CIVIL ENGINEERING

1. Given that

   Speed of a vehicle = V kmph

   Brake reaction time = t second

   Efficiency of the brakes = η

   Then the stopping distance of the vehicle is

   a. $0.28Vt + \dfrac{V}{0.01\eta}$

   b. $28Vt - \dfrac{V^2}{0.1\eta}$

   c. $0.28Vt + \dfrac{0.01V^2}{\eta}$

   d. $0.28V^2t + 0.01\eta V^2$

2. Consider the following pairs with reference to highway geometric design:

   1. Camber for CC pavement (1 in 33) to (1 in 40)

   2. Roadway formation width for two lane NH in plain terrain : 12 m

   3. Height of the object while calculating stopping sight-distance 0.15 m

   4. Reaction time of driver in the calculation of overtaking sight-distance 2.5 s

   Which of these pairs are correct?

   a. 2 and 3

   b. 1 and 3

   c. 2 and 4

   d. 3 and 4

3. For design speed of 80kmph, if the deviation angle of a valley curve is 1/20, then the length of a curve for comfort consideration is nearly

   a. 30m

   b. 61m

   c. 101m

   d. 122m

4. At sharp horizontal curves of highways of radius 'R' (in meters), the percentage reduction in gradient provided to compensate the loss of traction force due to curvature is

   a. 50/R

   b. 75/R

   c. 100/R

   d. 125/R

5. Width and the height of centre of gravity of a vehicle negotiating a horizontal curve, are b and h respectively, μ is the coefficient of friction between the road surface and the wheels. If radius of the curve is low and the speed of the vehicle is high, it would overturn before skidding when

   a. b/2h is more than μ

   b. b/h is less than μ

   c. b/h is more than μ

   d. b/2h is less than μ

6. The sub grade soil properties of a sample are as follows:

   Soil portion passing 0.0075mm sieve = 50%
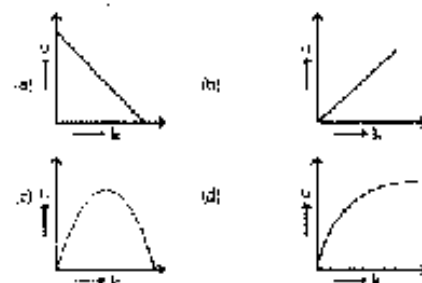
   Liquid limit = 40%

   Plasticity index = 20%

   The group index of the soil is

   a. Zero

   b. 4

   c. 6.5

   d. 8

7. Which one of the following diagrams illustrates the relation between speed 'u' and density 'k' of traffic flow?

8. In speed and delay study, if the average journey time on a stretch of road length of 3.5 km is 7.55 minutes and the average

stopped delay is 1.8 minutes. the average running speed will be, nearly

a.   36.5 kmph

b.   37.5 kmph

c.   38.5 kmph

d.   39.5 kmph

9.   Assuming a longitudinal coefficient of friction to be 0.4, the resulting retardation of a vehicle being brought to a stop is, nearly

a. 0.98 m/s^2

b. 1.95 m/s^2

c. 2.90 m/s^2

d. 3.93 m/s^2

10. Bituminous macadam construction is a type of

a.   Surface dressing

b.   Interface treatment

c.   Grouted construction

d.   Premix

11. Where the aircraft is standing (parking), the facility for loading and unloading operation in front of terminal building is known as

a.   Folding apron

b.   Apron

c.   Taxiway

d.   Hangar

12. The toes of both the tongue rails are connected together by means of a plate which is termed as

a.   Stretcher bar

b.   Gauge bar

c.   Tie bar

d.   Tongue rail

13. In a split, the speed of the main line of a BG track is 45 kmph and the equilibrium cant required is 7.78cm. if the cant deficiency allowed is 7.5cm, the actual cant to be provided on the branch line will be

a. $+0.18$ cm

b. -0.18 cm

c. $+0.28$ cm

d. -0.28 cm

14. Given that the width of the sleepers $=w$, the sleeper spacing $=s$. then the depth of ballast 'd' is

a. $\dfrac{s - w}{2}$

b. $\dfrac{w - s}{2}$

c. $s - \dfrac{w}{2}$

d. $w - \dfrac{s}{2}$

15. The equilibrium super elevation required on a broad gauge track and horizontal curve of radius 650 m for a speed of 65 kmph is nearly

a.   0.013 cm

b.   0.130 cm

c.   5.58 cm

d.   6.16 cm

16. The value of curve lead to be provided for a BG track with crossing number 8.5 is. nearly

a.   5.1 m

b.   14.25 m

c.   21.4 m

d.   28.5 m

17. Which one of the following methods gives the best estimate of population growth of a community with limited land area for future expansion?

a.   Arithmetical increase method

b.   Geometrical increase method

c.   Incremental increase method

d.   Logistic method

18. Consider the following units associated in water supply system

1.   Pumping of raw water

2   Intake works

3.   Treatment works

4   Distribution system

The sequence of these units in the order of their connections starting from the source (River) is

a.   1, 2, 3, 4

b.   2, 1, 3, 4

c.   2, 1, 4, 3

d. 1, 2, 4, 3

19. If pH value of solution 'A' is 4 and that of solution 'B' is 5, then the hydrogen-ion concentration of solution

a. 'A' is ten times higher than that of 'B'

b. 'B' is double than that of 'A'

c. 'A' is ten times less than that of 'B'

d. 'A' is double than that of 'B'

20. Match List I (Bacteria) with List II (Diseases) and select the correct answer:

List I

A. Escherichia coli

B. Salmonella typhi

C. Salmonella (~1700 spp)

D. Legionella pneumophira

List II

1. Food poisoning

2. Acute respiratory illness

3. Typhoid fever

4. Gastroenteritis Diarrhea

5. Cholera

	A	B	C	D
a.	3	4	2	1
b.	3	4	5	2
c.	4	3	5	2
d.	4	3	2	1

21. An ideal settling basin has a plan area of $100 m^2$. if a flow of $2400 m^3/$ day has passed through the basin then for removing the discrete particle completely form the basin, the terminal settling velocity is, nearly

a. 1 m/hour

b. 0.5 m/hour

c. 0.1 m/hour

d. 0.05 m/hour

22. Consider the given figure of mass curve for estimating the stronger capacity of the water supply tank. The storage capacity of the tank would be

a. A

b. B

c. A – B
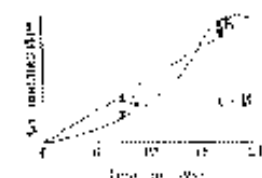
d. A+B

23. Consider the following is pairs:

1. Darcy Weisbach equation : $V = C\sqrt{RS}$

2. Manning's equation : $V = \dfrac{R^{2/3}S^{1/2}}{n}$

3. Hazen William equation : $V = kCR^{0.63}S^{0.54}$

4. Chezy's Equation : $\dfrac{H_f}{l}\left(\dfrac{f}{2g}\right)$

Which of these pairs are correct?

a. 1 and 2

b. 2 and 3

c. 3 and 4

d. 1 and 4

24. A sudden change in the slope of the hydraulic gradient line drawn for a straight section of a water pipe line indicates the

a. Change in ground slopes

b. Presence of water hammer

c. Accumulation of sediments

d. Leakage in pipe line

25. A 600 mm diameter RCC sewer is laid at a slope to develop a velocity of flow of 0.6 m/s while just running full. When the sewer is running exactly half-full, the velocity of flow, taking Manning's constant to be equal to 0.013, is nearly

a. 0.3 m/s

b. 0.6 m/s

c. 0.9 m/s

d. 1.2 m/s

26. The ventilation in sewers is needed to avoid the

a. Development of explosive mixtures of sewer gases

b. Build up of odorous gases

c. Danger of asphyxiation of sewer maintenance employees

d. Anaerobic decomposition of organics

27. Match List I (Treatment system) with List II (Item) and select the correct answer:

List I

A. Activated sludge process

B. Trickling filtration

C. Oxidation ponds

D. Anaerobic sludge digestion

List II

1. Fixed film reactor

2. Algae

3. F/m ratio

4. Proportional flow weir

5. Methane recovery

	A	B	C	D
a.	3	1	2	5
b.	1	3	5	4
c.	3	1	5	4
d	1	3	2	5

28. The velocity distribution over a flat plate is given $u = 3/4y - y8^2$ where u is the velocity in m/s at a distance y (in m) above the plate and μ for the given fluid is 0.84 Ns/m². The shear stress at a location 0.3 above the plate is K times the shear stress at a location 0.2 m above the plate. The value of K would be

a. 3/2

b. 9/4

c. 3/7

d. 7/3

29. If a rectangular plate 4m×3m is completely submerged under water as shown in the given figure, then the hydraulic thrust on the plate would be, nearly
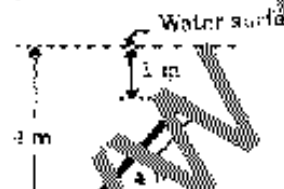
a. 220 kN

b. 4 kN

c. 294 kN

d. 353 kN

30. A 15cm diameter pipe carries a flow of 70 liters per second of an oil. $(\rho = 0.75)$. At a section 12 cm above the datum, there is a vacuum of 2cm of mercury. If the kinetic energy correction factor for this section is 1.1, the total head at the section of oil is

a. 0.648 m

b. 0.637 m

c. 0.557 m

d. 0.728 m

31. A water jet of an area of 0.03 m² impinges normal on a fixed plate. If a force of 1kN is produced as a result of the impact, the velocity of the jet would be

a. 15 m/s

b. 3.4 m/s

c. 5.78 m/s

d. 33.4 m/s

32. During a flow of 1.4 m³/s of water per 0.30m length of the spillway, a low spillway changes the velocity of flow from 1.40m/s on the upstream side 7m/s on the downstream side. The force exerted on the spillway per 0.30m length of the spillway, is nearly

a. 500 N

b.

c. 980 N

d. 11760 N

33. A jet of water issues out from a nozzle inclined at 30° to horizontal. If the velocity of the jet at the nozzle is 20 m/s, the maximum vertical distance attained by the jet above the nozzle is equal to

a. 2.55 m

b. 5.1 m

c. 10.2 m

d. 20.4 m

34. Which of the following represent possible flow fields?

1. $u = 4x^3$ and $v = -12x^2y$

2. $u = \log xy$ and $v = y/x$

3. $u = y^2$ and $v = -x$

4. $u = 2xy$ and $v = y^2$

Select the correct answer using the codes given below:

a. 1,3 and 4

b. 1,2 and 4

c. 2,3 and 4

d. 1,2 and 3

35. An open circular tank of 1 m height and 0.3 m diameter contains 0.8 m of water. If the tank is rotated about the vertical axis

such that there is no spillage of water, the maximum angular velocity of the tanks is, nearly

a. 18.65 rad/s.

b. 18.65 rad/minute

c. 1.865 rad/s

d. 1.865 rad/minute

36. A source of strength 2.0 m²/s and a corresponding sink at a distance of 0.2 cm constitute the doublet. If a uniform flow of 1.2 m/s is superimposed on the doublet, the radius of the Rankine circle is, nearly

a. 8.66 cm

b. 5.77 cm

c. 54.33 cm

d. 2.89 cm

37. Match List I (Flow patterns) with List II (Stream Functions, ψ) and select the correct answer:

List I

A. Free vortex

B. Source and sink pair

C. Doublet

D. Source in a uniform flow

List II

1. $\dfrac{\mu}{2\pi r}\sin\theta$

2. $\dfrac{I}{2\pi}\ln r$

3. $K\theta + U_r r\sin\theta$

4. $K(\theta_1 - \theta_2)$

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

38. A vertical U-tube with two legs 2 m apart is filled with water and rotated about a vertical axis 0.5 m from one leg. The difference in elevation of water levels in the two legs, open to atmosphere, when the speed of rotation is 45 rpm is, nearly

a. 0.283 m

b. 2.263 m

c. 2.546 m

39. Which one of the following is the model scale for a situation where both viscous and gravity forces are predominant. If kinematics viscosity of model and prototype fluids are 0.9 stokes and 7.2 stokes respectively?

a. $1/\sqrt{8}$

b. ¼

c. 1/8

d. 1/64

40. A hydraulic turbine, when tested in a laboratory at 250 rpm under 8 m head, develops 60 kW power. The power potential of a similar turbine of the appropriate size operating under a head of 40 m and run at the same speed is

a. 3254 kW

b. 2523 kW

c. 2100 kW

d. 1877 kW

41. A spillway flood discharge of 22,100 m³/s is simulated with a model in a laboratory provided with a pump of discharging capacity 1.25m³/s. A flood event lasting 12 hours simulated in the laboratory model will take

a. 0.24 hour

b. 1.7 hour

c. 4.5 hours

d. 84.85 hours

42. A 1 m wide and 3 m long flat plate, held stationary, parallel to the flow direction of a uniform oncoming stream of water of velocity 3 m/s, leaves a velocity profile, at its trailing edge, varying linearly from zero at the plate to the free-stream velocity of 3 m/s at 5 cm away from the plate. The water flow is only on one side of the plate. Assuming the pressure to be the same everywhere in the flowing water, the drag force on the plate will be

a. 75 N

b. 66.7 N

c. 62.5 N

d. 56.25 N

43. A very large and open reservoir feeds into a horizontally laid pipe which discharges

into the atmosphere at its outfall. All losses other than by friction are to be neglected. Due to some unforeseen reason, an orifice-like opening occurs at the mid-length of the pipe whereby 10% of the then-inflowing discharge from the reservoir is lost at this opening. The reduction in the then-available discharge at the outfall end is, nearly

a. 3.2%

b. 5.4%

c. 7.5%

d. 9%

44. A pipe of 100 m length and 200 mm diameter and friction factor 0.015 is to be replaced by a 400 mm diameter pipe of friction factor 0.012 to carry the same flow. For the head loss of the same magnitude, the equivalent length is given by

a. 40 m

b. 400 m

c. 4 km

d. 40 km

45. Laminar flow of a liquid through a smooth 25 mm diameter pipe has a head loss of m per meter length of the pipe with mean velocity of flow at 1.5 m/s. If the flow ve3locity is doubled, yet remaining in laminar flow, the resulting head loss per meter length of pipe will nearly, be

a. 4 m

b. 3.5 m

c. 2m

d. 1.4m

46. The given table shows the specific energy of flow at various stages of flow, d. both d and E are in meters.

	E
	5.29
0.4	1.57
0.5	1.37
0.7	1.24
0.74	1.15
0.9	1.12
1.3	1.2
1.2	1.48
1.4	1.5
1.5	1.67
1.9	1.86
2.0	2.09

The unit discharge in this case can be inferred as nearly

a. 1.25 m³/s

b. 1.62 m³/s

c. 1.94 m³/s

d. 2.08 m³/s

47. The sequent depths in a hydraulic jump formed in a 4.0 wide rectangular channel are 0.2 m and 1.0m, the discharge in the channel is

a. 1.12 m³/s

b. 2.17m³/s

c. 4.34m³/s

d. 5.0m³/s

48. A sluice gate across a 3 m wide rectangular channel has water depths of 1 m and 0.3 m on the opposite side of the gate.

The total force on the gate is, nearly (Take g = 9.81 m²)

a. 2678

b. 3119 N

c. 3826 N

d. 3885 N

An increase in pressure of 2 bars decreases the volume of a liquid by 0.01 percent. The bulk modulus of elasticity of the liquid is

a. $2 \times 10^5 \, N/m^2$

b. $2 \times 10^7 \, N/m^3$

c. $2 \times 10^9 \, N/m^2$

d. $2 \times 10^{11} \, N/m^2$

50. For a triangular section with base b and height h, the ratio of the moment of inertia about an axis passing through its vertex and parallel to its base to the moment of inertia about an axis passing through its centre of gravity and also parallel to its base would be

a. Twelve to one

b. Nine to one

c. Six to one

d. Four to one

51. Three forces acting at a point 'O' are

$P_1 = (3i + 6j) N$, $P_2 = (1.5i + 4.5j) N$ and

$P_3 = (-10.5i + 1.5j) N$

If a fourth force P_4 is added such that the point 'O' is in equilibrium, then force P_4 will be

a. $(15i - 15j) N$

b. $(9i - 12j) N$

c. $(-9i + 12j) N$

d. $(15i + 15j) N$

52. If a body of weight 100 N is hauled along a rough horizontal plane by a pull of 50 N acting at angle of 30° with the horizontal, the coefficient of friction is

a. $1/\sqrt{3}$

b. $2/\sqrt{3}$

c. $\sqrt{3}$

d. $4/\sqrt{3}$

53. Two blocks of masses m_1 and m_2 $(m_1 > m_2)$ are connected by an inextensible string passing over a smooth pulley and move vertically. If the acceleration of m_1 is g/5 downwards, then the ratio of $m_1 : m_2$ is

a. 3:1

b. 5:3

c. 5:1

d. 3:2

54. A projectile is shot straight up with a velocity of 40 m/s. After how many seconds, will it return if drag is neglected and g = 10 m/s²

a. 4s

b. 6s

c. 8s

d. 10s

55. The stiffness of spring A and B are K and 2K respectively. If each spring is subjected to load P for a while and the load is removed suddenly, the ratio of period of resulting simple harmonic of A to that of B is

a. 2

b. $\sqrt{2}$

c. ½

d. $1/\sqrt{2}$

56. Match List I with List II and select the correct answer:

List I (Material)

A. Steel

B. Cast iron

C. Aluminum

D. Timber

List II (Modulus of Elasticity N/mm²)

1. 0.6×10^5

2. 1×10^5

3. 2×10^5

4. 0.1×10^5

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

57. Two bars of same size but of different materials are subjected to same tensile force. If the bars have their axial elongation in the ratio of 4:6, then the ratio of modulus of elasticity of the two materials would be

a. 4:6

b. 6:4

c. 4:10

d. 16:36

58. ABC is a rigid bar. It is hinged at A and suspended at B and C by two wires, BD and CE made of copper an steel respectively, as shown in the given figure. The bar carries a load of 10 kN at F, midway between B and C, given that
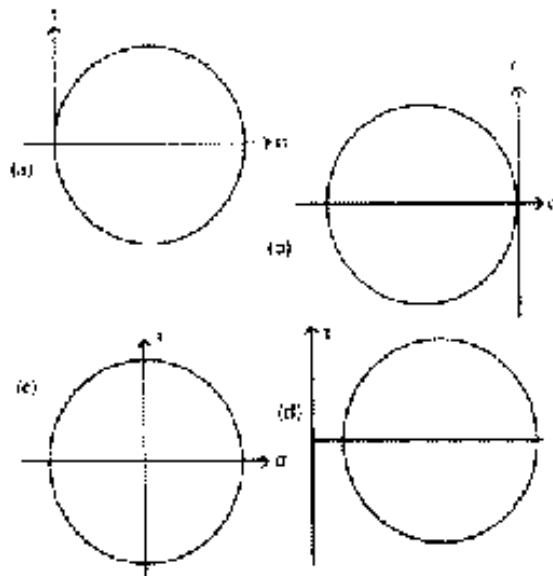
$A_c = 4cm^2, A_s = 2cm^2$

$E_c = 1 \times 10^5 N / mm^2$

$E_s = 2 \times 10^5 N / mm^2$

Subscript c and s stands for copper and steel. If the extensions in the steel and copper are Δ_s and Δ_c respectively, the ratio Δ_s / Δ_c would be
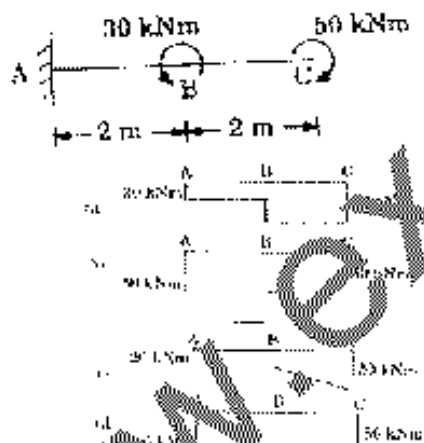
a. ½
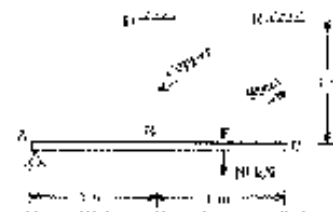
b. 4

c. 2

d. 1/2

59. Which one of the following Mohr's circles of stress represents the state of pure shear?

60. A cantilever beam is subjected to moments as shown in the given figure. The B.M. diagram for the beam will be

61. A beam has rectangular section 100mm × 200mm. If it is subjected to a maximum B.M. of 4×10^7 N.mm, then the maximum bending stress developed would be

a. 30 N/mm²

b. 60 N/mm²

c. 90 N/mm²

d. 120 N/mm²

62. A timber beam is simply supported at the ends and carries a concentrated load at mid-span. The maximum longitudinal stress 'f' is 12 N/mm² and the maximum

shear stress 'q' is 1.2 N/mm². The ratio of span to depth would be

a. 10

b. 6

c. 5

d. 4

63. For cantilever beam shown in the given figure, the deflection at C due to a couple M applied at B is equal to

EI = Constant
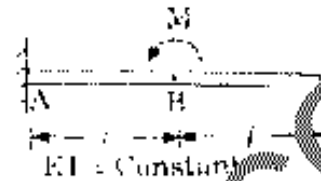
a. $Ml^2/2EI$

b. Ml^2/EI

c. $3Ml/2EI$

d. $2Ml^2/EI$

64. Consider the following statements:

For each component in a fetched beam under the action of a transverse load.

1. The radius of curvature will be different.

2. The radius of curvature will be the same

3. The maximum bending stress will be the same

4. The maximum bending stress will be dependent upon the modulus of elasticity of the martial of the component.

Which of these statements are correct?

a. 1 and 3

b. 1 and 4

c. 2 and 3

d. 2 and 4

65. Which one of the following associated with the rib shortening in arches either due to change in temperature or lack o fit to cause stresses in the arch members?

a. Only two-hinged arches and not three-hinged arches

b. Two and three-hinged arches

c. Two-hinged arches made of reinforced concrete only

d. Only three-hinged arches but not two-hinged arches

66. The absolute maximum bending moment due to a single rolling load in a three-hinged parabolic arch, span 'L' and central rise h, having one of its hinges at the crown, occurs at a distance 'x' from either support. The value of x is given by

a. $L/2\sqrt{3}$

b. $L/4$

c. $L/3\sqrt{2}$

d. $L/3+\sqrt{3}$

67. A symmetrical two - hinged parabolic arch rib has a span of 32 m between abutment pins at the same level and a central rise of 5 m. The second moment of area of the rib varies as the secant of the angle of inclination of the arch. When a rolling load of 100 kN crosses the span, the maximum horizontal thrust at the hinges will be

a. 100 kN

b. 125 kN

c. 160 kN

d. 240 kN

68. A uniformly distributed load of 2 kN/m covers left half of the span of a three-hinged parabolic arch, span 40 m and central rise 10 m. Which of the following statements relating to different functions at the loaded quarter point are correct?

1 The slope is $\tan^{-1}(1/2)$

2. The normal thrust is $\sqrt{5}KN$

3. The shear force is zero.

4 The bending moment is zero

Select the correct answer using the codes given below :

a. 1,2 and 4

b. 2 and 3

c. 1 and 3

d. 3 and 4

69. A simply supported beam of span 8m is subjected to a single concentrated moving load of 40kN, maximum bending moment at one-quarter span is

a. 40 kNm

b 60 kNm

c. 80 kNm

d. 100 kNm

70. The degree of static indeterminacy of the pin-jointed plane frame shown in figure is

a. 1

b. 2

c. 3
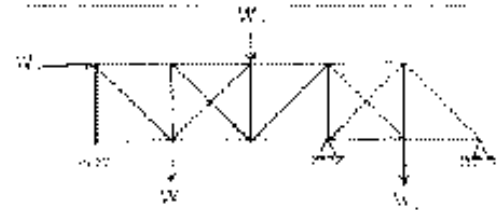
d. 4

71 A circular shaft of length 'L' is held at two ends without rotation. A bending moment 'T' is applied at a distance 'L/3' from left support as shown in the given figure. The twisting moment in the portion AB will be

72. A circular shaft of length 'L', a uniform cross-sectional area 'A' and modulus of rigidity 'G' is subjected to a twisting moment that produces maximum shear stress ' in the shaft. Strain energy in the shaft is given by the expression $r^2 A L/k$ G. where k is equal to

a. 2

b. 4

c. 8

d. 16

73. When two springs are in series, the stiffness of the competitive spring will be

a. Sum of the stiffness of the individual springs

b. Difference of the stiffness of the two springs

c. Any one of the stiffness of the two springs

d. Inverse of the sum of the reciprocals of the individual spring's stiffness

74. In a hollow thick cylinder the radial stress σ_r under an internal pressure 'p'

a. Increases from a minimum at the innermost surface to a maximum value at the outermost surface

b. Decreases from a maximum at the innermost surface to a minimum value at the outermost surface

c. Increases from zero at the innermost surface to a value $\sigma_r = p$ at the outermost surface

d. Decreases from a value $\sigma_r = p$ at the innermost surface to zero at the outermost surface

75. A certain steel has proportionality limit of 300 N/mm² in simple tension. Under a three dimensional stress system, the principal stress are 150 N/mm² (Tensile), 75 N/mm² (Tensile) and 30 N/mm² (Compressive), $\mu = 0.3$, the factor of safety according to maximum shear stress theory would be

a. 1.4

b. 1.5

c. 1.8

d 1.6

76 The fundamental difference between flexibility and stiffness matrix methods for the analysis of statically indeterminate structure, is that

a. The flexibility method chooses the redundant reactions or internal force while stiffness method considers the nodal displacements as the basic unknowns.

b. The number of simultaneous equations to be solved in the flexibility method will be very much smaller than the number of equations involved in the stiffness method.

c. In the flexibility matrix, the equations of equilibrium will inevitably be unsymmetrical and less sparsely populated while the stiffness matrix is always symmetric and sparsely populated

d Flexibility matrix method is suitable to structures with a smaller degree of statically indeterminacy than kinematics indeterminacy while stiffness matrix method is better suited to structures with a large degree of statically indeterminacy than kinematics indeterminacy

77. A bar AB of a pin-jointed truss lying in the x - y plane has the coordinates of A(0,0) and those of B($3\sqrt{3}$,3) in meters. Joints A and B are displaced, the x and y components of displacement being

$$\left(u_a, v_a, u_b, v_b\right) = \left(1\ \sqrt{3}\ 2\ 2\sqrt{3}\right) mm$$

For this bar, $k = EA/L = 100$ kN/mm. The force induced in the bar by end displacements is

a. 273 kN

b. 200 kN

c 173 kN

d. 100 kN

78 A portal frame is shown in the given figure. If $\theta_B = \theta_C = 400/EI$ radian, then the value of moment at B will be
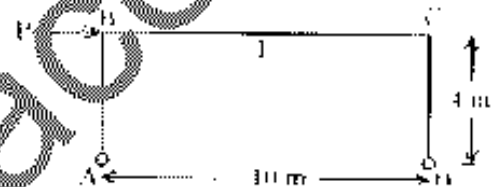

a 120 kNm

b. 240 kNm

c. 360 kNm

d. 480 kNm

79. Which one of the following equations represents influence line of fixed end moment at B of the fixed beam AB of length l with origin at A?

a. $\dfrac{x^2(l-x)}{l}$

b. $\dfrac{x(l-x)^2}{l^2}$

c. $\dfrac{x(l-x)}{l}$

d. $\dfrac{x^2}{l^2}$

80. A simply supported beam is shown in the figure I and in figure II an influence line for the beam is drawn. Which one of the following statements is correctly associated with the figure II?
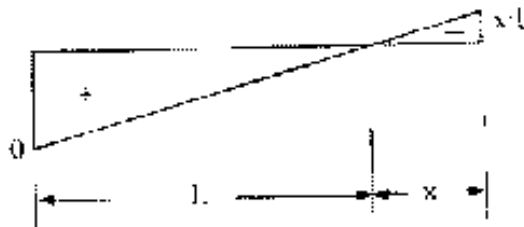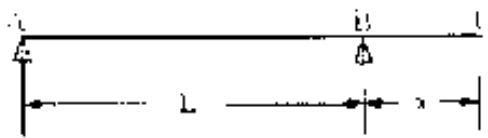
a. Influence line for shear force at B

b. Influence line for bending moment at B

c. Influence line for vertical reaction at A

d. Influence line for vertical reaction at B

81. Which one of the following statements correctly defines the term focal length of a beam?

a. The section of the beam within which shear force is prone to change sign under the influence of live loads

b. The section of the beam within which bending moment is prone to change sign under the influence of live loads

c. The length of the beam between two consecutive points of contra flexure

d. The effective span

82. Which of the following statements are correct?

1. Muller-Breslau principle enables the determination of influence line experimentally as well.

2. Influence line for deflection at any point in statically determinate beams is linear.

3. Also moment distribution, slope displacement and matrix methods can be applied to compute the ordinates of influence diagram at the required locations.

4. Influence lines cannot be drawn with the help of virtual displacements by making use of the principle of virtual work.

Select the correct answer using the codes given below:

a. 2 and 3

b. 1 and 3

c. 1 and 4

d. 2 and 4

83. A Warren truss is supported as shown in the given figure. Which one of the following diagrams represents the influence line for the force in member $U_1 U_2$?
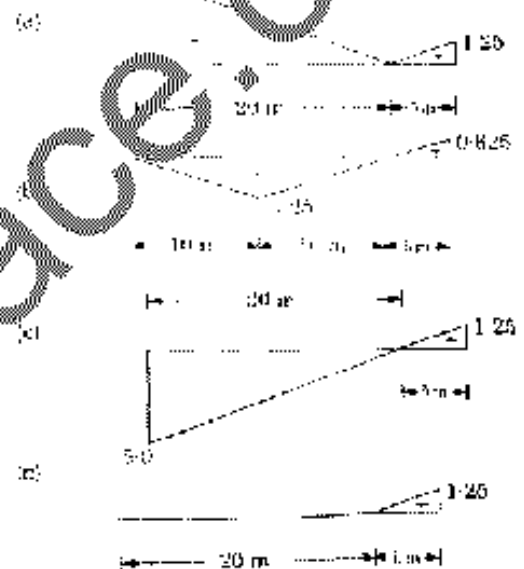
84. **Assertion (A) :** In the analysis of a truss by the method of joints, it should be ensured that the selected joint does not have more than two unknown member forces which are not collinear.

Reason (R): The method of joints employs the two basic equations of equilibrium $\sum F_x = 0$ and $\sum F_y = 0$ for the free body of each joint.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

85. **Assertion (A):** The peak value of the theoretical maximum capacity of the traffic flow is reached at an optimum speed.

Reason (R): As the speed of the traffic flow is increased above the optimum value, the maximum capacity of the lane starts decreasing due to increase in headway at the speed range.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

86. Assertion (A): In India most of water supply systems are provided with the surface water as the source.

Reason (R): Surface water is qualitatively superior than the sub-surface water.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

87. Assertion (A): For a developing town, combined system with egg shaped sewer is suitable.

Reason (R): Hydraulic characteristics are not much affected in egg shaped sewer while the flow increases with the development of the city.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

88. Assertion (A): The effluent of a septic tank needs further treatment before it is discharged into any receiving body, say public sewer.

Reason (R): The organic strength of the effluent is high.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

89. Assertion (A): A sewage is said to be biologically treatable when the BOD/COD is more than 0.5.

Reason (R): In biological treatment, biodegradable organic matter is being only removed.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

90. Assertion (A): With box-shear apparatus, quick and consolidated quick tests can be made only on clay samples.

Reason (R): The soils other than clays are so permeable that drainage takes place even under very rapid application of load on the sample.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

91. Assertion (A): Roads built on black cotton soils show cracks after some period.

Reason (R): Black cotton soils settle, and this results in deformation.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

92. Assertion (A): Crashing of construction duration admits of better optimal resource utilization.

Reason (R): Crashing of activities in a construction project network tends to increase the number of critical activities.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is NOT the correct explanation of A

c. A is true but R is false

d. A is false but R is true

93. The optimistic, likely and pessimistic time estimates for the PERT network of a project are shown in the given figure. The expected duration of the project is
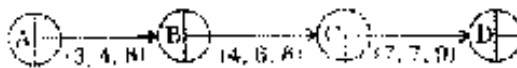
a. 14 days

b. 17 days

c. 17.83 days

d. 18.67 days

94. A scraper is to haul earth from a pit to a fill 0.4 km away, working under average-fixed-time conditions of 2.2 minutes, with an average haul speed of 7 kmph and an average return speed of 12.5 kmph. With operating factor of 0.8, the number of cycles which can effectively be performed per hour is nearly

a. 5.4

b. 6.4

c. 8.0

d. 9.6

95. When two different types of machines work in coordination as a team, which one of the following studies is required for the equipment performance?

a. Inventory model

b. Waiting-line model

c. CPM

d. PERT

96. Total Project Cost versus Time curve is/an

a. S-shaped curve

b. Parabola

c. U-shaped curve

d. Straight line

97. In arriving at a resource-based schedule bar-chart for a construction project, the following stages for planning of the work are involved:

1. Finalizing a network of activities.

2. Determining the optimal activity durations considering all the relevant parameters.

3. Computation of time and floats

4. Developing the resource-based bar-chart and the corresponding histograms and mass curves of resources.

5. Identification of the critical constraining resource.

6. Deciding the criteria for optimization.

The correct sequence of these stages in the planning of the work will be

a. 1,6,2,3,5,4

b. 6,2, 1,3,4,5

c. 1,2,3,6,5,4

d. 2, 1,3,5,6,4

98. CRF (10%, 20 years discrete compounding) is computed as 0.1174%. By placing Rs. 1,00,000 in a fixed deposit, now yielding 10% annual discrete compounding. It is intended to withdraw equal amounts at the end of 2nd, 4th, 6th............18th and 20th years from now, thereby exhausting the deposited funds. The amount that could be withdrawn in each of the ten installments is

a. Rs. 22000

b. Rs. 23200

c. Rs. 23492

d. Rs. 24667

99. Options of investment magnitudes with correspondingly capitalized benefits are given in the table for a type of project at a site, all options being technically feasible:

Option	A	B	C	D	E
Investment Rs. $\times 10^6$	10	15	18	21	24
Capitalized benefits Rs. $\times 10^6$	16	24	28	35	39

The most preferable option will be

a. E

b. D

c. C

d. (A or)B

100. In a particular soil sample, laboratory analysis has yielded the following result

1. Sand : 20%

2. Silt : 30%

3. Clay : 50%

Without using the textural chart, the correct textural classification of the soil would be

a. Loam

b. Sandy clay

c. Silty loam

d. Clay

101 In Caserne's liquid limit device. the material of the test specimen is harder than the standard rubber. This hardness indicates that the liquid limit, plasticity index, flow index and toughness index, respectively. of the specimen. are

a. more, less. more and same

b. same, less, same and more

c. less, less, same and less

d. less, same, less and more

102 Consider the following data obtained in falling head permeability tests regarding four soil-samples A, B, C and D

Time (Minute)	Height of water column in cm			
	A	B	C	D
0	40	40	40	40
10	32	30	20	36
20	25.6	22.5	12	32.4

Which one of the following soil-samples has internally inconsistent data?

a. A

b. B

c. C

d. D

103 A discharge 'Q' is occurring through a soil sample of length 'L' under a head 'H When the head is doubled and length reduced to half, the discharge will become

a. 4Q

b. 2Q

c. 1.5Q

d. 0.5Q

104. Consider the following statements regarding the flow nets

1. Flow lines and equipotent lines always intersect one- another at right angles irrespective of the permeability characteristics.

2. For an isotropic soil, the spacing of lines is inversely proportional to the hydraulic gradient.

3. For an isotropic soil and a flow net of approximate squares, the potential drop is the same through each field

4. For an anisotropic soil having greater horizontal coefficient of permeability. a flow net of approximate squares can be constructed by reducing the vertical dimensions of the flow domain to a certain scale.

Which of these statements are correct?

a. 2, 3 and 4

b. 2 and 3

c. 1, 2 and 4

d. 1 and 3

105. A sheet pile is driven into a sandy bed as shown in the given figure. The head along the upstream bed AB and the head along the downstream bed DE, respectively, are
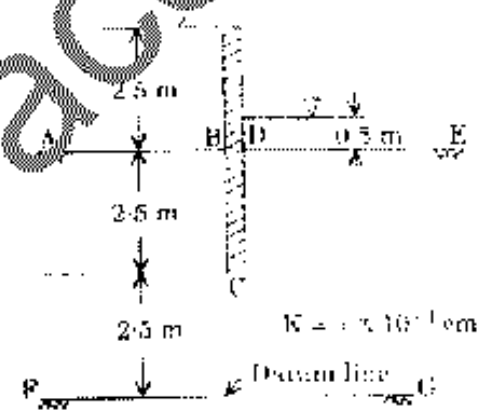
a. 75 m and 5.5 m

b. 2.5 m and 0.5 m

c. 5 m and 3 m

d. 5 m and 5.5 m

106. Which one of the following is the water content of the mixed soil made from 1 kg of soil (say A) with water content of 100% and 1 kg of soil (say B) with water content of 50%?

a. 66%

b. 71%

c. 75%

d. 82%

107. Match List I with List II and select the correct answer:

List I (In situ test)

A. SPT test

B. Plate load test

C. Field vane shear

D. CPT test

List II (Measurement Parameter)

1. Penetration resistance (N Value)
2. Load-Settlement data
3. Point resistance and skin friction
4. In situ torque strength

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

108. Consider the following statements:

Active earth pressure will be developed in the backfill when the

1. Horizontal strain is $\leq 0.1\%$.
2. Horizontal strain is $\geq 1\%$.
3. Mobilized shearing resistance along the failure plan is a minimum
4. Mobilized shearing resistance along the failure plane is a maximum.

Which of these statements are correct?

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

109. Which one of the following pairs is not correctly matched?

a. Swedish arc : Stability of slopes
b. Critical height : Stability number
c. Critical void ratio : Rapid draw down
d. Base failure : Soft clay

110. A clayey sample tasted in unconfined compression test is failed at a normal stress of 70 kN/m² and the failure plane make angle of 450 with the horizontal. If the same sample is tested in triaxial test using lateral pressure of 30 kN/m². then deviator stress, shear stress on principal plane and cohesion. respectively. would be

a. $70 kN/m^2, 70 kN/m^2, 100 kN/m^2$
b. $70 kN/m^2, zero, 50 kN/m^2$
c. $100 kN/m^2, 70 kN/m^2, zero$
d. $100 kN/m^2, zero, 50/m^2$

111. A clayey sample of 2cm thickness is collected from a 30cm thick clayey strata resting on impermeable rock. In a consolidation test. this clayey sample took time 't₁' to achieve 30% consolidation. If 't₂' is the time required to achieve 50% consolidation for the soil sample. then the ratio t₂/t₁ will be4

a. 375
b. 625
c. 1500
d. 2500

112. If a saturated soil sample is consolidated, the degree of saturation will

a. Reduce
b. Increase
c. Remain constant
d. Become zero

113. Rate of settlement of a compressible layer is dependent on

a. Applied load, thickness of layer and time factor
b. Applied load and time factor
c. Thickness of layer and time factor
d. Applied load and thickness of layer

114. A stratum of sand a stratum of clay have the same thickness of 3 m. The coefficient of compressibility of sand is 1/5th of the coefficient of compressibility of clay and the permeability of sand is 10,000 times that of the clay. Assuming the same void ratio, the ratio of the consolidation time for the clay to that of the sand is

a. 20.000
b. 30.000
c. 40.000
d. 50.000

115. When effective stress on a normally consolidated clay a increased from 25 kN/m² to 50 kN/m² settlement becomes 5 mm. If the stress is increased to 175 kN/m³, settlement will increase to (assuming coefficient of volume-decrease to be constant)

a. 25 mm
b. 30 mm
c. 35 mm
d. 40 mm

116. The equation relating the settlement 'δ_f' of an actual foundation of width 'B_f' in field with the settlement 'δ_p' of a plate width 'B_p' in the plate-load test is given by

$$\frac{\delta_f}{\delta_p} = \left[\frac{B_f\left(B_p \cdot 30\right)}{\delta_f\left(B_f \cdot 30\right)}\right]^2$$

The equation is applicable for

a. All type of soils

b. Stiff clays

c. Loose sands

d. Dense sands

117. Consider the following statements:

The safe bearing pressure for a raft on sand will be higher than that for an individual footing because

1. Density of sand increases with depth.

2. The permissible total settlement is twice that of a footing.

3. Differential settlement is less for a raft.

4. Raft is thicker than individual footings

Which is these statements are correct?

a. 1 and 2

b. 1 and 3

c. 2 and 3

d. 2 and 4

118. A surface footing 1m × 1m on a clayey soil with $\phi = 0°$ has the ultimate bearing capacity of 4q. Which one of the following is the correct value of ultimate bearing capacity for a surface footing 2.5×4m on the same soil?

a. Q

b. 4q

c. 9q

d. 16q

119. Match List I (Types of piles) with List II (Situations) and select the correct answer:

List I

A. Friction pile

B. Batter pile

C. Tension pile

D. Compaction pile

List II

1. Stiff clay

2. Loose granular soil

3. Lateral load

4. Uplift load

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

120. Consider the following statements regarding conduction of SPT in a bore hole:

1. Casing should be driven up to the level where SPT is conducted.

2. Casing should be not derived up to the level where SPT is conducted.

3. Water level in the bore hole to be maintained at a level slightly higher than GWL

4. Water level in the bore hold to be kept at a level lower than the GWL to ensure better penetration.

Which of these statements are correct?

a. 1 and 3

b. 2 and 4

c. 2 and 3

d. 3 and 4