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Previous Year Paper
(Civil Engineering-I) 16 Aug, 2023

Civil Engineering – I

1. The maximum value of span/depth ratio for simply supported beam of 15 m space should not exceed
   (a) 7   (b) 13.33   (c) 15   (d) 20

2. Limiting depth of neutral axis for Fe 415 grade of steel is taken as (here d = effective depth of beam)
   (a) 0.43 d   (b) 0.46 d   (c) 0.48 d   (d) 0.53 d

3. Development length L_d can be calculated using the relationship (notations have usual meaning)
   (a) $L_d = \dfrac{0.87\,\sigma_y\,\phi}{4\,\tau_{bd}}$ (b) $L_d = \dfrac{4\,\sigma_y\,\phi}{1.15\,\tau_{bd}}$ (c) $L_d = \dfrac{\sigma_y\,\phi}{1.15\,\tau_{bd}}$ (d) $L_d = \dfrac{0.87\,\sigma_y\,\phi}{2\,\tau_{bd}}$

4. The value of modular ratio (m) for M-20 concrete is taken as
   (a) 9.33   (b) 10.98   (c) 13.33   (d) 23.33

5. Value of limiting moment of resistance for Fe 415 grade of steel will be
   (a) $0.148\,f_{ck}\,bd^2$ (b) $0.138\,f_{ck}\,bd^2$ (c) $0.133\,f_{ck}\,bd^2$ (d) $0.12\,f_{ck}\,bd^2$

6. Minimum grade of concrete to be used in pre-tensioning shall not be less than
   (a) M-20   (b) M-30   (c) M-40   (d) M-50

7. A beam 25 cm × 40 cm subjected to a factored shear force 10 kN and factored torsional moment 4 kN – m. The equivalent shear force on the beam will be
   (a) 25.6 kN   (b) 35.6 kN   (c) 26.0 kN   (d) 14.0 kN

8. The modulus of elasticity of a concrete is 25000 MPa. The long-term of modulus of elasticity at 28 days will be
   (a) 7812.5 MPa   (b) 9615.4 MPa   (c) 10000 MPa   (d) 11905 MPa

9. One of the criteria to determine effective width of flange as per IS code is (notations have usual meaning)
   (a) $\dfrac{l_0}{3} + b_w + 6\,D_f$ (b) $\dfrac{l_0}{6} + b_w + 6\,D_f$ (c) $\dfrac{l_0}{6} + b_w + D_f$ (d) $\dfrac{l_0}{3} + b_w + D_f$

10. If the fluid property such as density, velocity and pressure at any given point does not change with the passage of time, the flow is known as
    (a) Steady flow   (b) Unsteady flow   (c) Rotational flow   (d) Irrotational flow

11. The energy loss due to friction in pipe flow is (All symbols have usual meaning)
    (a) $h_f = \dfrac{f\,LV^2}{2\,gD}$ (b) $h_f = \dfrac{Re\,\sqrt{f}}{2\,gD}$ (c) $h_f = \dfrac{f\,L^2 V}{2\,gD}$ (d) $h_f = \dfrac{f\,L^2\,V^2}{2\,gD}$

12. In a turbulent pipe flow, inside the laminar boundary layer, the velocity distribution will be :
    (a) linear [Assumed Approximation]   (b) parabolic [Actual]
    (c) logarithmic   (d) exponential decay type

13. A river model is constructed to a horizontal scale of 1 : 1000 and a vertical scale 1:100. If the model discharge was 0.1 m³/s, then the discharge in the river (m³/s) will be
    (a) 10^3 (b) 10^4 (c) 10^5 (d) 10^6

14. What is the ratio of flexural strength (f_{cr}) to the characteristic compressive strength of concrete (f_{ck}) for M25 grade of concrete ?
    (a) 0.17   (b) 0.14   (c) 0.11   (d) 0.09

15. A definite yield point is obtained in the following grade of steel :
    (a) Fe 250   (b) Fe 415   (c) Fe 500   (d) Fe 550

16. As per IS : 450 – 2000, the value of τ_{bd} for deformed bars in tension are greater than of plain bars by
    (a) 20%   (b) 25%   (c) 40%   (d) 60%

17. The dimension of specific weight in MLT system will be
    (a) ML^2T^2 (b) $ML^{-2}T^{-2}$ (c) MLT^2 (d) $ML^{-1}T^{-1}$

18. The path followed by a moving fluid particles is called
    (a) Streak line   (b) Path line   (c) Stream line   (d) None of these

19. In open channel flows, the critical Reynolds number is
    (a) 1.0   (b) 2100   (c) 500   (d) 7000

20. What will be ratio of horizontal force components F_1 and F_2 ? (Take γ_w = 10 kN/m³).
    Length = 1.0 m and Dimension = 2.0 m
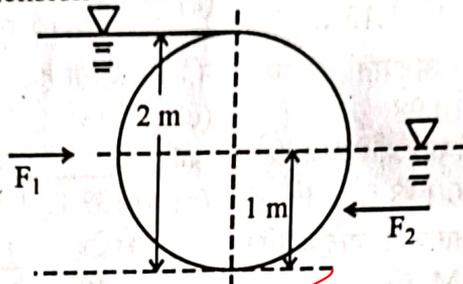
    (a) 2   (b) 3   (c) 4   (d) 5

21. The magnitude of the component of velocity at point (1, 1) for a stream function, $\psi = x^2 - y^2$ will be equal to :
    (a) 2   (b) $2\sqrt{2}$ (c) 4   (d) $4\sqrt{2}$

22. Energy correction factor α is expressed as (Here u = point velocity, v is average velocity and A is the area of flow) :
    (a) $\alpha = \frac{1}{A}\int \left(\frac{u}{v}\right)^3 dA$ (b) $\alpha = \frac{1}{A}\int \left(\frac{u}{v}\right)^2 dA$ (c) $\alpha = \frac{1}{A}\int \left(\frac{u}{v}\right) dA$ (d) $\alpha = \frac{1}{A}\int \left(\frac{v}{u}\right)^3 dA$

23. The correct relation among coefficient of discharge C_d, coefficient of velocity C_v and coefficient of contraction C_c is
    (a) $C_d = C_c \times C_v$ (b) $C_d = C_c / C_v$ (c) $C_d = \frac{C_c C_v}{2}$ (d) $C_d = \frac{C_c C_v}{3}$

24. Due to each end contraction, the discharge of rectangular sharp crested weir is reduced by
    (a) 5%   (b) 10%   (c) 15%   (d) 30%

25. A floating body is said to be in a state of stable equilibrium
    (a) when its metacentric height is zero.
    (b) when the metacentre is above the centre of gravity.
    (c) when the metacentre is below the centre of gravity.
    (d) when its centre of gravity is below its centre of buoyancy.

26. If the velocity, bulk modulus of elasticity, the mass density of a fluid are denoted by U, K and ρ respectively, Mach no. will be given by
    (a) $U\sqrt{K} / \sqrt{\rho}$ (b) $U\sqrt{\rho} / \sqrt{K}$ (c) $\rho\sqrt{U} / \sqrt{K}$ (d) $K\sqrt{U} / \sqrt{\rho}$

27. A pressure increase of 200 N/cm² increases the density of water by 0.1%, bulk modulus of elasticity of water will be equal to :
    (a) 200 G N/m²   (b) 20 G N/m²   (c) 2 G N/m²   (d) 0.2 G N/m²

28. The sequent depth ratio in hydraulic jump formed in a horizontal rectangular channel is 16.48. Froude No. of the super-critical stream will be
    (a) 4   (b) 8   (c) 12   (d) 120

29. The energy loss in an orifice flow is given by

    (a) $H(C_v^2 - 1)$ (b) $H\left(1 - \dfrac{1}{C_v^2}\right)$ (c) $H(1 - C_v^2)$ (d) $H\left(\dfrac{1}{C_v^2} - 1\right)$

30. For a laminar flow in circular pipes friction factor 'f' is equal to (Re – Reynold's number)

    (a) 16/Re   (b) 32/Re   (c) 64/Re   (d) 4/Re

31. If x is the distance from leading edge of a plate held in uniform stream, the thickness of laminar boundary layer varies as

    (a) $x^{1/2}$ (b) $x^{4/5}$ (c) $x^{3/5}$ (d) $x^{1/7}$

32. The condition for complete similarity to exist between model and prototype, where both gravity and viscous forces are important, is : (where μ_r is kinematic viscosity ratio and L_r is length scale ratio)

    (a) $\mu_r = L_r^{3/2}$ (b) $\mu_r = L_r^{5/2}$ (c) $\mu_r = L_r^{1/2}$ (d) $\mu_r = L_r^{2/3}$

33. At a rated capacity of 44 cumecs, a centrifugal pump develops 36 m of head when operating at 1450 rpm. Its specific speed will be

    (a) 654   (b) 509   (c) 700   (d) 90

34. A Francis turbine under a head of 25 m produces 2000 kW at a speed of 250 rpm. Its specific speed is

    (a) 50   (b) 100   (c) 150   (d) 200

35. Stream lines and equipotential lines always intersects at _____.

    (a) 30°   (b) 45°   (c) 60°   (d) 90°

36. The flow of water in a wash basin, when it is being emptied through a central opening, is an example of

    (a) Free vortex   (b) Forced vortex   (c) Rotational vortex   (d) Rankine vortex

37. Hot wire anemometer is used to measure
    (a) discharge   (b) velocity of gas
    (c) pressure intensity of gas   (d) pressure intensity of liquid

38. Coefficient of contraction for an external cylindrical mouth piece is
    (a) 1.00   (b) 0.855   (c) 0.711   (d) 0.611

39. Length of a pipe is 1.0 km and its diameter is 20 cm. If diameter of an equivalent pipe is 40 cm, the length of pipe will be
    (a) 32 km   (b) 20 km   (c) 8 km   (d) 4 km

40. The equation $\dfrac{P}{W} + \dfrac{V^2}{2g} + z = $ constant is based on the following assumption regarding the flow of fluid :
    (a) steady, frictionless, incompressive and along a stream line
    (b) steady, frictionless, uniform and along a stream line
    (c) steady, incompressible, uniform and along a streamline
    (d) steady, frictionless incompressible and uniform

41. A velocity field with no component in the y & z direction is given by v = 6 + 2xy + t². Acceleration along x-direction at a point (3, 1, 2) at time t = 2 will be
    (a) 8 units   (b) 16 units   (c) 28 units   (d) 36 units

42. The differential equation for energy for a reversible adiabatic flow may take one of the following form : (All symbols have usual meaning)
    (a) $dp + d(\rho v^2) = 0$ (b) $v\, dv + c^2 \dfrac{d\rho}{\rho} = 0$ (c) $2v\, dv + \dfrac{d\rho}{\rho} = 0$ (d) $v\, dv + \dfrac{d\rho}{\rho} = 0$

43. Uplift pressure on the floor of syphon aqueduct due to canal seepage is maximum when
(a) canal is running full but drainage dry (b) drainage is running full but canal is dry
(c) both canal & drainage are running full (d) both canal & drainage are dry

44. A land is known as water-logged when
(a) the permanent wilting point is reached
(b) gravity drainage has ceased
(c) capillary fringe reaches the root zone of plants
(d) None of the above

45. As per Lacey's theory, the silt factor is
(a) directly proportional to average particle size
(b) inversely proportional to average particle size
(c) directly proportional to square root of average particle size
(d) not related to average particle size

46. Piping in body of hydraulic structures generally starts from
(a) Centre towards upstream   (b) Centre towards downstream
(c) downstream to upstream of structures (d) upstream to downstream of structures

47. Height of capillary fringe is
(a) more in fine grained soil   (b) more in coarse grained soil
(c) does not depend on soil characteristics (d) depends on quantity of water in the soil

48. For a given discharge in a channel the critical path is function of
(a) slope of the channel   (b) roughness of the channel
(c) geometry of the channel   (d) viscosity of the liquid

49. In a horizontal rectangular channel a hydraulic jump with a sequent depth ratio of 5.0 is formed. This jump can be classified as
(a) Weak jump   (b) Oscillating jump   (c) Strong jump   (d) Steady jump

50. A rectangular channel 2.5 m wide carries water depth of 1.2 m. The bed slope of the channel is 0.0036, average shear stress on the boundary will be approximately :
(a) 11.23 Pa   (b) 21.58 Pa   (c) 31.11 Pa   (d) 41.09 Pa

51. Chezy formula is (All symbols have usual meanings)
(a) $V = C\sqrt{RS_o}$ (b) $V = \frac{1}{n}R^{2/3} S_o^{1/2}$ (c) $V = \frac{1}{n}R^{1/2} S_o^{2/3}$ (d) $V = CR^{2/3} S_o$

52. Escape provided across the channel at its fag end to maintain required full supply is called
(a) Head cluster   (b) Silt includer   (c) Silt excluder   (d) Tail cluster

53. The main function of diversion head works provided at the offtake of a canal from a river is
(a) to raise water level in river   (b) to control floods
(c) store water   (d) control silt entry into the canal

54. Tunnels of a sediment excluder are so designed that
(a) longest tunnel is farthest from canal head regulator
(b) longest tunnel is nearest to canal head regulator
(c) all tunnels are of the same length
(d) None of the above

55. The super-critical flows are governed by control section existing at _____ of the section.
    (a) upstream end   (b) downstream end   (c) slope   (d) bottom

56. Which of the following velocity fields represents a possible fluid flow ?
    (a) $u = x, v = y$ (b) $u = x^2, v = y^2$ (c) $u = xy, v = x^2y^2$ (d) $u = x, v = -y$

57. Tube-well should not be near than _____ m from an unlined canal.
    (a) 300   (b) 400   (c) 500   (d) 600

58. In gravity well, the water level in the well is _____.
    (a) equal to ground level
    (b) greater than water table
    (c) less than water table
    (d) equal to top surface

59. The role of the core in dam
    (a) provides higher pressure at the contact between core and foundation
    (b) reduces the possibility of leakage and piping
    (c) increases its safety
    (d) all above

60. For a trapezoidal channel section to be most economical, its hydraulic radius must be equal to _____. (y – depth of channel)
    (a) $\dfrac{y}{4}$ (b) $\dfrac{y}{2}$ (c) $\dfrac{y}{2\sqrt{2}}$ (d) $\dfrac{y}{3\sqrt{2}}$

61. The speed of a pressure wave through a pipe depends upon
    (a) the length of pipe
    (b) the viscosity of fluid
    (c) the bulk modulus for the fluid
    (d) the original head

62. If there are n pipes of the same diameter 'd' laid in parallel in place of single pipeline of diameter D, then
    (a) $d = D/n^{2/5}$ (b) $D = d/n^{2/5}$ (c) $d = D/n^{2/3}$ (d) $d = D/n^{1/5}$

63. The specific energy in m kg/kg for the flow expressed by v = 2.22 m/sec and y = 1 m is
    (a) 1.25   (b) 2.22   (c) 3.22   (d) 4.22

64. The pressure coefficient is the ratio of pressure forces to
    (a) gravity forces   (b) viscous forces   (c) inertia forces   (d) none of these

65. Given, g = acceleration due to gravity, R = hydraulic mean depth; the Darcy-Weisback friction factor is related to Mannings rugosity coefficient 'n' as
    (a) $8gn^2/R^{1/3}$ (b) $gn^2/8R^{1/3}$ (c) $64ng/Rv^{1/3}$ (d) $Ry^3/8gn^2$

66. The specific energy 'E' in a critical flow at depth 'y_c' occuring in a triangular channel is given by
    (a) $E = 1.25 y_c$ (b) $E = 1.5 y_c$ (c) $E = 1.75 y_c$ (d) $E = 2 y_c$

67. Uniform flow in a channel is characterized by following statement :
    (a) The total energy remains constant along the channel.
    (b) Gradient of total energy is parallel to the channel bed.
    (c) Specific energy decreases along the channel.
    (d) Total energy line rises or falls.

68. Which of the following pressure units represents the least pressure ?
    (a) Millibar   (b) mm of mercury   (c) N/mm^2 (d) k_{gf}/cm^2

69. A trapezoidal channel is 10 m wide at base, has a side slope of 1.5 horizontal: 1 vertical. The bed slope is 0.0003. The channel is linked with smooth concrete of n = 0.012. The wetted perimeter for a depth of flow 3.0 m is
    (a) 20.82 m   (b) 18.82 m   (c) 22.82 m   (d) 24.82 m

70. The ratio of volume of voids to the volume of solids is called
(a) water content   (b) porosity   (c) void ratio   (d) permeability

71. The specific gravity of inorganic clays is in the range of
(a) 2.66 – 2.70   (b) 2.70 – 2.80   (c) 2.65 – 2.68   (d) 2.75 – 2.85

72. The maximum water content at which a decrease in moisture content does not cause any decrease in the volume of soil mass is called
(a) Shrinkage limit   (b) Plastic limit   (c) Elastic limit   (d) Liquid limit

73. The ratio of plasticity index to flow index is called
(a) Strength Index   (b) Abrasion Index   (c) Toughness Index   (d) Liquidity Index

74. Which one of the following is not a factor for influencing compaction ?
(a) Type of soil   (b) Water content   (c) Compactive effect   (d) Permeability

75. Which of the following equipment is used for the compaction of clayey soils ?
(a) Vibratory roller   (b) Smooth wheel roller   (c) Steel roller   (d) Sheep foot roller

76. The falling head test is done to find permeability of
(a) Coarse sand   (b) Fine sand and silt   (c) Clay   (d) None of these

77. The decrease in soil volume by the squeezing out of the pore water on account of gradual dissipation of excess hydrostatic pressure induced by an imposed total stress is called
(a) Compaction   (b) Settlement   (c) Consolidation   (d) Dissipation

78. The maximum slope at which a material dropped down through a natural process, remains stable is called
(a) Angle of stability   (b) Angle of repose   (c) Angle of equality   (d) Angle of deviation

79. A temporary structure constructed in a river, lake etc. to keep the working area dry for construction work is called
(a) Coffer Dam   (b) Masonry Dam   (c) Retaining Wall   (d) Bulk Head

80. The Dynamic Pile formula is used to estimate
(a) Pile capacity   (b) Pile strength   (c) Pile value   (d) Pile energy

81. The instrument used to measure specific gravity of solids will be
(a) Thermometer   (b) Manometer   (c) Barometer   (d) Pycnometer

82. An unsaturated 100 cc sample of soil weigh 190 gm. If its dry weight is 160 gm, water content will be
(a) 0.188   (b) 0.288   (c) 0.388   (d) 0.488

83. Compactive energy ratio of modified compaction test to the standard compaction test will be
(a) 4.0   (b) 4.5   (c) 5.0   (d) 5.5

84. In the capillary zone, the pore pressure is
(a) at atmospheric pressure   (b) more than atmospheric pressure   (c) negative   (d) usually fluctuating

85. In a gradually varied flow, if $\frac{dy}{dx}$ is positive then $\frac{dE}{dx}$ will be
(a) always zero   (b) positive if $y > y_c$ (c) negative if $y > y_c$ (d) always negative

86. For max. discharge in a circular channel section, the ratio of depth of flow to that of diameter of the channel is :
(a) 0.30   (b) 0.50   (c) 0.81   (d) 0.95

87. The relationship between Mannings coefficient 'n' and Chezy constant 'C' is given by (R = Hyd Mean depth)
(a) $C = \frac{R^{2/3}}{n}$ (b) $C = \frac{R^{1/6}}{n}$ (c) $C = \frac{R^{1/3}}{n}$ (d) $C = \frac{R^{1/4}}{n}$

88. A sand sample was tested under tri-axial loading with a cell pressure of 100 kN/m^2. The sample failed at a deviator stress of 200 kN/m^2. The strength parameters of the sand are :
    (a) $c = 0$, $\phi > 30°$
    (b) $c = 100 \text{ kN/m}^2$, $\phi < 30°$
    (c) $c = 100 \text{ kN/m}^2$, $\phi = 30°$
    (d) $c = 0$, $\phi < 30°$

89. For determining unconfined compressive strength of a soil, change in cross-sectional area is taken as following : (where A_o is original area and $\in$ is axial strain)
    (a) $A_f = \dfrac{A_o}{1 + \in}$
    (b) $A_f = A_o (1 + \in)$
    (c) $A_f = \dfrac{A_o}{1 - \in}$
    (d) $A_f = A_o (1 - \in)$

90. The soil having uniformity coefficient less than 4.0 is called
    (a) uniformly graded soil
    (b) fine graded soil
    (c) coarse grained soil
    (d) well graded soil

91. Shear strength of highly plastic cohesive soil is found out by which equipment ?
    (a) Cone Test
    (b) Penetration Test
    (c) Van shear Test
    (d) Torsional Test

92. Which type of foundation is preferable on soil of poor bearing capacity ?
    (a) Raft
    (b) Stepped
    (c) Grillage
    (d) None of these

93. Coulomb's equation for shear strength can be represented as (all notations carry normal meaning)
    (a) $\tau = c - \sigma \tan \phi$
    (b) $\tau = c + \sigma \tan \phi$
    (c) $\tau = \sigma - c \tan \phi$
    (d) $\tau = \sigma + c \tan \phi$

94. A sample of a dry soil has mass 68 gm. If the volume of the sample is 40 ml and specific gravity of soil is 2.65, volume of voids will be :
    (a) 14.34 ml
    (b) 25.66 ml
    (c) 12.02 ml
    (d) 13.65 ml

95. The capillary size in silt is 50 cm and that in fine sand is 30 cm. The difference in the pore size of the two soils will be :
    (a) 6.0×10^{-3} cm
    (b) 4.0×10^{-3} cm
    (c) 10.0×10^{-3} cm
    (d) 5.0×10^{-3} cm

96. The immediate settlement of a rigid footing is about _____ times the maximum settlement of an equal flexible footing.
    (a) 0.9
    (b) 0.8
    (c) 0.7
    (d) 0.6

97. Relation between e, G, w and S_r is given by (e = void ratio, w = water content, G = specific gravity, S_r = Degree of saturation)
    (a) $e = \dfrac{wSr}{G}$
    (b) $e = \dfrac{wG}{Sr}$
    (c) $e = wG\,Sr$
    (d) $w = eG\,Sr$

98. A SPT was conducted in a dense sand deposit at a depth of 22 m and a value of 48 was observed for N. If the density of sand was 15 kN/m^3, the value of N corrected for over burden pressure will be
    (a) 40
    (b) 41
    (c) 37
    (d) 42

99. A three metre high cantilever retaining wall retains a horizontal back fill of granular material of properties, total active force will be : ($\phi = 30°$, c = 0, $\gamma = 15 \text{ kN/m}^3$)
    (a) 15 kN/m
    (b) 22.5 kN/m
    (c) 45 kN/m
    (d) 30 kN/m

100. A flow net for seepage under a sheet pile is drawn. The head difference on both side of the pile is 2 m. The flow net gives $n_f = 4.5$, $n_d = 9$. If permeability of soil is 5×10^{-3} cm/c, the quantity of seepage in m^3/s/m will be
    (a) 5×10^{-5}
    (b) 5×10^{-3}
    (c) 2×10^{-3}
    (d) 2×10^{-5}

101. A circular area of 2m diameter on the ground is loaded uniformly with an intensity of 100 kN/m^2. The load intensity at 1m just below its centre will be
    (a) $\dfrac{100}{\sqrt{2}}$
    (b) $100\sqrt{2}$
    (c) $100\sqrt{8}$
    (d) $\dfrac{100}{\sqrt{8}}$

102. A 10 cm thick clay sample is tested in the laboratory under single drainage condition. It took 3.1416 hours to consolidate 60%. The coefficient of consolidation is
    (a) 9 cm^2/hr
    (b) 18 cm^2/hr
    (c) 31.416 cm^2/hr
    (d) 3.416 cm^2/hr

103. A simply supported beam having span 'L' carrying a point load 'P' at mid-span. The strain energy of the beam due to bending moment is

(a) $\dfrac{P^2 L^3}{48\,EI}$　　　(b) $\dfrac{P^2 L^2}{48\,EI}$　　　(c) $\dfrac{P^3 L^2}{96\,EI}$　　　(d) $\dfrac{P^2 L^3}{96\,EI}$

104. In the analysis of rigid jointed frames, it is assumed that the members are :

(a) inextensible　　(b) extensible　　　(c) both (a) and (b)　　(d) none of these

105. In case of rigid jointed unbraced space frames, the degree of kinematic indeterminancy is : (all symbols have usual meanings)

(a) $D_K = 6j - (r + m)$　(b) $D_K = 6j - (r - m)$　(c) $D_K = 3j - (r + m)$　(d) $D_K = 3j - (r - m)$

106. A pin jointed plane frame is stable and statically indeterminate if (all symbols have usual meaning)

(a) $(m + r) < 2j$　　(b) $(m + r) = 2j$　　(c) $(m + r) > 2j$　　(d) $m + r = 3j$

107. Which of the following options is correct ?

(a) Maxwell's law of reciprocal deflection is a special case of Betti's law of reciprocal work.
(b) Betti's law of reciprocal deflection is a special case of Maxwell's law of reciprocal work.
(c) Maxwell's law of reciprocal and Betti's law of reciprocal are not interconnected.
(d) Maxwell's law of reciprocal is connected to bending moment in the structure.

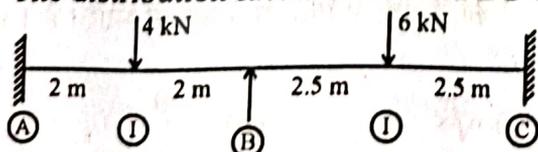108. For the beam shown below, the shear force diagram will be :
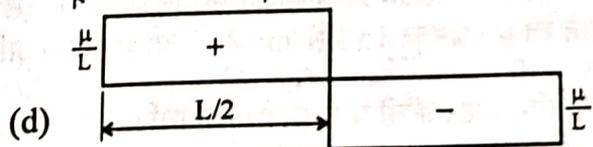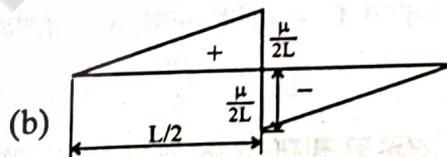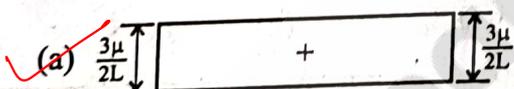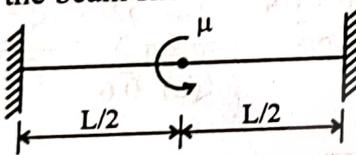
109. Determine degree of freedom of the beam shown below. Assume that beam is inextensible :
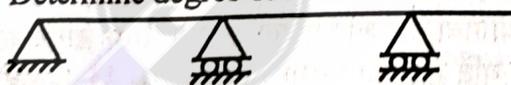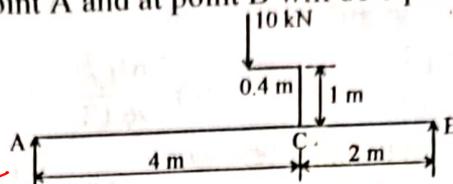

(a) Zero　　　　(b) 7　　　　(c) 5　　　　(d) 3

110. The distribution factor of BA and BC of beam ABC shown as below is :

(a) $DF_{BA} = 0.47$ & $DF_{BC} = 0.53$　　　(b) $DF_{BA} = 0.56$ & $DF_{BC} = 0.44$

(c) $DF_{BA} = 0.40$ & $DF_{BC} = 0.60$　　　(d) $DF_{BA} = 0.30$ & $DF_{BC} = 0.70$

111. The sum of reactions at point A and at point B will be equal to :

(diagram: beam with 10 kN load, A at left, C at 4 m, 0.4 m and 1 m marks, B at right 2 m from C)

(a) 8 kN   (b) 10 kN   (c) 12 kN   (d) 4 kN

112. The ratio of change of dimension of the body to the original dimension is known as
(a) Stress   (b) Strain
(c) Modulus of elasticity   (d) Elongation

113. A uniformly tapering rod having diameter D_1 at one end and D_2 at other end is having length 'L' and is subjected to an axial load P. The change in length will be

(a) $\dfrac{4\,PL}{\pi\,E\,D_1 D_2}$ (b) $\dfrac{PL}{4\pi\,E\,D_1 D_2}$ (c) $\dfrac{PL}{\pi E\,D_1 D_2}$ (d) $\dfrac{2\,PL}{\pi\,E\,D_1 D_2}$

114. If Direct compressive stress > Bending stress then
(a) There will be no tensile stress across the section
(b) Tensile stress will be zero across the section
(c) There will be tensile stress across the section
(d) There will be no compressive stress across the section

115. For no tensile stress, the value of eccentricity of a circular section having diameter, 'D' will be

(a) $\dfrac{D}{6}$ (b) $\dfrac{D}{8}$ (c) $\dfrac{D}{2}$ (d) $\dfrac{D}{3}$

116. A fixed beam AB of span 'L' is subjected to a point load W at a distance of 'a' from support A and 'b' from support B. Fixed end moment at support A will be

(a) $\dfrac{W\,ab^2}{L^2}$ (b) $\dfrac{W\,a^2 b}{L^2}$ (c) $\dfrac{W\,ab}{L}$ (d) $\dfrac{W\,a^2 b^2}{L^3}$
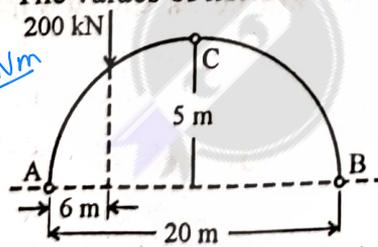
117. For a single point load W moving on a symmetrical parabolic three hinged arch of span L, the maximum sagging moment occurs at distance 'x' from ends. The value of x will be
(a) 0.211 L   (b) 0.250 L   (c) 0.234 L   (d) 0.510 L

118. Two point loads of 40 kN and 60 kN spaced 6 m apart, crosses a girder of 16 m span with 40 kN load leading. The magnitude of maximum bending moment under the 60 kN load will be :
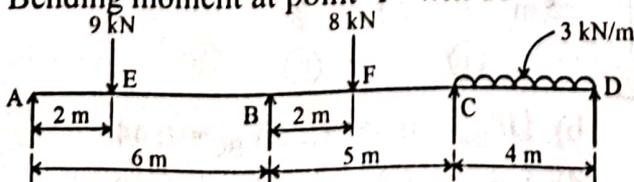(a) 206 kN – m   (b) 306 kN – m   (c) 356 kN – m   (d) 256 kN – m

119. The values of horizontal thrust at point A as shown in Arch below is :

(diagram: arch with 200 kN load at top, C at crown, 5 m, A and B supports, 6 m and 20 m spans)

(a) 100 kN   (b) 140 kN   (c) 120 kN   (d) 180 kN

120. Bending moment at point 'F' will be

(diagram: beam with 9 kN at E, 8 kN at F, 3 kN/m distributed load to D; A, B, C, D supports; 2 m, 2 m spacing; 6 m, 5 m, 4 m spans)

(a) 12 kN – m   (b) 9.6 kN – m   (c) 7.2 kN – m   (d) 14.2 kN – m

121. In a three hinged arch maximum hogging moment occurs when the point load is at
    (a) springing   (b) crown   (c) quarter span   (d) the section itself

122. Deflection in a truss depends upon
    (a) axial rigidity   (b) flexural rigidity   (c) torsional rigidity   (d) frictional rigidity

123. For a fixed beam loaded as shown below, if the support 'B' rotates through θ_B in anticlockwise direction, the fixed end moment at 'B' will be

W/Unit Length

A ————— B

$+\theta_B$

L

EI = Constant
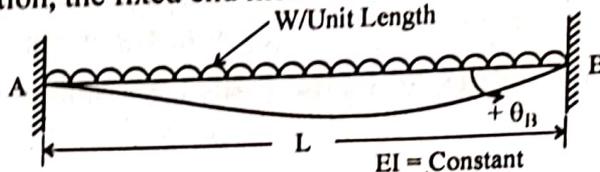
(a) $-\dfrac{WL^2}{12} + \dfrac{2EI\theta_B}{L}$ (b) $-\dfrac{WL^2}{12} + \dfrac{4EI\theta_B}{L}$ (c) $\dfrac{WL^2}{12} - \dfrac{2EI\theta_B}{L}$ (d) $\dfrac{WL^2}{12} - \dfrac{4EI\theta_B}{L}$

124. Which of the following method is not classified as force method ?
    (a) three moment theorem   (b) moment distribution
    (c) method of consistent method   (d) Castigliano's theorem

125. The Castigliano's second theorem can be used to compute deflection
    (a) in statically determinate structure only   (b) for any type of structure
    (c) in statically indeterminate structure only   (d) for beams and frame only

126. In the following truss, the force in member BC will be ← Data missing

2t

A B   C
      30°

E
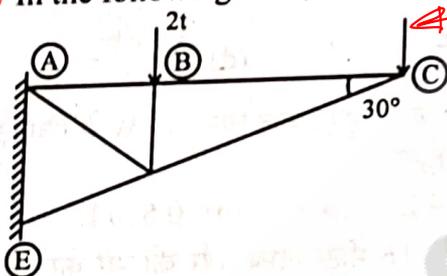
    (a) Zero   (b) 0.5 t tensile   (c) 0.5 t compressive   (d) $\sqrt{3}$ t tensile

127. In a fixed beam the effect of sinking of a support by 'δ' is to create a bending moment equal to
    (a) $\dfrac{2EI\delta}{L^2}$ (b) $\dfrac{6EI\delta}{L^2}$ (c) $\dfrac{3EIL}{\delta^2}$ (d) $\dfrac{6EIL}{\delta^2}$

128. Which of the following is not an indeterminate structure ?
    (a) continuous beam   (b) 3 – hinged arch   (c) fixed beam   (d) 2 – hinged arch

129. For the truss shown below, which statement is true ?
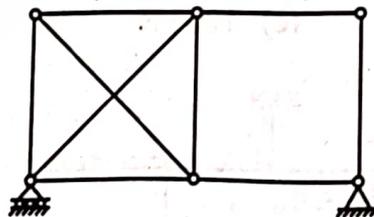
    (a) Internally unstable   (b) Externally unstable
    (c) Statically determinate   (d) Statically indeterminate

130. The moment required to rotate the near end of a prismatic beam through unit angle, without translocation, as the far end being fixed, is given by
(a) EI/L   (b) 2EI/L   (c) 3EI/L   (d) 4EI/L

131. Unit load method is also known as
(a) dummy load method   (b) displacement method
(c) energy load method   (d) elongation method

132. Principle of superposition is applicable when
(a) deflections are linear functions of applied loads
(b) material does not obey Hooke's law
(c) the action of applied loads will be affected by small deformation of the structure
(d) stress-strain relation is non-linear

133. The width of analogous column in the method of column analogy will be
(a) $\dfrac{1}{4\,EI}$ (b) $\dfrac{1}{2\,EI}$ (c) $\dfrac{1}{EI}$ (d) $\dfrac{2}{EI}$

134. A fixed beam of span L is carrying a point load 'P' at its mid span. If the moment of inertia of middle half length is twice that of remaining length, then the fixed end moment will be
(a) $\dfrac{PL}{32}$ (b) $\dfrac{5PL}{48}$ (c) $\dfrac{3PL}{32}$ (d) $\dfrac{5PL}{32}$
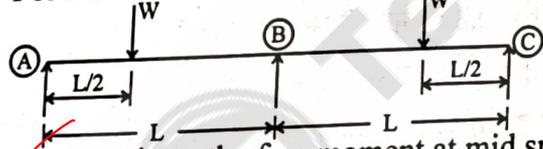
135. The effective length of fillet weld should not be less than
(a) size of weld   (b) two times the size of weld
(c) three times the size of weld   (d) four times the size of weld

136. For the following structure, the ratio of relative stiffness for AB and AC is
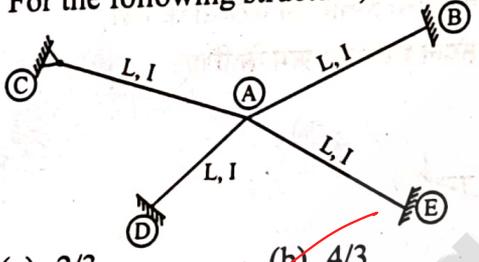
(a) 2/3   (b) 4/3   (c) 1   (d) 1/3

137. For the continuous beam (EI constant) loaded as shown, the moment at 'B' will be

(a) 0.75 times the free moment at mid span of AB
(b) same as the free moment at mid span of AB
(c) 1.5 times the free moment at mid span of AB
(d) 2.0 times the free moment at mid span of AB

138. In the following frame, support ④ settles by δ. The fixed end moment in the horizontal member "2 – 3" of the frame will be : (other symbols have usual meaning)
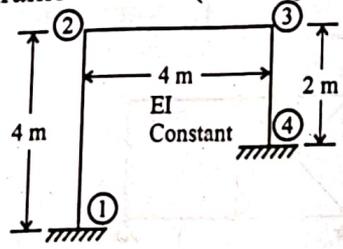
(a) $\dfrac{EI\,\delta}{8}$ (b) $\dfrac{6\,EI\,\delta}{16}$ (c) $\dfrac{3\,EI\,\delta}{16}$ (d) $\dfrac{EI\,\delta}{16}$

139. The strength at which steel fails under repeated applications of load is known as :
   (a) impact strength (b) tensile strength (c) yield strength (d) fatigue strength

140. What is the collapse load of beam as shown in figure ?
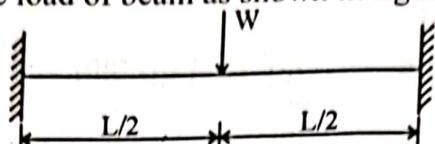
   (a) $W_\mu = 8 M_P/L$ (b) $W_\mu = 4 M_P/L$ (c) $W_\mu = 6 M_P/L$ (d) $W_\mu = 2 M_P/L$

141. For the steel members which are always in tension (other than pre-tensioned members), maximum slenderness ratio will be
   (a) 250 (b) 325 (c) 350 (d) 400

142. In tension members, splice is used
   (a) to join two sections
   (b) to join more than two sections
   (c) as beam section
   (d) as column section

143. Effective length of a steel column which is effective held in position at both ends but not restrained against rotation is (L – unsupported length of column)
   (a) 2.0 L (b) 1.0 L (c) 3.0 L (d) 0.5 L

144. Slenderness ratio (λ) of a compression member is the ratio of
   (a) effective length and cross-section area
   (b) effective length and minimum radius of gyration
   (c) unsupported length and cross-sectional area
   (d) unsupported length and minimum radius of gyration

145. The steel section used as connecting piece at the intersection of two or more members in a roof truss is known as
   (a) base plate (b) gusset plate (c) toe plate (d) tie plate

146. Consider the following names :
   (i) stanchion (ii) strut (iii) boom (iv) principal rafter (v) cables
   Which of above have compressive stress in a steel structure ?
   (a) (i) and (ii) only
   (b) (i), (ii) and (iii) only
   (c) (i), (ii), (iii) and (iv) only
   (d) (i), (ii), (iv) and (v) only

147. Which of the followings are specifically considered in the design of plate girders ?
   (i) Local buckling of web
   (ii) Local buckling of flange
   (iii) Joints between web and flange plates
   (a) (i) and (iii) only (b) (ii) and (iii) only (c) (i) and (ii) only (d) (i), (ii) and (iii)

148. Web crippling in beams generally occurs at the point where
   (a) concentrated load acts
   (b) bending moment is maximum
   (c) shear force is maximum
   (d) deflection is maximum

149. Horizontal web stiffeners are used in plate girders if depth to thickness ratio of web is greater than
   (a) 100 (b) 180 (c) 200 (d) 300

150. In design of steel structure the design wind speed is 60 m/s, the basic wind pressure to be considered will be
   (a) 2.16 N/mm² (b) 21.6 N/mm² (c) 2.16 kN/m² (d) 216 kN/m²

151. Which of the following cross-section has maximum value of shape factor ?
    (a) Circular   (b) Rectangular   (c) Triangular   (d) I-Section

152. The load factor in the plastic design is normally taken as
    (a) 1.5   (b) 1.6   (c) 1.7   (d) 2.0

153. The centre to centre distance between individual fasteners in a line in the direction of load is known as
    (a) effective length   (b) gauge length
    (c) diagonal distance   (d) pitch

154. The design strength (in tension) of a plate (T_{dn}) governed by rupture of net cross-sectional area (A_n) at the hole will be given by :

    (when f_u is ultimate stress of material and γ_m is partial safety factor)

    (a) $T_{dn} = \dfrac{0.9\, A_n\, f_u}{\gamma_m}$ (b) $T_{dn} = \dfrac{0.8\, A_n\, f_u}{\gamma_m}$

    (c) $T_{dn} = 0.8\, \gamma_m\, A_n\, f_u$ (d) $T_{dn} = 0.9\, \gamma_m\, A_n\, f_u$

155. For laced column, the thickness of flat lacing bar shall not be less than
    (a) one-fortieth of its effective length for single lacing
    (b) one-sixtieth of the effective length for double lacings
    (c) both (a) and (b)
    (d) none of the above

156. For connection, the distance between the centres of any two adjacent fasteners shall not exceed _____ or _____ whichever is less (where 't' is thickness of thinner plate in mm)
    (a) 32 t or 200 mm   (b) 32 t or 300 mm   (c) 16 t or 300 mm   (d) 16 t or 200 mm

157. A tie bar 50 mm × 8 mm is to carry a load of 160 kN. A specimen of the same material is tested having cross-sectional area 250 mm² in the laboratory. The maximum load carried by the specimen was 125 kN. The factor of safety in the design is
    (a) 1   (b) 1.25   (c) 2   (d) 2.5

    [handwritten: → If it is 1 cm, then Ans = 18 mm]

158. A steel plate is 35 cm wide and 10 cm thick. A rivet of nominal diameter 'd' is driven in the plate. If the net sectional area of the plate is 33.05 cm², find the nominal diameter of the rivet.
    [handwritten: No option correct]
    (a) 16 mm   (b) 18 mm   (c) 20 mm   (d) 22 mm

159. What is the collapse load of the beam as shown in figure ?

$W = \left(\dfrac{W}{L}\right)$

L
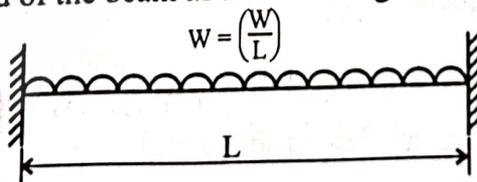
    (a) $W_u = \dfrac{16\, M_P}{L}$ (b) $W_u = \dfrac{12\, M_P}{L}$ (c) $W_u = \dfrac{8\, M_P}{L}$ (d) $W_u = \dfrac{6\, M_P}{L}$

160. In plastic design of portal frames with the increase in redundancies, the number of possible modes of failure :
    (a) decreases   (b) increases
    (c) remains the same   (d) the two have no relationship

161. For a RCC column, the unsupported length between end restraints shall not exceed
(a) 20 times its least lateral dimension
(b) 40 times its least lateral dimension
(c) 60 times its least lateral dimension
(d) 80 times its least lateral dimension

162. The anchorage value of a standard U-type hook shall be equal to
(a) four times the diameter of the bar
(b) six times the diameter of the bar
(c) eight times the diameter of the bar
(d) sixteen times the diameter of the bar

163. What is the maximum permissible area of tension reinforcement for the given cross-section of a RCC beam as per IS code ?
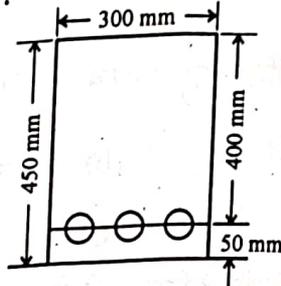

(a) 4800 mm²   (b) 5400 mm²   (c) 7200 mm²   (d) 8100 mm²

164. What is the minimum reinforcement in slabs in terms of the percentage of total cross-sectional area of slab if mild steel is used ?
(a) 0.12%   (b) 0.15%   (c) 0.18%   (d) 0.04%

165. If the diameter of the longitudinal bars of a RCC column is 16 mm, the diameter of lateral ties should not be less than
(a) 6 mm   (b) 5 mm   (c) 4 mm   (d) 3 mm

166. For the given cross-section of a RCC beam, the depth of neutral axis is 253 mm. What type of section is it if M20 grade of concrete and Fe 500 steel is used ?
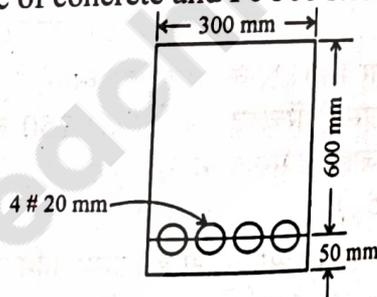
(a) Under-reinforced section
(b) Over-reinforced section
(c) Balanced section
(d) Critical section

167. As per IS 800 code in working stress design, in load combination involving wind or seismic load, the permissible stresses in steel structural members may be increased by _____ percent.
(a) 25   (b) 33   (c) 50   (d) 100

168. Approximate dead load of roof truss is _____ N/m².
(a) $\left(\dfrac{Span}{3}+5\right)\times 10$ (b) $\left(\dfrac{Span}{5}+3\right)\times 10$ (c) $\left(\dfrac{Span+5}{3}\right)\times 10$ (d) $\left(\dfrac{Span}{2}+3\right)\times 10$

169. A RCC compression member may be considered as short column when both the slenderness ratio $\dfrac{lex}{D}$ and $\dfrac{leg}{b}$ are less than
(a) 12   (b) 16   (c) 24   (d) 32

170. The main reinforcement of a RCC slab consists of 10 mm bars at 100 mm spacing. If 10 mm bars are replaced by 12 mm bars, the spacing of 12 mm bars should be
    (a) 120 mm   (b) 130 mm   (c) 138 mm   (d) 144 mm

171. When HYSD bars are used in place of mild steel bars, the bond strength
    (a) decreases   (b) increases   (c) does not change   (d) becomes zero

172. Minimum percentage area of HYSD reinforcement in a 145 mm thick water tank wall will be
    (a) 0.24%   (b) 0.23%   (c) 0.20%   (d) 0.25%

173. Which of the following factors govern the depth of footing for an isolated column ?
    (1) maximum bending moment   (2) shear force   (3) punching shear
    (a) (1) and (3) only   (b) (1) and (2) only   (c) (1), (2) and (3)   (d) (2) and (3) only

174. A concrete beam of rectangular cross-section of 250 mm × 400 mm is pre-stressed with a force of 400 kN at an eccentricity of 100 mm. The maximum compressive stress in the concrete will be
    (a) 12.5 N/mm^2 (b) 10.0 N/mm^2 (c) 7.5 N/mm^2 (d) 2.0 N/mm^2

175. What is the percentage loss of pre-stress due to an anchorage slip of 4 mm in a concrete beam of length of 30 m which is post tensioned by a tendon subjected to an initial stress of 1500 N/mm^2 ? Modulus of elasticity is 2×10^5 N/mm^2.
    (a) 1.0%   (b) 1.25%   (c) 1.50%   (d) 1.75%

176. In which system of post-tensioning, instead of wires, high tensile steel bars are used as tendons ?
    (a) Lee McCall system   (b) Freyssinet system
    (c) Magnel system   (d) Gifford-Udall system

177. Which of the following losses is/are not considered in pre-tensioned beams ?
    (1) Friction   (2) Elastic shortening of concrete
    (3) Shrinkage of concrete   (4) Creep of concrete
    (5) Anchorage slip
    (a) (2), (3) and (5) only   (b) (3) and (4) only
   (c) (1) only   (d) (2) only

178. The area of cross-section and section of modulus of rectangular pre-stressed beam are A and Z respectively. P is the pre-stressing force applied to the tendon. If beam is subjected to maximum bending moment M, the maximum stress 'f' will be,
    (a) $f = \dfrac{P}{A} + \dfrac{Z}{M}$ (b) $f = \dfrac{A}{P} + \dfrac{M}{Z}$ (c) $f = \dfrac{P}{A} + \dfrac{M}{Z}$ (d) $f = \dfrac{P}{A} + \dfrac{M}{6Z}$

179. A short axially loaded RCC column of size 200 mm × 200 mm is having 1200 mm^2 of longitudinal reinforcement. What is the maximum load carrying capacity of the column if M20 grade of concrete and Fe 500 steel is used ?
    (a) 722.0 kN   (b) 712.40 kN   (c) 732.0 kN   (d) 782.8 kN

180. A simply supported RCC beam having clear span 5 m and support width 300 mm has the cross-section as shown in figure below. Find the effective span of the beam as per IS 456 : 2000.
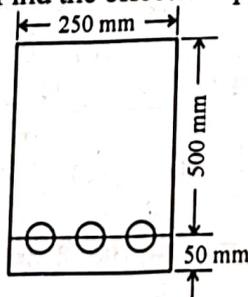
    (a) 5250 mm   (b) 5300 mm   (c) 5500 mm   (d) 5550 mm