



1. Which of the following statements are correct
 - (i) A dummy activity is artificially introduced in a network when necessary
 - (ii) a dummy activity most necessarily be introduced in every network
 - (iii) A dummy activity is represented by dotted arrow
 - (iv) A dummy activity does not consume time

(a) (i), (ii) & (iii) (b) (i), (iii) & (iv)
 (c) (i), (ii) (d) (iii) & (iv)

2. Match List-I (Chart) with List-II (Facilitation) and select correct answer using codes given below

List-I	List-II
A. Bar chart	1. Activity dependencies can be implied
B. Milestone bar chart	2. Resource requirement can be depicted
C. WBS	3. Higher level authorities can effect monitoring and control
D. Linked bar chart	4. Trade based site supervision can be assigned

Codes :

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

3. A linkend bar chart is an improvement over a conventional bar chart, because
 - (i) Resource for individual activities can be planned
 - (ii) Floats will be available for utilization as needed
 - (iii) Mile stone event need not be specially monitored

Which of above is/are correct

(a) (i), (ii) and (iii) (b) (iii) only
 (c) (ii) only (d) (ii) and (iii)

4. In PERT analysis, the time estimates of activities and probability of their occurrence follow
 - (a) beta distribution
 - (b) gamma distribution
 - (c) normal distribution
 - (d) poisson's distribution

5. Total project cost versus time curve is a
 - (a) s-shaped curve
 - (b) parabola
 - (c) u-shaped curve
 - (d) straight line

6. Sodium Absorption Ratio (SAR) is defined as

(a) $\frac{Na^+}{\sqrt{Ca^{++} + Mg^{++}}}$	(b) $\frac{Na^+}{2\sqrt{Ca^{++} + Mg^{++}}}$
(c) $\frac{Na^+}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$	(d) $\frac{2Na^+}{\sqrt{Ca^{++} + Mg^{++}}}$

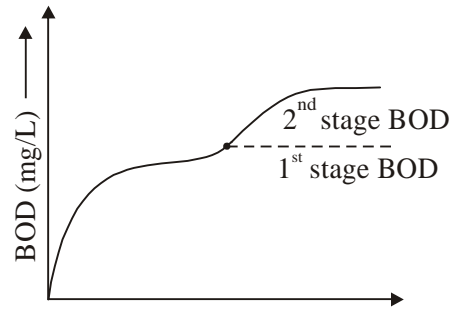
7. The amount of irrigation water required to meet the evapotranspiration needs of the crop during its full growth is called
 - (a) effective rainfall
 - (b) consumptive use
 - (c) consumptive irrigation requirement
 - (d) net irrigation requirement

8. Trap efficiency of a reservoir is a function of
 - (a) capacity / in flow ratio
 - (b) capacity / out flow ratio
 - (c) out flow / in flow ratio
 - (d) None of the above

9. The uplift pressure on the face of a drainage gallery in a dam is taken as
 - (a) hydrostatic pressure at toe
 - (b) average of hydrostatic pressure at toe and heel
 - (c) two-third of hydrostatic pressure at toe plus one third of hydrostatic pressure at heel
 - (d) None of the above



10. By providing a top width for roadway and free board in the elementary profile of a gravity dam, the resultant force for full reservoir condition will
 (a) Shift towards the heel
 (b) Shift towards the toe
 (c) Not shift at all
 (d) None of the above
11. Negative moment in reinforced concrete beam at the location of support is generally much higher than the positive span moment. This is primarily due to curvature at the support being
 (a) very high (b) very low
 (c) zero (d) of reversing nature
12. A double reinforced beam is considered less economical than a singly reinforced beam because
 (a) tensile steel required is more than that for a balanced section
 (b) shear reinforcement is more
 (c) concrete is not stressed to its full value
 (d) compressive steel is under stressed
13. In limit state design of reinforced concrete, deflection is computed by using
 (a) Initial tangent modulus
 (b) Secant modulus
 (c) tangent modulus
 (d) short and long-term values of Young's modulus
14. A reinforced cantilever beam of span 4m has a cross section of 150×500 mm. If checked for lateral stability and deflection, the beam will be
 (a) Fail in deflection only
 (b) Fail in lateral stability only
 (c) Fail in both deflection and lateral stability
 (d) Satisfy the requirement of deflection and lateral stability
15. The reduction coefficient of a reinforced concrete column with an effective length of 4.8 m and size 250×300 mm is
 (a) 0.80 (b) 0.85
 (c) 0.90 (d) 0.95
16. Unequal top and bottom reinforcement in a reinforced concrete section leads to
 (a) creep deflection
 (b) shrinkage deflection
 (c) long term deflection
 (d) large deflection
17. The second stage BOD as shown in figure is due to



- (a) experimental error
 (b) increased activity of bacteria
 (c) nitrification demand
 (d) interference by certain chemical reactions.
18. What does high COD to BOD ratio of an organic pollutant represent
 (a) High biodegradability of the pollutant
 (b) Low biodegradability of the pollutant
 (c) Presence of free oxygen for aerobic decomposition
 (d) presence of toxic material in the pollutants
19. From ecological considerations, the minimum level of dissolved oxygen (DO) necessary in rivers is
 (a) 1 mg/L (b) 4 mg/L
 (c) 2 mg/L (d) 10 mg/L



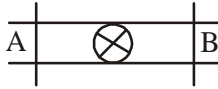


- 20.** Sewage sickness is a term used for
- A treatment plant does not function properly
 - Sewage / polluted water mix with drinking water
 - A stream where flora and fauna die due to sewage inflow
 - The condition of land where sewage is applied continuously for a long period
- 21.** Match list-I with list-II and select the correct answer using the codes given below
- | List-I | List-II |
|------------------------------|--|
| A. Manning's equation | 1. Frictional head loss estimation in pipe |
| B. Darcy-weisbach | 2. Sanitary sewer design |
| C. Hardy-cross method | 3. Storm sewer design |
| D. Rational method | 4. Water distribution system design |
- Codes :**
- | | A | B | C | D |
|-----|----------|----------|----------|----------|
| (a) | 1 | 4 | 3 | 2 |
| (b) | 2 | 1 | 4 | 3 |
| (c) | 2 | 1 | 3 | 4 |
| (d) | 1 | 4 | 2 | 3 |
- 22.** For combined sewerage system, the egg shaped sewers preferred because
- Their construction is economical
 - They perform satisfactorily during dry weather flow
 - Their maintenance is easier
 - They are structurally more stable than other shape sewer
- 23.** A tie bar 50 mm × 8 mm is to carry a load of 80 kN. A specimen of the same quality steel of cross sectional area 250 mm² was tested in the laboratory. The maximum load carried by the specimen was 125 kN. What is the factor of safety in the design.
- 1.5
 - 2.0
 - 2.5
 - 3.0
- 24.** A 6 mm thick angle section is jointed to a 10 mm thick gusset plate. The angle is supporting a load of 55 kN. What is the number of 16 mm diameter power driven rivets.
- 3
 - 4
 - 5
 - 6
- 25.** Which one of the following is most suitable weld under alternating stresses
- Convex fillet weld
 - Concave fillet weld
 - Square butt weld
 - Bevel bult weld
- 26.** A bult weld (double U-type) is used to connect two plates 180 mm × 18 mm each. What is the stress developed in the weld if it is subjected to a moment of 13000 kNmm
- 130.26 N/mm²
 - 133.74 N/mm²
 - 140.43 N/mm²
 - 142.64 N/mm²
- 27.** Elastic critical stress in compression in column is given by
- $\frac{\pi^2 E}{\lambda^2}$
 - $\frac{\pi^2 E}{\lambda}$
 - $\frac{\pi E}{\lambda^2}$
 - $\frac{\pi E^2}{\lambda}$
- 28.** The concept of continuum in fluid flow assume that the characteristic length of the flow is
- Smaller than the mean free path of the molecules
 - Larger than the dimensions of the suspended particles
 - Larger than the dimensions of the suspended particles
 - Larger than the wavelength of sound in the medium
- 29.** The basic differential equation for the variation of pressure 'p' in the static fluid with vertical distance 'y' (measured upwards) is
- $dp = -\gamma dy$
 - $dy = -\gamma dp$
 - $dp = -\rho dy$
 - $dp = -dy$

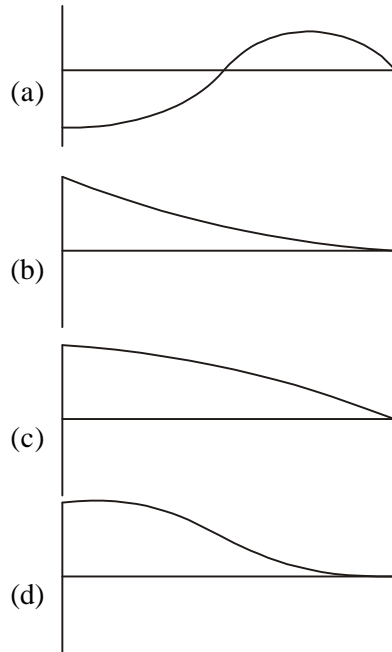
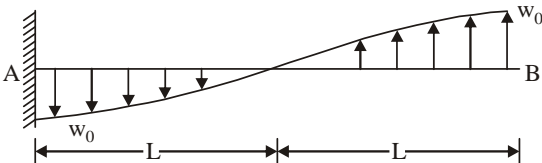




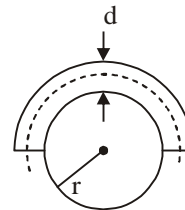
30. In a steady flow
- Stream lines & pathlines are identical but are different from streak line
 - Streak line & path line are identical but are different from stream lines
 - Stream line, streak line and path line can all be different from each other
 - None of the above
31. Section 'A' and 'B' in a pipe line (as shown in the figure) are at same elevation of 2.5 m above the datum level. A valve lies in between 'A' and 'B'. The flow parameters at 'A' are; velocity head of 0.5 m and pressure head of 2.5 m. The valve loss is 0.2 m. The piezometric head at 'B' is



- 5.5 m
 - 5.3 m
 - 5.0 m
 - 4.8 m
32. The dimensionless combination of pressure drop ΔP , dynamic viscosity ' μ ', velocity ' V ' and length ' L ' is
- $\frac{\Delta P \mu L}{V}$
 - $\frac{\Delta P}{\mu V L}$
 - $\frac{\Delta P L}{\mu V}$
 - $\frac{\Delta P \mu}{V^2 L}$
33. A cantilever beam carries the antisymmetric load shown, where w_0 is the peak intensity of distributed load. Qualitatively, the correct bending moment diagram for this beam is



34. A steel wire of diameter d is bend over a drum of radius r as shown in figure. The maximum bending stress in the wire will be.



- $\frac{Ed}{2r + d}$
 - $\frac{Er}{2r + d}$
 - $\frac{Ed}{r + 2d}$
 - $\frac{Er}{r + 2d}$
35. If a beam with two side horizontal rotates by 45° about its longitudinal axis then the ratio of bending strength for beam for situation first to situation second.

- 2
- $\frac{1}{2}$
- $\sqrt{2}$
- $\frac{1}{\sqrt{2}}$



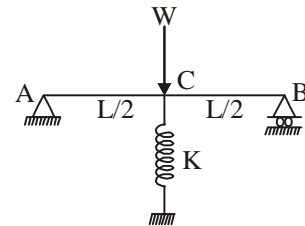
36. For a solid circular shaft subjected top twisting moment then if the length of this shaft is increases to some value for same of the properties
- (a) angle of twist will be increase
(b) angle of shear will be increase
(c) angle of twist will be decrease
(d) angle of shear will be decrease
37. Match List-I (Term) with List-II (Defination) and select the correct answer using codes given below :
- List-I**
- A. Apparent solar day
B. Sidereal day
C. Tropical year
D. Sideroal year
- List-II**
- The time internal between two successive upper transits of the first point of Aries over the same meridian
 - The internal between two successive lower transits of the centre of sun accross the same
 - Time internal between two successive passage of sun over the meridain of any one of the fixed star
 - Time internal between two successive vanl equinoxes.

Codes : **A** **B** **C** **D**

- (a) 1 2 3 4
(b) 2 1 4 3
(c) 2 1 3 4
(d) 1 2 4 3

38. If angular measurement of traverse are more accurate than the linear measurements, balancing of the traverse mostly done by
- (a) Axis method (b) Bowditch method
(c) Transit method (d) Arbitrary method

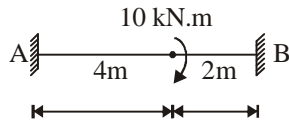
39. A vertical photograph of a chimney was taken from an elevation of 500 m above MSL. The elevation of the base of the chimney was 250m. If the relief displacement of the top of chimey was 51.4 mm and radial distance of the image of the top of chimney was 110mm. The height of chimney is
- (a) 233.64 m (b) 133.2 m
(c) 116.82 m (d) 58.41 m
40. In the case of line of levels, the weight varies
- (a) directly as the length of the route
(b) inversaly as the length of route
(c) directly as square root of length of the route
(d) inversaly as square root of the length of the route
41. The plan of a map was photocopied to reduced size such that a line orginally 100mm, measures 95mm. The original scale of plane was 1 : 1000. The revised scale will be
- (a) 1 : 1053 (b) 1 : 1000
(c) 1 : 950 (d) 1 : 1111
42. A beam AB is supported by spring at C. (Stiffness of spring = K). Vertical at simple support A is given by-



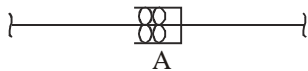
- (a) $\frac{W}{2\left(1 + \frac{48EI}{KL^3}\right)}$ (b) $\frac{W}{2\left(1 - \frac{KL^3}{48EI}\right)}$
- (c) $\frac{W}{2\left(1 + \frac{KL^3}{48EI}\right)}$ (d) None



43. A beam AB is fixed at supports. At point C 4m from A, moment 10 kN.m(CW) is applied. Moment reaction at A will be



- (a) 3.33 kNm (ACW)
(b) 3.33 kNm (CW)
(c) Zero
(d) None
44. For a structural member having $EI \rightarrow \infty$ elastic curve is represented by
- (a) Parabolic curve
(b) Circular curve
(c) Straight line
(d) None
45. If members are extensible then Number of independent displacements at A is



- (a) 3
(b) 4
(c) 5
(d) 6
46. RC-2, MC-2 and SC-2 related as
- (a) Same viscosity
(b) Viscosity in decreasing order from RC-2 to SC-2
(c) Viscosity in increasing order from SC-2 to RC-2
(d) None of the above
47. Marshal flow value is expressed in unit of
- (a) 25 mm
(b) 0.25 mm
(c) 8 mm
(d) 2 mm

48. The number of conflict point when two lane roads both are one way is 'x' and when one road one way and other one is two way is 'y' the ratio of x to y is

- (a) 0.545
(b) 0.73
(c) 0.25
(d) 0.33

49. Consider the following factors regarding geometric design of highways

1. Headlighth beam distance
2. Sight distance requirement
3. Deviation angle
4. Drainaje

Which of the following is used for determining the length of summit curve.

- (a) 1 and 3
(b) 2 and 3
(c) 1 and 2
(d) 1, 2 and 3

50. Composite sleeper index is the index of

- (a) hardness and strength
(b) strength and toughness
(c) toughness and war resistance
(d) hardness and wear resistance

51. Surkhi is added to lime mortar to

- (a) Prevent shrinkage
(b) Decrease setting time
(c) Increase bulk
(d) Impart hydraulicity

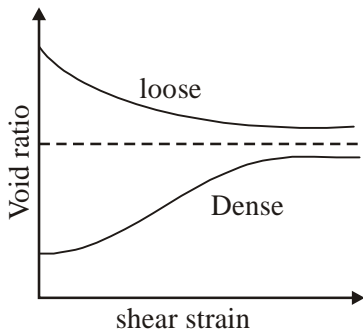
52. The role of superplasticizer in a cement paste is to

- (a) disperse the particles
(b) disperse the particles and to remove air bubbles
(c) disperse the particles, remove air bubbles and to retard setting
(d) refard setting





53. During the conversion of timber by sawing, in order to obtain strong timber pieces, the cuts should be made by
 (a) ordinary sawing (b) tangential sawing
 (c) quarter sawing (d) radial sawing
54. The approximate ratio between the strengths of cement concrete at 7 days and 28 days is
 (a) 3/4 (b) 2/3
 (c) 1/2 (d) 1/3
55. Principle settlement is relatively higher for
 (a) Isolated footings on clays
 (b) Isolated footings on sands
 (c) Rafts on clays
 (d) Rafts on sands
56. Figure shows the relation between void ratio and shear strain for sand under two density conditions. The void ratio corresponding to the dashed line in called



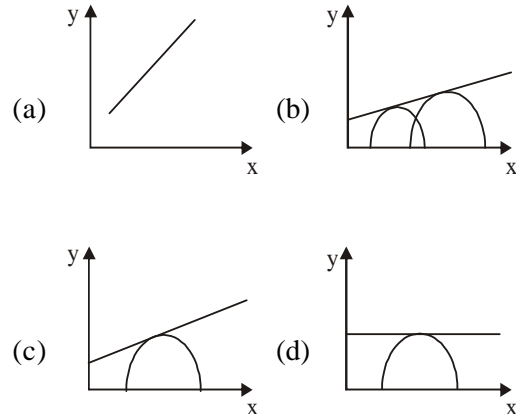
- (a) optimum void ratio
 (b) critical void ratio
 (c) residual void ratio
 (d) undisturbed void ratio
57. The time 't' required for attaining a certain degree of consolidation of a clay layer is proportional to
 (a) H^2 and C_v (b) H^2 and $1/C_v$
 (c) $1/H^2$ and C_v (d) $1/H^2$ and $1/C_v$

58. For an overconsolidated clay soil deposit, the pressure under which the deposit has been fully consolidated in the past is 125 kN/m^2 and the present overburden pressure is 75 kN/m^2 , the overconsolidation ratio of the soil deposit is
 (a) $\frac{75}{125}$ (b) $\frac{50}{75}$
 (c) $\frac{125}{75}$ (d) $\frac{200}{75}$

59. Given that
 ω_n = natural frequency of foundation soil system
 c_u = coefficient of elastic uniform compressional soil
 A = contact area of foundation with soil and
 m = mass of machine plus foundation
 Natural frequency of foundation soil system for analysis of machine foundation shall be determined by Barken's method using the equation.

(a) $\omega_n = c_u \frac{A}{m}$ (b) $\omega_n = c_u \sqrt{\frac{A}{m}}$
 (c) $\omega_n = \frac{A}{m} \sqrt{c_u}$ (d) $\omega_n = \sqrt{\frac{c_u A}{m}}$

60. Which one of the following diagram correctly illustrates the Mohr's stress conditions of unconfined shear test on cohesive soil ?
 (x - axis normal stress ; y -axis shear stress)





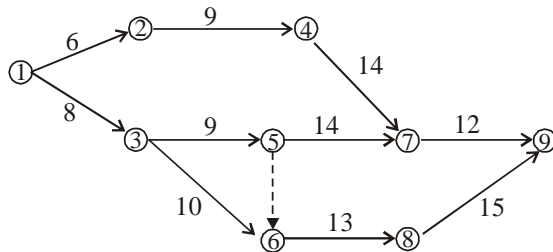
61. The difference between maximum void ratio and minimum void ratio of a sand sample is 0.30. If the relative density of this sample is 66.6% at a void ratio of 0.40, then the void ratio of this sample at its loosest state will be

- (a) 0.40 (b) 0.60
(c) 0.70 (d) 0.75

62. A vane shear test on a soil sample gives moment of total resistance M . the shear stress failure, 's' being more or less uniform at top, bottom and surface of cylinder at soil, is given by (where H = height of vane, D = diameter of vane)

- (a) $S = \frac{2M}{\pi D^2 H}$ (b) $S = \frac{2M}{\pi D^2 (H + D)}$
(c) $S = \frac{2M}{\pi D^2 \left(H + \frac{D}{3} \right)}$ (d) $S = \frac{2M}{\pi D^2 H}$

63. The critical path of the network shown below is



- (a) 1 - 3 - 5 - 7 - 9
(b) 1 - 3 - 6 - 8 - 9
(c) 1 - 2 - 4 - 7 - 9
(d) 1 - 3 - 5 - 6 - 8 - 9

64. Which of the following statement is not correct

- (a) Interfering floats is the excess of total float over free float
(b) For each critical activity total, free and independent float are equal to zero
(c) Total float is the sum of the free, interfering and independent float
(d) An activity with some free float cannot be a critical activity

65. Which of the following techniques most suitable in case of research and development type of activity

- (a) Critical path method
(b) Bar chart
(c) Graphical evaluation and reiew technique
(d) Project evaluation and review technique

66. Slack time in PERT analysis

- (a) is minimum for critical activities
(b) an never be less than zero
(c) can never be greater than zero
(d) is always zero for critical activity

67. Consider the following statement of network

1. Only one time estimate is required for each activity
2. Three time estimate for each activity
3. Time and cost both are controlling factor
4. It is build-up of event oriented diagram

Which of the following statement are correctly applicable to CPM network

- (a) 1 and 3 (b) 1 and 2
(c) 2 and 4 (d) 3 and 4

68. Overhead expensed on a project are included in

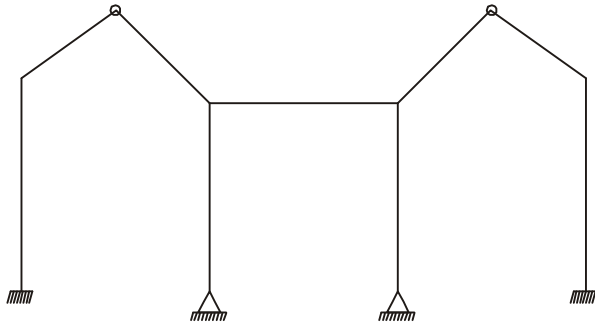
- (a) indirect cost (b) direct cost
(c) variable cost (d) fixed cost

69. In the time cost optimisation of a project, the project can be crashed by expediting

- (a) all activities on the critical path
(b) critical activities having minimum cost slope
(c) activities on sub critical path
(d) critical activities having maximum cost slope

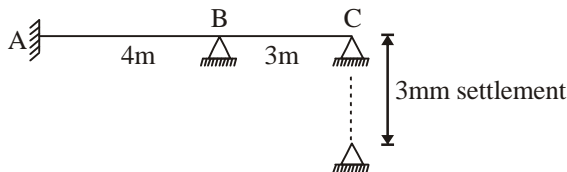


70. Which of the following pairs is not correctly matched ?
- (a) Bowditch's rule : Employed to adjust closing error of a closed traverse
 - (b) Declination : Horizontal angle between magnetic meridian and true meridian
 - (c) Angle of dip : The vertical angle of magnetic flux direction with respect to horizontal line
 - (d) Reconnaissance : Employed for detailed and precise survey
71. The sensitiveness of a bubble tube in a level would decrease is
- (a) Increase in radius of curvature of internal surface
 - (b) Increase in diameter of level tube
 - (c) Decrease in viscosity of liquid
 - (d) Decrease in length of bubble tube
72. Degree of static indeterminacy of following frame is



- (a) 7
- (b) 9
- (c) 5
- (d) 6

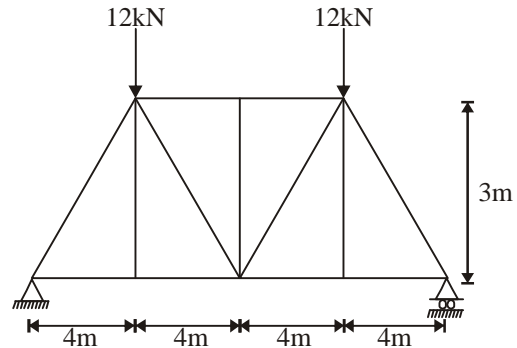
73. A continuous beam ABC is fixed at A and simply supported at B & C as shown below support C settles by 3mm then induced moment at support A is (in kNm, upto two digits after decimal)



$E = 10^5 \text{ N/mm}^2$
 $I = 3 \times 10^8 \text{ mm}^4$

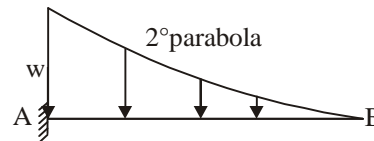
- (a) 11.7
- (b) 8.8
- (c) 6.5
- (d) 7.5

74. A truss is shown below, total strain energy of truss is given by $\frac{K}{AE}$, where K is (Nearest integer)



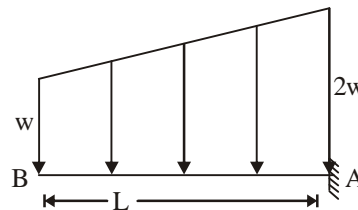
- (a) 4072
- (b) 6072
- (c) 5072
- (d) 8080

75. Degree of curve of BMD of following cantilever which is loaded by parabolic loading as shown, below is



- (a) 3
- (b) 4
- (c) 5
- (d) 6

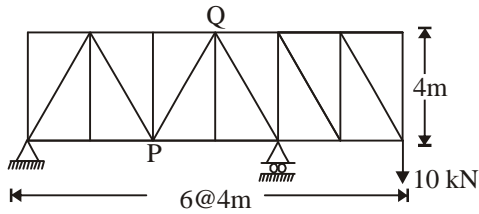
76. A cantilever AB is loaded as shown in following figure. Slope at free end B is given by $K \frac{WL^3}{EI}$, where K is. (upto two digits after decimal)



- $EI = \text{constant}$
- (a) 0.21
 - (b) 1.11
 - (c) 0.45
 - (d) 6.5



77. Force in the member PQ of following pin jointed truss is (in kN, upto two digits after decimal)



- (a) 6.6 (b) 7.07
(c) 1.52 (d) 2.82

78. The following boundary condition exist at the wall ($y = 0$) in a boundary layer

- (a) $u = U_\infty$ (b) $\frac{dP}{dx} = -Ve$
(c) $\tau_0 = 0$ (d) $u = 0, v = 0$

79. Pressure drag result due to

- (a) Formation of wake
(b) Turbulence in wake
(c) Existence of stagnation point in front of a body
(d) High Reynold's number

80. Shear stress in turbulent flow is due to

- (a) The viscous property of the fluid
(b) The fluid density
(c) Fluctuation of velocity in the direction of flow
(d) fluctuation of the velocity in the direction of flow as well as transverse to it

81. Three pipes are connected in series, then

- (a) The head loss in each pipe is the same
(b) The total discharge is the sum of the discharge in the individual pipes
(c) The discharge through each pipe is the same
(d) The Reynolds number for each pipe is same

82. In a venturimeter, the coefficient of discharge C_d is related to the head loss between the inlet and throat as

- (a) $(1 - C_d^2) \Delta h$ (b) $(1 - C_d) \Delta h$
(c) $(1 - C_d \Delta h)^2$ (d) $\left(\frac{1}{C_d} - 1\right)^2 \Delta h$

- (a) Avoid reversal of flow
(b) Reduce the water hammer effect in pipe line
(c) Prevent occurrence of mass oscillation of water
(d) None of these

84. Timber can be made more fire resistance by

- (a) Dipping and steeping process
(b) Sir Abel's process
(c) Charring
(d) Hot and cold open tank treatment

85. For a given environment, the most significant factor that influences the total shrinkage of concrete is

- (a) cement content of mix
(b) total amount of water added at the time of mixing
(c) size of the member concreted
(d) maximum size of the coarse aggregate used

86. The aggregate crushing value of coarse aggregates which is used for making concrete, which in turn is used for purposes other than wear surfaces, should not exceed

- (a) 30 % (b) 40 %
(c) 45 % (d) 50 %

87. Which of the following cements is suitable for use in massive concrete structures such as large dam ?

- (a) ordinary portland cement
(b) low heat cement
(c) rapid hardening cement
(d) sulphate resisting cement

88. Match List-I (curve) with List-II (design factor) and select the correct answer using codes given below

- | List-I | List-II |
|---------------------|-----------------------------|
| A. summit curve | 1. super elevation |
| B. Sag curve | 2. Setback distance |
| C. Horizontal curve | 3. right of way |
| D. Transition curve | 4. headlight sight distance |



5. passing sight distance (a) 3000 mm (b) 1900 mm
(c) 1600 mm (d) 1500 mm
- Codes :** A B C D
- (a) 5 1 3 2
(b) 4 3 2 1
(c) 5 2 3 1
(d) 5 4 2 1
- 89.** The maximum and minimum gradient provided for station and yards are
(a) 1 in 400 and 1 in 1000
(b) 1 in 1000 and 1 in 400
(c) 1 in 400 and 1 in 500
(d) 1 in 500 and 1 in 400
- 90.** Which of the following distance the minimum required sight distance in valley curve?
(a) Design speed
(b) Height of obstacle
(c) Height of driver eye level
(d) Night time driving condition
- 91.** What is the ratio of deflection at centre for a flexible plate and rigid plate of same diameter ?
(a) 0.79 (b) 1.18
(c) 1.27 (d) 1.5
- 92.** The load carrying capacity of a column designed by working stress method is 500 kN. The collapse load of the column is
(a) 500.0 kN (b) 662.5 kN
(c) 750.0 kN (d) 1100.0 kN
- 93.** A T-beam roof section has the following particulars
Thickness of slab = 100 mm
Width of rib = 300 mm
depth of beam = 500 mm
Centre to centre distance of beam = 3.0 m
Effective span of beams = 6.0 m
Distance between points of contraflexure = 3.60 m
The effective width of flange of the beam is
- 94.** Torsion resisting capacity of a given RC section
(a) decreases with decrease in stirrup spacing
(b) decreases with increase in longitudinal bars
(c) does not depend on open stirrup and longitudinal steels
(d) increase with the increase in stirrup and longitudinal steels
- 95.** Lacey's regime scour depth is given by
(a) $1.35\left(\frac{q}{f}\right)^{1/3}$ (b) $1.35\left(\frac{q^2}{f}\right)^{1/6}$
(c) $1.35\left(\frac{q^2}{f}\right)^{1/3}$ (d) $1.3\left(\frac{q^2}{f}\right)^{1/6}$
- Where q is discharge per unit width and f is silt factor
- 96.** Wetted perimeter of a regime channel for a discharge of 64 cumecs as per Lacey's theory will be
(a) 19 m (b) 38 m
(c) 57 m (d) 76 m
- 97.** The maximum rainfall depth of 300 mm in 24 hours has a return period of 100 years. The probability of 24 hours rainfall equal to or greater than 300 mm occurring at least once in 10 years is given by
(a) $(0.99)^{10}$ (b) $1-(0.99)^{10}$
(c) $(0.9)^{100}$ (d) $1-(0.9)^{100}$
- 98.** The stage of river carrying a discharge of Q m³/sec at a point is 10m and slope of water surface is $\left(\frac{1}{4000}\right)$. The discharge of a flood at the same point and same stage of 10m with a water surface slope of $\left(\frac{1}{1000}\right)$ will be
(a) $\sqrt{2} Q$ m³/sec (b) $0.5Q$ m³/sec
(c) $2Q$ m³/sec (d) $4Q$ m³/sec
- 99.** The peak of a 4 hour flood hydrograph is 240 m³/sec. If the rainfall excess is 80mm and base

flow which is constant is $40\text{m}^3/\text{sec}$, then the peak of 4-hours unit hydrograph will be

- (a) $20\text{ m}^3/\text{sec}$ (b) $25\text{ m}^3/\text{sec}$
(c) $30\text{ m}^3/\text{sec}$ (d) $35\text{ m}^3/\text{sec}$

100. According to indian standards, the number of rain gauge station for an area of 5200 km^2 in plains should be

- (a) 10 (b) 15
(c) 20 (d) 40

101. What is the maximum slenderness ratio (λ) for compression flange of a beam

- (a) 250 (b) 300
(c) 350 (d) 400

102. The angle of dispersion of a concentrated load on the flange to the web plate of a steel beam is

- (a) 90° with the horizontal
(b) 60° with the vertical
(c) 45° with the horizontal
(d) 30° with the vertical

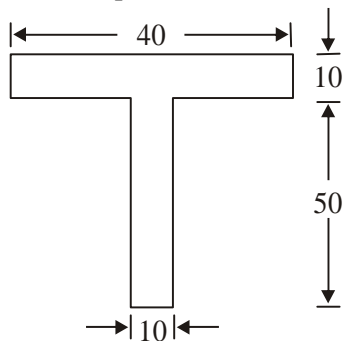
103. The connection of intermediate vertical stiffeners to the web not subjected to external loads, shall be designed for a minimum shear force of

- (a) $75\text{ t}^2/\text{h}$ (b) $125\text{ t}^3/\text{h}^2$
(c) $125\text{ t}^2/\text{h}$ (d) $175\text{ t}^2/\text{h}$

Where t = the web thickness in mm

h = the outstand of stiffener in mm

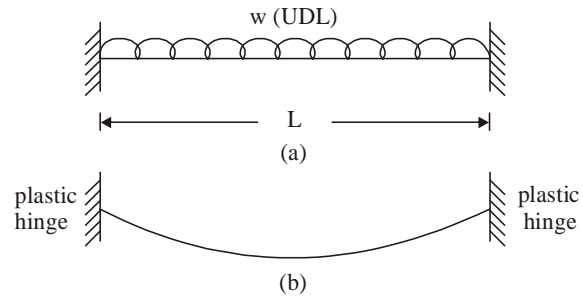
104. In the T-section shown in fig. (dimension in mm) the distance of plastic neutral axis from top is



- (a) 10 (b) 15
(c) 20 (d) 30

105. A fixed beam as shown in fig (a) is loaded with a U.D.L. over the entire span; the total load being w ; When load was just increased to w_1 , the deformed shape as shown in fig (b) was

seen



The value of w_1 (plastic moment of resistance = M_p) is

- (a) $24 M_p/L$ (b) $16 M_p/L$
(c) $12 M_p/L$ (d) $8 M_p/L$

106. The thickness of web for unstiffened plate girder with clear distance of between the flanges shall not be less than

- (a) $d/200$ (b) $d/85$
(c) $d/100$ (d) $d/160$

107. High yield deformed bars have a

- (a) Definite yield value
(b) Chemical composition different from mild steel
(c) Percentage elongation less than that of mild steel
(d) Percentage elongation more than that of mild steel.

108. Main gases liberated from anaerobic sludge digestion tank would include

- (a) ammonia and carbon dioxide
(b) carbon dioxide and methane
(c) ammonia and methane
(d) methane and hydrogen sulphide

109. The correct sequency of sludge disgestion steps is

- (a) Hydrolysis \rightarrow acid formation \rightarrow methane formation
(b) Methane formation \rightarrow acid formation \rightarrow hydrolysis
(c) Hydrolysis \rightarrow methane formation \rightarrow acid formation
(d) acid formation \rightarrow hydrolysis \rightarrow methane formation

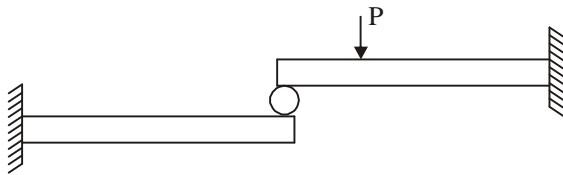
110. Which of the following cation imparts pseudo-hardness to water

- (a) Calcium
- (b) Magnesium
- (c) Calcium and magnesium
- (d) Sodium

111. For a cylindrical pressure vessel with spherical end if the hoop strain at junction is same the what will be ratio of thickness for spherical to cylindrical part of vessel. If Poisson's ratio for pressure vessel material is m

- (a) $\frac{m+1}{2m-1}$
- (b) $\frac{2m-1}{m-1}$
- (c) $\frac{m-1}{2m-1}$
- (d) $\frac{2m-1}{m+1}$

112. Two identical cantilever beams are supported as shown, with their free ends in contact through a rigid roller. After the load P is applied the free ends will have



- (a) equal deflection but not equal slopes
- (b) equal slopes but not equal deflection
- (c) equal slopes as well as equal deflection
- (d) neither equal slopes nor equal deflection

113. If a triangular section subjected to transverse shear then the distance between the centroid and maximum shear stress line if the height of section is h

- (a) $\frac{h}{6}$
- (b) $\frac{h}{3}$
- (c) $\frac{h}{2}$
- (d) $\frac{h}{8}$

114. A thin spherical vessel is subjected to internal fluid pressure P the inner dia of vessel is D and

thickness is t , the Poisson's ratio for vessel material is μ then what is the volumetric strain for this vessel is modulus of elasticity is E

- (a) $\frac{3PD}{2tE}(1-\mu)$
- (b) $\frac{3PD}{4tE}(1-\mu)$
- (c) $\frac{PD}{4tE}(5-4\mu)$
- (d) $\frac{PD}{2tE}(5-4\mu)$

115. The energy absorbed in a body, when it is strained within the elastic limit is known as

- (a) strain energy
- (b) resilience
- (c) proof resilience
- (d) modulus of resilience

116. Match List-I (types of test and material) with List-II (types of fractures) and select the correct answer using the codes given below

List-I

- (a) tensile test on CI
- (b) torsion test on MS
- (c) tensile test on MS
- (d) torsion test on CI

List-II

1. Plain fracture on transverse plain
2. Granular helicoidal fracture
3. Plain granular at 45° to the axis
4. cup and cone
5. Granular fracture on a transverse plane

Codes : **A** **B** **C** **D**

- (a) 4 2 3 1
- (b) 5 1 4 2
- (c) 4 1 3 2
- (d) 5 2 4 1

117. Which one of the following properties cannot be evaluated by static tension test

- (a) shear strength
- (b) modular of elasticity
- (c) ductility
- (d) Poisson's ratio

118. A vane 20 cm long and 10 cm in diameter was pressed into a soft marine clay at the bottom of

a bore hole. Torque was applied gradually and failure occurred at 1000 kg/cm. The cohesion of the clay in kg/cm² is.

- (a) $\frac{1}{\pi} \times \frac{6}{7}$ (b) $\frac{1}{\pi} \times \frac{5}{7}$
(c) $\frac{1}{\pi} \times \frac{4}{7}$ (d) $\frac{1}{\pi} \times \frac{3}{7}$

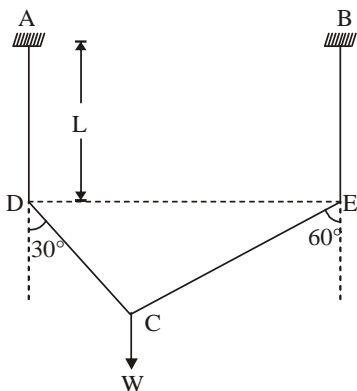
119. A building is supported on shallow foundation in sand at 1 m below ground level. The water table at 5m below the ground surface. For which one of the following foundation will the net bearing capacity of the soil be a maximum.

- (a) 2 m wide strip footing
(b) 2m × 2m square footing
(c) 2m diameter circular footing
(d) 4m × 1m rectangular footing

120. Terzaghi's equation of ultimate bearing capacity for a strip footing may be used for square footing resting on pure caly soil with the correction factor

- (a) 0.4 (b) 0.6
(c) 1.2 (d) 1.3

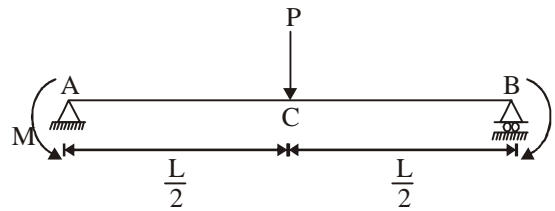
121. In the following frame a cable DCE is attached at D and C with the members AD & BE respectively. AD & BE are fixed at A & B respectively. Induced fixed end moment at support A when load W acts at C, is-



- (a) $\frac{WL}{4}$ (b) $\frac{WL\sqrt{3}}{4}$

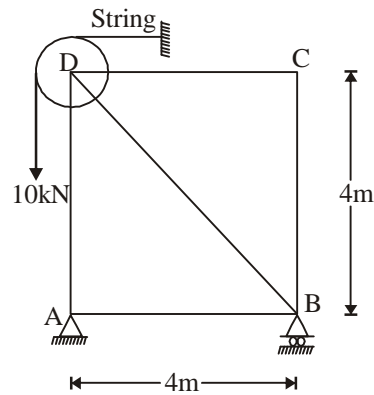
- (c) $\frac{WL}{2}$ (d) None

122. Moment 'M' to be applied at supports to make zero deflection at mid span C is-



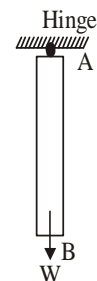
- (a) $\frac{PL}{6}$ (b) $\frac{PL}{3}$
(c) $\frac{PL}{2}$ (d) zero

123. A pully is fixed at joint D of the truss as shown in figure. Force in member AB is given by



- (a) 10 kN (C) (b) 10 kN (T)
(c) $10\sqrt{2}$ kN (T) (d) None

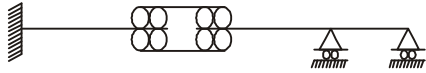
124. Which type of equilibrium the member AB is in?



- (a) Stable (b) Unstable
(c) Neutral (d) All of the above



125. Which type of instability is present in the following structure



- (a) Static instability (b) Geometric instability
(c) Both (d) None

126. Francis turbines are available in the following range of specific speed

- (a) 8–30 (b) 40–420
(c) 380–950 (d) 10–300

127. The condition of no slip at rigid boundaries is applicable to

- (a) Flow of Newtonian fluids only
(b) Flow of ideal fluids only
(c) Flow of all real fluids
(d) Flow of non-Newtonian fluids only

128. Aneroid barometer measures

- (a) local atmospheric pressure
(b) standard atmospheric pressure
(c) gauge pressure
(d) difference between the standard and local atmospheric pressure

129. In a cylinder containing a liquid is rotated about a vertical axis coinciding with the axis of the cylinder, the pressure in vertical direction

- (a) Decreases as depth
(b) Increases as depth
(c) Increases as square root of depth
(d) Decreases as square root of depth

130. What is the process of incorporating changes and rescheduling or replanning called ?

- (a) Resource allocation
(b) resource smoothing

- (c) resource levelling
(d) updating

131. Which of the following rules should be followed while doing the resource scheduling ?

1. CPM network logic must be maintained
2. Activities on the critical path must use normal crew size
3. Activities on non-critical path must use minimum crew size

Select correct answer using the codes given below :

- (a) 1, 2 and 3 (b) 1 and 2
(c) 1 and 3 (d) 2 and 3

132. Reinforced concrete door and window frame can be compacted using

1. needle vibrator
2. plate vibrator
2. form vibrator
4. tamping

the correct sequence of these equipment in order of preference (from the best to the worst) is

- (a) 2, 3, 1, 4 (b) 3, 2, 1, 4
(c) 2, 3, 4, 1 (d) 3, 2, 4, 1

133. Grader is used mainly for

- (a) trimming and finishing
(b) shaping and trimming
(c) finishing, shaping and trimming
(d) finishing and shaping

134. What is efflorescence

- (a) Formation of white patches on the brick surface due to insoluble salts in the brick clay
(b) Swelling of brick due to presence of carbonaceous matter and gas
(c) Deformation of brick due to exposure to rain
(d) impurities in the brick clay which show after burning.

135. The coefficient of linear expansion of granite is in the range of that of

- (a) glass (b) mild steel

- (c) high carbon steel (d) bamboo





136. To make one cubic metre of 1 : 2 : 4 by volume concrete, the volume of coarse aggregates required is
(a) 0.95 m^3 (b) 0.85 m^3
(c) 0.75 m^3 (d) 0.65 m^3
137. The most important purpose of frog in a brick is to
(a) emboss manufactures's name
(b) reduce the weight of brick
(c) from keyed joint between brick and mortar
(d) improve insulation by providing 'hollows'
138. Bureau of indian standard classifies bitumen into grades 65/25, 85/40 etc. The first and second numbers respectively refer to
(a) softening point and penetration
(b) penetration and softening point
(c) flash point and penetration
(d) flash point and softening point
139. Blast furance slag has approximately
(a) 45% calcium oxide and about 35% silica
(b) 50% alumina and 20% calcium oxide
(c) 25% magnesia and 15% silica
(d) 25% calcium sulphate and 15% alumina
140. Consider the following statements.
1. Carbonate hardness is due to bicarbonates
2. Non-carbonate hardness is due to sulphates and chlorides of Ca and Mg
3. Both the hardness can be removed by lime soda method
4. Both the hardness can be removed by ion-exchange method
Which of these statement are correct
(a) 1, 2 and 3 (b) 1, 2, 3 and 4
(c) 2, 3 and 4 (d) 1, 3 and 4
141. Which of the following treatment reduce salinity of water ?
1. Flash mixing and sedimentation
2. Electrolysis
3. Reverse osmosis
5. Filtration
(a) 1, 2, 3 and 4 (b) 1, 2, 3 and 5
(c) 1, 3 and 4 (d) 1, 2, 4
142. For a deep beam whose overall depth is 5.0 m and effective span is 6m, the lever arm for simply supported beam will be
(a) 3.2 m (b) 3.6 m
(c) 2.7 m (d) 3.0 m
143. A beam of balanced section has to be construction along a sea-cost. Find the stress in steel at failure as per working stress method (Assume minimum grade of concrete is used for given condition as per IS 456 : 2000, and Fe 415)
(a) 215 MPa (b) 230 MPa
(c) 245 MPa (d) 260 MPa
144. Due to circumferential action of the spiral in a spirally reinforced column
(a) Capacity of column is decreased
(b) Ductility of column reduces
(c) Capacity of column is decreased but ductility of column increases
(d) Both the capacity of column and ductility of column increases
145. In T-shaped R.C. retaining walls, the main reinforcement in the stem is provided on
(a) the front face in one direction
(b) the front face in both direction
(c) the inner face in one direction
(d) the inner face in both direction
146. Due to shrinkage stresses, a simply supported beam having reinforceemnt only at bottom tends to
(a) deflect downward



- (b) deflect upward
 (c) deflect downward or upward
 (d) None of the above
- 147.** Match List-I (water treatment) with list-II (operating problem) and select the correct answer using the codes given below the list

List-I	List-II
A. Trickling filter	1. Negative head
B. Activated sludge process	2. Fly breeding
C. Rapid gravity filter	3. sludge bulking
D. Anaerobic sludge digester	4. pH reduction

Codes :

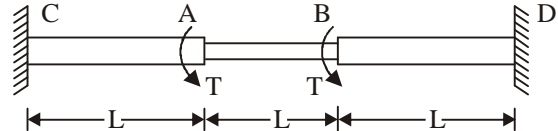
A	B	C	D
(a) 4	3	1	2
(b) 4	1	3	2
(c) 2	1	3	4
(d) 2	3	1	4

- 148.** Which one of the following is the correct expression for maximum shear stress induced in the wire of a closed-coiled helical spring of wire diameter d and mean coil radius R which carries an axial load w ?

- (a) $\frac{16wR}{\pi d^3}$ (b) $\frac{w}{\left(\frac{\pi d^2}{4}\right)}$
- (c) $\frac{\left(\frac{w}{2}\right)}{\left(\frac{\pi d^2}{4}\right)}$ (d) $\frac{16wR}{\pi d}$

- 149.** A column of rectangular section ($I_{xx} > I_{yy}$) is subjected to an axial load. What is the axis about which the column will have a tendency to buckle
- (a) x-x axis

- (b) y-y axis
 (c) the diagonal of the section
 (d) x-x - or y-y without any preference
- 150.** A circular shaft shown in the figure is subjected to torsion T at two points A and B. The torsional rigidity of portions CA and BD is GJ_1 and that of portion AB is GJ_2 the rotation of shaft at points A and B are θ_1 and θ_2 . Then the rotation θ is



- (a) $\frac{TL}{GJ_1 + GJ_2}$ (b) $\frac{TL}{GJ_1}$
- (c) $\frac{TL}{GJ_2}$ (d) $\frac{TL}{GJ_1 - GJ_2}$



ANSWER & EXPLANATION

1. *Ans.(b)*
2. *Ans.(b)*
3. *Ans.(a)*
4. *Ans.(a)*
5. *Ans.(c)*
6. *Ans.(c)*
7. *Ans.(c)*
8. *Ans.(a)*
9. *Ans.(c)*
10. *Ans.(a)*
11. *Ans.(a)*
12. *Ans.(d)*
13. *Ans.(d)*
14. *Ans.(c)*

For failure in deflection $\frac{L}{D} > 7$

For lateral stability, L should not be greater than 25 b

Since $\frac{L}{D} = \frac{4000}{500} = 8$ and $25b = 3750$ mm

beam fails both in deflection and lateral stability

15. *Ans.(b)*

Reduction coefficient is given by

$$\begin{aligned}
 &= 1.25 - \frac{L_e}{48b} \\
 &= 1.25 - \frac{4800}{48 \times 250} \\
 &= 0.85
 \end{aligned}$$

16. *Ans.(b)*
17. *Ans. (c)*
18. *Ans. (b)*
19. *Ans. (b)*

20. *Ans. (d)*
21. *Ans. (b)*
22. *Ans. (b)*
23. *Ans. (c)*

Yield strength for the steel

$$\begin{aligned}
 &= \frac{\text{maximum load}}{\text{cross-sectional area}} \\
 &= \frac{125 \times 1000}{250} = 500 \text{ N/mm}^2
 \end{aligned}$$

$$\text{Working stress} = \frac{80 \times 1000}{50 \times 8} = 200 \text{ N/mm}^2$$

$$\text{Factor of safety} = \frac{\text{yield strength}}{\text{working stress}} = \frac{500}{200} = 2.5$$

24. *Ans. (a)*

Gross dia of rivet

$$= d = 16 + 1.5 = 17.5 \text{ mm}$$

Strength of rivet in single shear

$$\begin{aligned}
 &= \frac{\pi}{4} d^2 \tau_{vf} \\
 &= \frac{\pi}{4} \times (17.5)^2 \times 100 \times 10^{-3} \\
 &= 24.052 \text{ kN}
 \end{aligned}$$

Using minimum thickness of the section

$$t = 6 \text{ mm}$$

∴ Strength of rivet in bearing

$$\begin{aligned}
 &= \text{d.t. } \sigma_{pf} \\
 &= 17.5 \times 6 \times 300 \times 10^{-3} \\
 &= 31.50 \text{ kN}
 \end{aligned}$$

Strength of rivet = min of strength in shear and bearing

$$= (24.052, 31.50)$$





$$R_v = 24.052 \text{ kN}$$

Number of rivets

$$n = \frac{P}{R_v} = \frac{55}{24.052} = 2.287 \approx 3$$

25. *Ans. (b)*

26. *Ans. (b)*

The section modulus of the bult weld

$$= \frac{18 \times 180^2}{6} = 97.2 \times 10^3 \text{ mm}^3$$

Permissible bending stress, $\sigma_{bf} = 165 \text{ N/mm}^2$

$$\begin{aligned} \sigma_{bf,cal} &= \frac{13000 \times 10^3}{97.2 \times 10^3} \\ &= 133.74 \text{ N/mm}^2 \end{aligned}$$

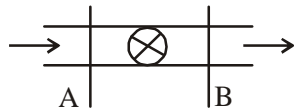
27. *Ans. (a)*

28. *Ans. (b)*

29. *Ans. (a)*

30. *Ans. (d)*

31. *Ans. (d)*



$$\frac{P_A}{\rho g} + \frac{V_A^2}{2g} + Z_A = \frac{P_B}{\rho g} + \frac{V_B^2}{2g} + Z_B + h_L$$

$$\Rightarrow 2.5 + 0.5 + 2.5 =$$

$$\left(\frac{P_B}{\rho g} + Z_B \right) + 0.5 + 0.2$$

$$\Rightarrow \frac{P_B}{\rho g} + Z_B = 4.8 \text{ m}$$

32. *Ans. (b)*

33. *Ans. (d)*

34. *Ans. (a)*

35. *Ans. (c)*

36. *Ans. (d)*

37. *Ans. (a)*

38. *Ans. (c)*

29. *Ans. (c)*

40. *Ans. (b)*

41. *Ans. (a)*

42. *Ans. (c)*

43. *Ans. (a)*

44. *Ans. (c)*

45. *Ans. (b)*

46. *Ans. (a)*

47. *Ans. (b)*

48. *Ans. (a)*

49. *Ans. (b)*

50. *Ans. (a)*

51. *Ans. (d)*

52. *Ans. (c)*

53. *Ans. (b)*

54. *Ans. (b)*

55. *Ans. (c)*

56. *Ans. (b)*

57. *Ans. (b)*

58. *Ans. (c)*

59. *Ans. (d)*

60. *Ans. (d)*

61. *Ans. (b)*

Relative density is given by

$$= \left(\frac{e_{\max} - e}{e_{\max} - e_{\min}} \right) \times 100\%$$

$$\therefore 66.6 = \left(\frac{e_{\max} - e}{0.3} \right) \times 100$$

$$\therefore e_{\max} \approx 0.6$$





62. *Ans. (c)*
63. *Ans. (b)*
64. *Ans. (c)*
65. *Ans. (d)*
66. *Ans. (a)*
67. *Ans. (a)*
68. *Ans. (a)*
69. *Ans. (b)*
70. *Ans. (d)*
71. *Ans. (d)*
72. *Ans. (c)*
73. *Ans. (d)*
74. *Ans. (c)*
75. *Ans. (b)*
76. *Ans. (a)*
77. *Ans. (b)*
78. *Ans. (d)*
79. *Ans. (a)*
80. *Ans. (c)*
81. *Ans. (c)*
82. *Ans. (a)*
83. *Ans. (b)*
84. *Ans. (b)*
85. *Ans. (b)*
86. *Ans. (c)*
87. *Ans. (b)*
88. *Ans. (d)*
89. *Ans. (a)*
90. *Ans. (d)*
91. *Ans. (c)*
92. *Ans. (c)*
93. *Ans. (d)*
94. *Ans. (d)*
95. *Ans. (c)*

96. *Ans. (b)*

It is gives by $4.75 \sqrt{Q} = 4.75 \sqrt{64} = 38 \text{ m}$

97. *Ans. (b)*

98. *Ans. (c)*

For a given stage $Q \propto \sqrt{s}$

$$Q_2 = Q_1 \sqrt{\frac{s_2}{s_1}} = Q \sqrt{\frac{1/1000}{1/4000}} = 2Q$$

99. *Ans. (b)*

Peak of direct run off

$$= 240 - 40 = 200 \text{ m}^3/\text{sec}$$

peak of 4-hour unit hydrograph

$$= \frac{200}{8} = 25 \text{ m}^3/\text{sec}$$

100. *Ans. (a)*

In plains 1 station per 520 km² is recommended

101. *Ans. (b)*

102. *Ans. (b)*

103. *Ans. (c)*

104. *Ans. (b)*

105. *Ans. (c)*

106. *Ans. (b)*

107. *Ans. (c)*

108. *Ans. (b)*

109. *Ans. (a)*

110. *Ans. (d)*

111. *Ans. (c)*

112. *Ans. (a)*

113. *Ans. (a)*

114. *Ans. (b)*

115. *Ans. (b)*

116. *Ans. (b)*

117. *Ans. (a)*





118. Ans. (a)

It is given by

$$= \frac{2T}{\pi d^2 \left[h + \frac{d}{3} \right]}$$

$$= \frac{2 \times 1000}{\pi \times 10^2 \left[20 + \frac{10}{3} \right]} = \frac{6}{7\pi}$$

$$z = 0.2(1+2D) \text{ for } 1.0 \leq \frac{\ell}{D} < 2$$

And $z = 0.61$ for $\frac{\ell}{D} < 1$

Since $\frac{\ell}{D} = \frac{6.0}{5.0} = 1.2$

$$z = 0.2(6 + 2 \times 5) = 3.2 \text{ m}$$

143. Ans.(b)

As per IS 456 : 2000 minimum grade of concrete is M30 for a RCC structure near sea coast

Hence at failure

$$\frac{\sigma_{cbc}}{x_e} = \frac{t/m}{(d - x_e)}$$

$$m = \frac{280}{3\sigma_{cbc}} = \frac{280}{3 \times 10} = \frac{28}{3}$$

$$x_e = \left(\frac{m\sigma_{cbc}}{m\sigma_{cbc} + \sigma_{st}} \right) d$$

$$= \left(\frac{\frac{28}{3} \times 10}{\frac{28}{3} \times 10 + 230} \right) d = 0.289 d$$

$$\therefore \frac{10}{0.289d} = \frac{t/28/3}{(1-0.289)d}$$

$$\Rightarrow t = 230 \text{ N/mm}^2$$

119. Ans. (a)

120. Ans. (d)

121. Ans. (b)

122. Ans. (b)

123. Ans. (b)

124. Ans. (a)

125. Ans. (b)

126. Ans. (b)

127. Ans. (c)

128. Ans. (a)

129. Ans. (b)

130. Ans. (d)

131. Ans. (a)

132. Ans. (b)

133. Ans. (c)

134. Ans. (a)

135. Ans. (a)

136. Ans. (b)

137. Ans. (c)

138. Ans. (a)

139. Ans. (a)

140. Ans. (d)

141. Ans. (c)

142. Ans.(a)

lever arm for simply supported beam

144. Ans.(d)

145. Ans.(c)

146. Ans.(a)

147. Ans.(d)

148. Ans.(a)

149. Ans.(b)

150. Ans.(b)

