. C<sub>3</sub> curve
- 2. M<sub>2</sub> curve
- 3. C<sub>1</sub> curve
- 4. M<sub>3</sub> curve

	B	C	D
a.	3	2	1
b.	1	4	3
c.	4	3	1
d.	2	1	3

24. Velocity measurements of flow through a rough circular pipe indicate that the average velocity is 2.6 m/s and the centre-line velocity is 3.17 m/s. What is the friction factor for the pipeline?

- a. 0.027
- b. 0.020
- c. 0.015
- d. 0.010

25. If the velocity potential  $\phi = 4xy$ , what are the  $x$  and  $y$  components of velocity at the point (1,4)?

- a.  $u = -16, v = -4$
- b.  $u = -4, v = -16$
- c.  $u = 16, v = -4$
- d.  $u = 16, v = 16$

26. Two reservoirs at different surface elevations are connected by a set of two pipes A and B of same diameter and length in parallel. If the friction factor of A is 4 times that of the pipe B, what is the ratio of the discharge in A to that in B?

- a. 0.25
- b. 4.0
- c. 2.0
- d. 0.5

27. Which one of the following is the correct value of boundary roughness for the stated condition ( $f$  = friction factor,  $e$  = roughness,  $Re$  = Reynold's number,  $D$  = diameter)

- a. For laminar flow :  $f = 640/Re$
- b. For turbulent flow with smooth boundary:

$$\frac{1}{\sqrt{f}} = 2 \log Re \sqrt{f} \quad 0.8 \quad \text{for } Re > 10,000$$

- c. For transition :  $\frac{1}{\sqrt{f}} = 2 \log \left( \frac{e}{f} \cdot \frac{9.35}{D} \right)$

- d. For turbulent flow with rough boundary :  $\frac{1}{f} = 2 \log \left( \frac{D}{e} \right)$

28. A 10 cm dia pipe carries a fluid with kinematics viscosity of 0.25 Stokes at 22°C. If the flow has to be critical (at  $Re = 2000$ ), what is the corresponding velocity of flow?

- a. 0.8 m/s
- b. 8 m/s
- c. 0.5 m/s
- d. 1.5 m/s

29. In a 40 cm diameter pipeline, water flows with a mean velocity of 2 m/s and the shear stress at a radial distance of 10 cm from the centerline of the pipeline is 20 Pa. What is the value of the Darcy's friction coefficient?

- a. 0.008

- b. 0.02
- c. 0.04
- d. 0.08

30. Match List I with List-II and select the correct answer using the code given below the lists

**List I**

- A. Form drag
- B. Circulation
- C. Karmian vortex street
- D. Drag coefficient for sphere

**List II**

- 1.  $Re < 0.5$
- 2. Separation downstream of a submerged cylinder
- 3. Magnus effect
- 4. Bluff objects

	A	B	C	D
a.	4	2	3	1
b.	1	3	2	4
c.	4	3	2	1
d.	1	2	3	4

31. On an extreme value probability paper (Gumbel), how do annual rainfall extremes get plotted?

- a. Hyperbola
- b. Parabola
- c. Straight line
- d. Circle

32. Which one of the following is stated by the moment of momentum principle in respect of a rotating system?

- a. The angular momentum is conserved
- b. Vector sum of all external forces acting on a control volume in a fluid flow equals rate of change of linear momentum
- c. The resultant force exerted on a body is equal to the rate of change of angular momentum.

The torque due to resultant force is equal to the rate of change of angular momentum

33. Consider Euler's equation for one-dimensional (horizontal) unsteady flow. In a 20 cm diameter horizontal pipe, water discharge increases from 25 to 100 liters per second in 3 seconds. What is the pressure gradient that can sustain the flow?

- a. - 5970 Pa/m
- b. - 7808 Pa/m
- c. - 796 Pa/m
- d. 0

34. A circular cylinder 10 m diameter is placed in a uniform stream of 32 m/s. What is minimum speed of the cylinder for imminent detached stagnation?

- a. 420 r.p.m.
- b. 440 r.p.m.
- c. 840 r.p.m.
- d. 880 r.p.m.

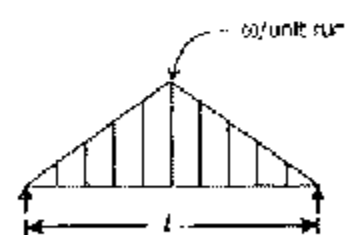
35. In a three-dimensional incompressible flow, the velocity components in the x and y directions are  $u = x^2 + z^2 + 6$  and  $v = y^2 + 2z^2 + 7$ . What is the velocity component in the z direction.

- a.  $2xz - yz + f(x, y)$
- b.  $2xz - yz + f(x, y)$
- c.  $4xz - 2yz + f(x, y)$
- d.  $4xz - 2yz + f(x, y)$

36. Which one of the following statements is correct?

- A two-dimensional vortex has
  - a. Vorticity about any circular streamline including the origin
  - b. Zero circulation around it
  - c. Constant circulation around any closed path including the origin
  - d. Constant circulation around any closed path excluding the origin

37.



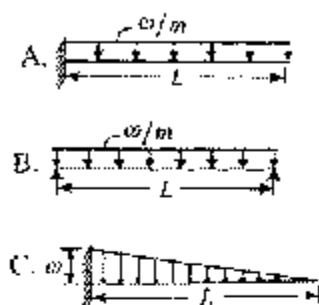
What is the maximum bending moment at mid-span of the beam given above?

- a.  $\frac{wl^2}{2}$
- b.  $\frac{wl^2}{6}$
- c.  $\frac{wl^2}{12}$

d.  $\frac{\omega l^2}{6\sqrt{2}}$

38. Match List-I with List-II and select the correct answer using the code given below the lists:

List I

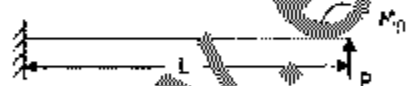


List II (Maximum Bending Moment)

1.  $\frac{\omega L^2}{8}$   
 2.  $\frac{\omega L^2}{12}$   
 3.  $\frac{\omega L^2}{2}$   
 4.  $\frac{\omega L^2}{6}$

	A	B	C
a.	3	2	4
b.	4	1	3
c.	3	1	4
d.	4	2	3

39.



A propped cantilever is acted upon by a moment  $M_0$  at the propped end. What is the propped reaction?

- a.  $\frac{5M_0}{L}$   
 b.  $\frac{M_0}{L}$   
 c.  $\frac{1.5M_0}{L}$   
 d.  $\frac{2.0M_0}{L}$

40. A symmetric parabolic arch of span 12 m and rise 4 m has hinges at springing and at the crown. What is the influence line

ordinate at the location 3 m from one lower hinge?

- a. 2.25 units  
 b. 1.25 units  
 c. 1.125 units  
 d. 1.0 units

41.



A fixed beam AB with a central hinge C is built of two components. AC is rigid and CB has a moment of inertia I. When support A yields and rotates through  $\theta$ , what is the moment at B?

- a.  $\frac{EI\theta}{l}$   
 b.  $\frac{2EI\theta}{l}$   
 c.  $\frac{3EI\theta}{l}$   
 d.  $\frac{4EI\theta}{l}$

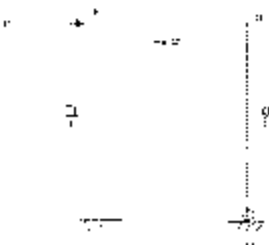
42.



For a symmetrical continuous beam as shown in the figure given above, which one of the following is correct in respect of distribution factors at B?

- a.  $\delta_{BA} : \delta_{BC} = 3 : 4$   
 b.  $\delta_{BA} : \delta_{BC} = 1 : 2$   
 c.  $\delta_{BA} : \delta_{BC} = 3 : 2$   
 d.  $\delta_{BA} : \delta_{BC} = 3 : 8$

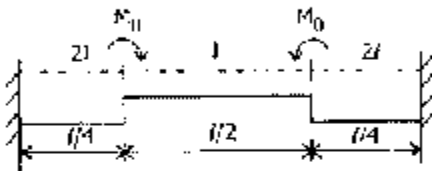
43.



What is the horizontal sway of the point A of the portal frame shown in the figure given above?

- a.  $\frac{PL^3}{3EI}$   
 b.  $\frac{PL^3}{9EI}$   
 c.  $\frac{PL^3}{12EI}$   
 d.  $\frac{PL^3}{15EI}$

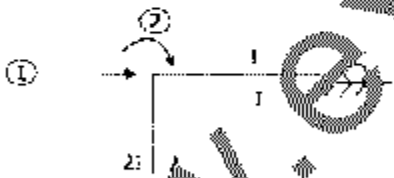
44.



What is the fixed end moment for the beam shown in the figure given above?

- a.  $M_0$   
 b.  $\frac{2M_0}{3}$   
 c.  $\frac{M_0}{3}$   
 d.  $\frac{M_0}{6}$

45.



For the structure shown with loadings symbolised as ① and ②, what is the stiffness matrix?

- a.  $\begin{pmatrix} \frac{EI}{l^2} & \frac{24}{l} \\ \frac{12}{l} & 11 \end{pmatrix}$   
 b.  $\begin{pmatrix} \frac{EI}{l} & \frac{24}{l} \\ \frac{12}{l} & 11 \end{pmatrix}$

- c.  $\begin{pmatrix} \frac{EI}{l} & \frac{24}{l} \\ \frac{12}{l} & 11 \end{pmatrix}$   
 d.  $\begin{pmatrix} \frac{EI}{l^2} & \frac{24}{l} \\ \frac{12}{l} & \frac{11}{l} \end{pmatrix}$

46. For a laminated spring,  $l$  = length,  $n$  = number of plates, width of each plate =  $b$ , thickness of each plate =  $t$ , central point load =  $W$ . What is the expression for the maximum bending stress?

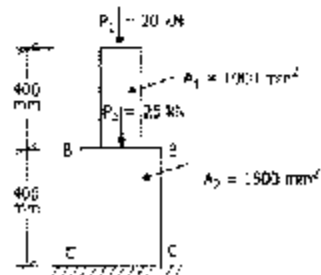
- a.  $f = \frac{3Wl}{4nbt^2}$   
 b.  $f = \frac{3Wl}{2nb^2t}$   
 c.  $f = \frac{3Wl}{2nbt^2}$   
 d.  $f = \frac{3Wl}{2nb^2t}$

47. A bar of length  $l$  is uniformly tapering from a diameter  $d_1$  at one end to a diameter  $d_2$  at the other end. The bar is subjected to a tensile load  $P$ . What is the total elongation?

- a.  $\frac{4Pl}{\pi E d_1 d_2}$   
 b.  $\frac{4Pl^2}{\pi E d_1 d_2^2}$   
 c.  $\frac{4Pl^3}{\pi E d_1^2 d_2}$   
 d.  $\frac{8Pl}{\pi E d_1 d_2}$

( $E$  = Young's modulus of elasticity)

48.

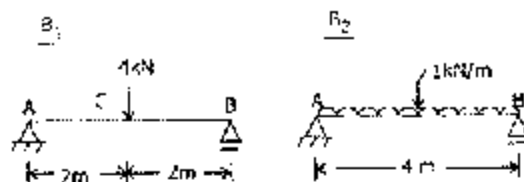


What is values of stress at the base CC for the bar shown in the figure given above?

- a.  $16.67 \text{ N/mm}^2$   
 b.  $13.33 \text{ N/mm}^2$  www.examrace.com

- c.  $26.67 \text{ N/mm}^2$   
d.  $30 \text{ N/mm}^2$

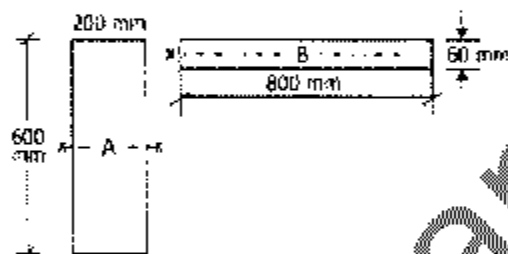
49.



The above diagrams show the details of two simply supported beams  $B_1$  and  $B_2$ . EI is constant throughout the length and same for both the beams. The beams have the same area of cross-section and the same depth. What is the ratio of maximum bending stress in  $B_2$  to that in  $B_1$ ?

- a. 4  
b. 1  
c. 2  
d. 1/2

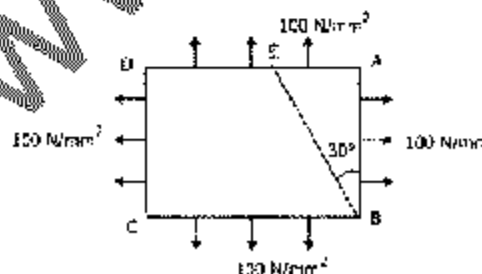
50.



Cross-sections of two beams A ( $600 \text{ mm} \times 200 \text{ mm}$ ) and B ( $800 \text{ mm} \times 60 \text{ mm}$ ) are shown in the figure given above. Both the beams have the same material. By how many times is the beam A stronger than the beam B in resisting bending?

- a. 80  
b. 60  
c. 50  
d. 25

51.



A point in an element is stressed as shown in the figure given above. What is the value of normal stress on the oblique plane BE?

- a.  $200 \text{ N/mm}^2$   
b.  $175 \text{ N/mm}^2$   
c.  $150 \text{ N/mm}^2$   
d.  $100 \text{ N/mm}^2$

52. Two long columns  $C_1$  and  $C_2$  are made of the same material. Column  $C_1$  has both the ends hinged while the column  $C_2$  has one end hinged and other end fixed. What is the ratio of the critical load for  $C_1$  to that of  $C_2$  according to the Euler's formula?

- a. 2  
b.  $1/2$   
c. 4  
d.  $1/4$

53. If  $\epsilon_x$  and  $\epsilon_y$  be the maximum and minimum strains, respectively, in the neighborhood of a point in a stressed material, then what is the expression for the maximum principal stress?

- a.  $\epsilon_x$   
b.  $\frac{E}{1-\mu}(\epsilon_x + \mu\epsilon_y)$   
c.  $\frac{E}{1-\mu^2}(\epsilon_x + \mu\epsilon_y)$   
d.  $\frac{E}{1-\mu^2}(\epsilon_x + \mu\epsilon_z)$

54. A car accelerates from rest to a speed of 10 m/s and the energy spent in doing this is E. If the car is further accelerated from 10 m/s to 20 m/s, what is the amount of energy to be spent further?

- a. E  
b. 2E  
c. 3E  
d. 4E

55. A horizontal rod AB carries three loads of 3.0 kg, 7.0 kg and 10.0 kg at distances of 2.0 cm, 9.0 cm and 15.0 cm respectively from A where it is hinged. Neglecting the weight of the rod, which is the point at which the rod will balance?

- a. 10.95 cm from A  
b. 11.95 cm from A  
c. 12.55 cm from A  
d. 13.25 cm from A

56. A grinding wheel rotates at 3000 rpm. When power supply is cut off, the wheel stops completely in 10 seconds. What is

the number of revolutions made by the wheel before coming to rest?

- 3000
- 1000
- 500
- 250

57. A player catches a cricket ball of mass 0.1 kg moving with a speed of 20 m/s. If the ball is in contact with his hand for 0.1 s, what is the impulse (approximate) exerted by the ball on the hand of the player?

- 2 Ns
- 5.2 Ns
- 10.8 Ns
- 12.5 Ns

58. Which one of the following is a linear reservoir?

- In which storage volume varies linearly with time since initiation of rainfall excess.
- In which outflow rate varies linearly with storage.
- In which release varies linearly with inflow rate.
- In which storage volume varies linearly with water surface elevation.

59. The rotation of a rigid body is governed by

$\phi = 2.5 \sin\left(\frac{\pi t}{4}\right)$  what is its angular velocity at  $t = 2$  s?

- 18 rad/s
- $\pi/4$  rad/s
- $\pi/8$  rad/s
- Zero

60. A 100 kg flywheel having a radius of gyration of 1 m is rotating at 1000 rpm. What is the angular momentum (approximate) of the flywheel about its axis of rotation in  $\text{kg m}^2/\text{s}$ .

- 3000
- 10470
- 1000
- 12000

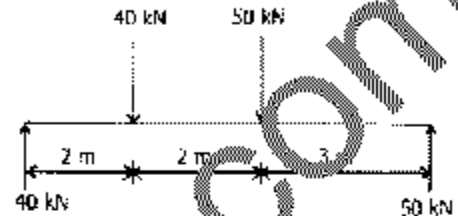
61.



What is the moment (approximate) of the force acting on a railway sign post shown in the figure given above about the point O?

- 1135 Nm
- 1205 Nm
- 980 Nm
- 1300 Nm

62.



What is the magnitude of the result of the parallel force system as shown in the figure given above?

- 70 kNm clockwise
- Zero
- 70 kNm couple anticlockwise
- 40 kN vertical force and a moment of 70 kNm clockwise

A 12 kg mass rests on a surface for which the coefficient of the friction is  $\mu = 0.15$ .

What is the smallest force that can give the mass an acceleration of  $3 \text{ m/s}^2$ ? (Take  $g = 10 \text{ m/s}^2$ )

- 120 N
- 100 N
- 65 N
- 54 N

64.

Match List I with List II and select the correct answer using the code given below the lists:

**List I (Inventory Control Technique)**

- X Y Z
- A B C
- F N S D
- V E D

**List II (Basis of Classification)**

- Consumption value
- Value in storage
- Criticality
- Consumption rate

- |    | A | B | C | D |
|----|---|---|---|---|
| a. | 4 | 3 | 2 | 1 |
| b. | 2 | 1 | 4 | 3 |
| c. | 4 | 1 | 2 | 3 |



d. 2 3 4 1

65. What does higher standard deviation imply in cost analysis?

- Higher uncertainty
- Lower uncertainty
- Nothing to do with uncertainty
- Extra costs are likely

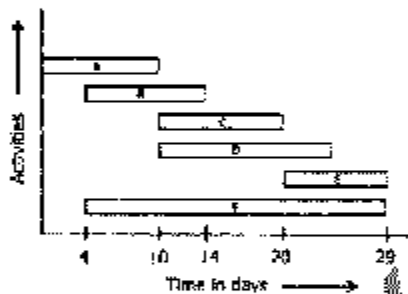
66. What does the critical path in PERT represent?

- The shortest path for the earliest completion of the project.
- The longest path of the network from the initial to final event.

Select the correct answer using the code given below:

- 1 only
- 2 only
- Both 1 and 2
- Neither 1 nor 2

67.



Which are the critical activities in the bar chart shown above?

- Activities B and E
- Activities A, D and E
- Activities A, C and E
- Activities A and E

68. In the PERT analysis, which one of the following is followed by the time estimate of activities and probability of their occurrence?

- Normal distribution
- Poisson's distribution
- $\beta$ -distribution
- Binomial distribution

69. An equipment with a first cost of Rs. 10000/- is depreciated by the straight line method to Rs. 2000/- at the end of 5 years. The interest rate considered is 10% per annum. What is the annual cost by the method of straight line depreciation plus average interest?

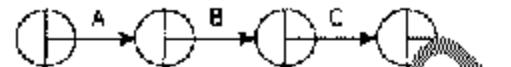
a. Rs. 2000/-

b. Rs. 2160/-

c. Rs. 2200/-

d. Rs. 2280/-

70. The three consecutive activities A, B and C have alternative sets of TIME-DIRECT COST contributions as given below:



T	DC	T	DC	T	DC
8	100	10	125	6	80
7	120	9	140	7	100
6	145	8	160	8	125

What is the least direct cost for a total of 23 days?

- 370
- 375
- 380
- 385

71. In a PERT network, the activity durations are given as  $t_o$  (optimistic time),  $t_p$  (pessimistic time) and  $t_m$  (most likely time). What is the variance of the activity?

- $\frac{t_o + 4t_m + t_p}{6}$
- $\left(\frac{t_p - t_o}{6}\right)$
- $\left(\frac{t_p - t_o}{6}\right)^2$
- None of the above

72. The normal duration and normal cost of an activity are 10 days and Rs. 350/- respectively. The cost slope is Rs. 75/- per day. If the crash duration is 8 days, then what is the crash cost of the activity?

- Rs. 400/-
- Rs. 500/-
- Rs. 600/-
- None of the above

73. When are drop manholes provided in a sewerage system?

- There is change from gravity system to pressure system
- There is change in the elevation of the ground level
- There is change in the diameter of the sewer

- d. There is change in the direction of the sewer line
74. Where does sloughing occur?
- Grit chamber
  - Biological treatment unit
  - Trickling filter
  - Septic tank
75. Activated sludge is the
- Resultant sludge removable from the aeration unit
  - Sludge settled in the humus tank
  - Sludge in the secondary tank post-aeration, rich in microbial mass
  - Sludge in the secondary tank post-aeration, rich in nutrients
76. What is the zone where fish life might tend to progressively dwindle when wastewater is discharged into a river, called?
- Zone of degradation
  - Zone of active decomposition
  - Zone of mixing
  - Zone of recovery
77. What are leaping weirs?
- Sewage flow measuring devices
  - Storm regulators
  - Velocity control devices
  - Sewer outfalls
78. What is the value of generally accepted SOD/N/P weight ratio required for aerobic biological treatment?
- 100/17/3
  - 100/5/1
  - 100/23/5
  - None of the above
79. What are the phenomena of global warming and acid rain formation attributed to?
- $\text{SO}_2$  and  $\text{CO}_2$ , respectively
  - $\text{CO}$  and  $\text{SO}_2$ , respectively
  - $\text{CO}_2$  and  $\text{SO}_2$ , respectively
  - $\text{CO}$  and  $\text{CO}_2$ , respectively
80. What are the values of tolerable CO concentration in residential areas for continuous exposure durations of 1 hour and 8 hours, respectively?
- 4 and 2  $\text{mg}/\text{m}^3$
  - 1 and 2  $\text{mg}/\text{m}^3$
  - 4 and 6  $\text{mg}/\text{m}^3$
  - 5 and 1  $\text{mg}/\text{m}^3$
81. Match List-I with List-II and select the correct answer using the code given below the lists:
- List I (Pollution control Equipment)**
- Cyclones
  - ESP
  - Wet scrubbers
  - Absorbers
- List II (Pollutant Removed)**
- Oily gas emissions
  - Coarse particulate matter
  - Oxides of nitrogen
  - Fine particulate matter
- |    | A | B | C | D |
|----|---|---|---|---|
| a. | 3 | 4 | 1 | 2 |
| b. | 2 | 1 | 4 | 3 |
| c. | 3 | 1 | 4 | 2 |
| d. | 2 |   | 1 | 3 |
82. The traffic density for a highway is 1200 vehicles/hr and the average vehicle speed is 40 km/hr. The average carbon monoxide emission per vehicle is 40 g/s. What is the source strength per unit length.
- 0.4 g/ms
  - 0.6 g/ms
  - 1.0 g/ms
  - 1.2 g/ms
83. An open cylindrical vessel with axis vertical and filled with a liquid is falling freely with an acceleration  $g$ . What will be the absolute pressure at the base of the vessel?
- Equal to liquid column
  - Below atmospheric pressure
  - Above atmospheric pressure
  - Equal to atmospheric pressure
84. An inviscid, incompressible and uniform flow about a stationary cylinder whose axis is held perpendicular to the flow can be simulated by superposition of uniform flow and which of the following?
- A sink and a vortex
  - A doublet
  - A vortex
  - A doublet and a vortex
85. Match List I with List II and select the correct answer using the code given below the lists:
- List I (Valve)**

- A. Sluice valve
- B. Drain valve
- C. Air relief valve
- D. Reflux valve

List II (Where Installed?)

- 1. Where sub mains branch off
- 2. In service pipe connection
- 3. At high elevation points
- 4. At low level reaches

	A	B	C	D
a.	1	3	4	2
b.	2	4	3	1
c.	1	4	3	2
d.	2	3	4	1

86. Which one of the following statements is correct?

In the lime-soda process of water softening,

- a. Lime reduces carbonate hardness while soda removes non-carbonate hardness
- b. Only carbonate hardness is removed
- c. Lime reduces non-carbonate hardness while soda removes carbonate hardness
- d. Only non-carbonate hardness is removed

87. Which concept of the following distributions is used to estimate coli form density?

- a. Normal distribution
- b. Rectangular distribution
- c. Poisson distribution
- d. Extreme value distribution

88. What does eutrophication of a water body with NO cause?

- a. Eutrophication
- b. Gas bubble disease in fish
- c. Methemoglobinemia
- d. Endemic goiter

89. Presence of which one of the following in water is the major cause of depression, paralysis, blindness and/or birth defects?

- a. Cadmium
- b. Chromium
- c. Manganese
- d. Mercury

90. Which is the best sewer material to resist hydrogen sulphide corrosion?

- a. Glazed stoneware
- b. Glazed earthenware
- c. R.C.C.
- d. Brick masonry

91. What is the cause of bulking of sewage?

- a. Absence of micro-organisms
- b. Low sludge volume index
- c. Poor to nil settlement of micro-organisms
- d. High organic loading

92. Why are sheep foot rollers more effective in compacting clayey soils?

- a. There is differential expulsion of water under the roller
- b. Contact pressure is high
- c. Roller speed is high
- d. Drum width is large

93. Untrained strength of a clay soil can be obtained by conducting which & the following tests?

- 1. U.C test
- 2. Vane shear test
- 3. Cyclic triaxial test
- 4. Slow direct shear test

Select the correct answer using the code given below:

- a. 1 and 2 only
- b. 1 and 4
- c. 2 only
- d. 1, 2 and 3

94. Which one of the following shear tests on a saturated clay soil gives a unique effective stress Mohr's circle?

- a. Drained triaxial test
- b. Unconsolidated undrained triaxial test
- c. Consolidated undrained triaxial test
- d. Consolidated drained triaxial test.

95. Which of the following influence the bearing capacity of a circular footing on clay, immediately after construction?

- 1. Size of the footing
- 2. Depth of the footing
- 3. Drained strength of the clay
- 4. Undrained strength of the clay

Select the correct answer using the code given below:

- a. 1 and 3
- b. 1 and 4
- c. 2 and 3

- d. 2 and 4
96. What is the appropriate field test to determine the in-situ undrained shear strength of a soft clay?
- Static cone penetration test
  - Standard penetration test
  - Plate load test
  - Vane shear test
97. A raft foundation with a basement floor is placed at a depth of 4m below ground level. The superstructure imposes a load of  $150 \text{ kN/m}^2$  on the raft. The unit weight of the soil is  $20 \text{ kN/m}^3$ . What are the values of the gross and net loading pressures on the soil, respectively?
- $230 \text{ kN/m}^2$ ,  $150 \text{ kN/m}^2$
  - $150 \text{ kN/m}^2$ ,  $230 \text{ kN/m}^2$
  - $150 \text{ kN/m}^2$ ,  $70 \text{ kN/m}^2$
  - $80 \text{ kN/m}^2$ ,  $150 \text{ kN/m}^2$
98. The confining pressure and the deviator stress on a triaxial sample are, respectively,  $100 \text{ kN/m}^2$  and  $300 \text{ kN/m}^2$ . What is the normal stress acting on the plane of maximum shear stress?
- $150 \text{ kN/m}^2$
  - $200 \text{ kN/m}^2$
  - $250 \text{ kN/m}^2$
  - $400 \text{ kN/m}^2$
99. An undisturbed soil sample, 2 cm thick, undergoes a change in thickness of 0.2 mm when subjected to a consolidation pressure of  $50 \text{ kN/m}^2$ . The initial void ratio of the sample is 10. What is the change in the void ratio?
- 0.01
  - 0.02
  - 0.03
  - 0.04
100. Which one of the following is correct in respect of pore water pressure  $u$  and effective stress  $\sigma_v$  in the soil just below the bottom of a pond due to a 2m rise in water level in the pond?
- $u$  increases by  $20 \text{ kN/m}^2$  and  $\sigma_v$  remains unaltered
  - $u$  increases by  $20 \text{ kN/m}^2$  and  $\sigma_v$  decreases by  $20 \text{ kN/m}^2$
  - $u$  decreases by  $20 \text{ kN/m}^2$  and  $\sigma_v$  remains unaltered
  - Both  $u$  and  $\sigma_v$  remain unaltered
101. When is a soil mass said to have entered the solid phase?
- When loss in water is not accompanied by a corresponding reduction in the volume of soil mass
  - When reduction in the volume of the soil mass is nearly equal to the volume of water lost.
  - When the soil mass becomes brittle.
  - When the soil mass shows a small shearing resistance as the water content is reduced.
102. Consider the following statements  
Lime stabilization of soil leads to
- Decrease in shrinkage limit
  - Increase in plastic limit
  - Decrease in liquid limit
  - Flocculation of clay particles
- Which of the statements given above are correct?
- 1, 2 and 4
  - 2 and 3
  - 1, 3 and 4
  - 2, 3 and 4
103. A stratum of clay draining both at top and bottom undergoes 30% consolidation under a load in 9 years. If an additional drainage layer were present at the mid-height of this clay stratum, what would be the time taken for 30% consolidation under the same load?
- 3 years
  - 4 years and 6 months
  - 2 years and 3 months
  - 9 years
104. Which of the following are the reasons for pre-consolidation of a clay layer?
- Desiccation of upper layers.
  - Rising of water table.
  - Removal of construction load.
  - Withdrawal of a glacier.
- Select the correct answer using the code given below:
- 1, 2 and 3
  - 2, 3 and 4
  - 1, 3 and 4
  - 1, 2 and 4
105. Consider the following statements
- Loess is of volcanic origin

2. Loess soils are uniformly graded silt size particles.
3. Climatic changes cause vertical swelling and shrinkage of loess.
4. Permeability of loess in horizontal direction is less than that in the vertical direction.

Which of the statements given above are correct?

- a. 1 and 4
- b. 2 and 4
- c. 2 and 3
- d. 1 and 3

- 106 Match List-I with List-II and select the correct answer using the code given below the lists.

List I (Cause)

- A. Brownian movement
- B. Soil grading
- C. Consistency
- D. Stratification

List II (Effect)

1. Soil structure
2. Flow index
3. Coefficient of curvature
4. Particle settlement

	A	B	C	D
a	4	1	2	3
b	2	3	4	1
c	4	3	2	1
d	2	1	4	3

- 107 Which one of the following is the most active clay material?

- a. Na-illite
- b. Na-kalinite
- c. Na-montmorillonite
- d. Ca-bentonite

- 108 A fully saturated capillary zone of thickness 2m exists above water table in a fine sandy sand deposit. What is the pore water pressure 1.5 m above the water table?

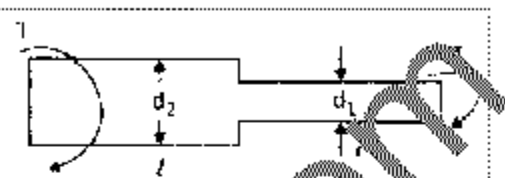
- a. 5 kN/m<sup>2</sup>
- b. 15 kN/m<sup>2</sup>
- c. 5 kN/m<sup>3</sup>
- d. 15 kN/m<sup>3</sup>

- 109 Which one of the following is the appropriate field test for assessing the

angle of shearing resistance  $\phi$  of a deep seated sand deposit?

- a. Vane shear test
- b. Plate load test
- c. Standard penetration test
- d. Static cone penetration test

110



Two shafts of same material and same length are connected in series and subjected to a torque 'T' as shown in the figure given above.

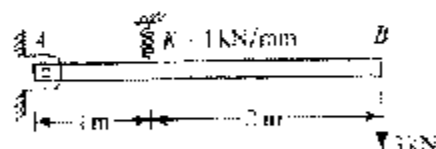
If  $\frac{d_1}{d_2} = 2$ , what is the value of the ratio of

$\frac{\tau_1}{\tau_2}$

(Where  $\tau_1$  and  $\tau_2$  are the extreme shear stresses in either of the two segments)

- a. 4
- b. 2
- c. 8
- d. 16

111.



A rigid bar AB is loaded as shown above. What is the deflection of point B of the bar AB?

- a. 9 mm
- b. 18 mm
- c. 23 mm
- d. 27 mm

112.

How is a truss, which undergoes rigid body translation for an arbitrary load, classified as?

- a. Determinate structure
- b. Geometrically unstable structure
- c. Statically unstable structure
- d. Structurally unstable structure

113. **Assertion (A):** The traffic rotary is an effective traffic management system if the traffic volume exceeds 5000 vehicles/hour.  
**Reason (R):** In rotary merging, weaving and diverging improve traffic management.
- Both A and R are individually true and R is the correct explanation of A.
  - Both A and R are individually true but R is not the correct explanation of A.
  - A is true but R is false
  - A is false but R is true
114. **Assertion (A):** Function of a ballast is to transmit and distribute the wheel loadings from the base of the sleepers to the sub grade.  
**Reason (R):** Well-graded closely packed crushed stones are used to perform the required functions of ballast.
- Both A and R are individually true and R is the correct explanation of A.
  - Both A and R are individually true but R is not the correct explanation of A.
  - A is true but R is false
  - A is false but R is true
115. **Assertion (A):** Most floating ships are more stable in pitching (about longitudinal axis) than in rolling (about longitudinal axis).  
**Reason (R):** Ships have greater length than width.
- Both A and R are individually true and R is the correct explanation of A.
  - Both A and R are individually true but R is not the correct explanation of A.
  - A is true but R is false
  - A is false but R is true
116. **Assertion (A):** The unit load method is used for computing deflection and slope at individual points of a structure.  
**Reason (R):** The unit load method is based on the strain energy principle.
- Both A and R are individually true and R is the correct explanation of A.
  - Both A and R are individually true but R is not the correct explanation of A.
  - A is true but R is false
  - A is false but R is true
117. **Assertion (A):** In precedence networks (AON), start float can be equal to finish float in certain instances.  
**Reason (R):** Interruption between the split segments of appropriate activities is the distinguishing feature of a precedence network.
- Both A and R are individually true and R is the correct explanation of A.
  - Both A and R are individually true but R is not the correct explanation of A.
  - A is true but R is false
  - A is false but R is true
118. **Assertion (A):** The selection of the optimal cross-section of a transmission main is independent of hydraulic performance and structural behavior.  
**Reason (R):** Hydraulic capacity is a direct function of the hydraulic radius.
- Both A and R are individually true and R is the correct explanation of A.
  - Both A and R are individually true but R is not the correct explanation of A.
  - A is true but R is false
  - A is false but R is true
119. **Assertion (A):** Tap water should not be used for carrying out the permeability test on soil.  
**Reason (R):** Tap water contains dissolved salts which obstruct the flow during the test.
- Both A and R are individually true and R is the correct explanation of A.
  - Both A and R are individually true but R is not the correct explanation of A.
  - A is true but R is false
  - A is false but R is true
120. **Assertion (A):** Lowering of water table results in settlement of the ground surface.  
**Reason (R):** Lowering of water table causes decreases in effective weight of soil between the original and final positions of the water table.
- Both A and R are individually true and R is the correct explanation of A.
  - Both A and R are individually true but R is not the correct explanation of A.
  - A is true but R is false
  - A is false but R is true