DO NOT BREAK THE SEAL UNTIL YOU GO THROUGH THE FOLLOWING INSTRUCTIONS

QUESTION BOOKLET

Name of Post –ASSISTANT ENGINEER (PUBLIC HEALTH)
Name of Subject – CIVIL ENGINEERING - PAPER - I

Roll No. | | | | **Booklet Series** **A**

(Enter your Roll number in the above space)

Time Allowed: 2 Hour **Max. Marks: - 200**

INSTRUCTIONS :

1. Use only BLUE/BLACK Ball Point Pen.
2. All questions are COMPULSORY.
3. All questions carry equal marks. Each question carries two marks. There will be no negative marking.
4. Check the BOOKLET thoroughly.

   IN CASE OF ANY DEFECT - MISPRINT, MISSING QUESTION/S, GET THE BOOKLET CHANGED. NO COMPLAINT SHALL BE ENTERTAINED AFTER THE TEST.
5. Before you mark the answer, read the instruction on the back page of the OMR sheet (answer sheet) as well as on the question booklet before attempting the questions and fill the particulars in the ANSWER SHEET carefully and correctly. Incomplete & Incorrect particulars may result in your answer sheet not being evaluated by the Computer.
6. There are FIVE options to each question.
7. After completing the test, handover the ANSWER SHEET to the Invigilator.
8. For Rough Work, Blank Sheet is provided at the end of the question – booklet
9. Write the BOOKLET SERIES given at the TOP RIGHT HAND SIDE of the question booklet in the space provide in the answer sheet, by darkening the corresponding circles.

1. If a system of forces **A, B** and **C** are in equilibrium, then magnitude of their resultant is equal to
   (a) A+ B + C
   (b) $A^2+ B^2 + C^2$
   (c) $\sqrt{(A^2+ B^2 + C^2)}$
   (d) Zero
   (e) None of the above

2. The maximum number of unknown forces that can be determined in a concurrent force system under equilibrium is
   (a) Zero
   (b) 2
   (c) 3
   (d) 6
   (e) None of the above

3. The principle of superposition states that the total deflection of a structure under different sets of oads is equal to the sum of deflections under each set of loads acting separately on the structure if the loads are within,
   (a) Elastic limit
   (b) Limit State
   (c) Proportionality limit without buckling
   (d) Elastic limit including buckling
   (e) None of the above

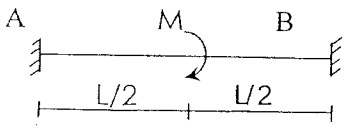
4. The curvature at any point along the curve representing the deformed shape of a beam is given by
   (a) $\frac{1}{R} = \frac{\pm\frac{dy}{dx}}{\left[1+\frac{d^2y}{dx^2}\right]^{1/2}}$
   (b) $\frac{1}{R} = \frac{\pm\frac{d^2y}{dx^2}}{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{5/2}}$
   (c) $\frac{1}{R} = \frac{\frac{d^2y}{dx^2}}{\left[1+\frac{d^2y}{dx^2}\right]^{3/2}}$
   (d) $\frac{1}{R} = \frac{\pm\frac{dy}{dx}}{\left[1+\frac{d^2y}{dx^2}\right]^{2}}$
   (e) None of the above

5. If a cantilever beam of span L and flexural rigidity EI carries a moment M concentrated at the free end, the deflection at the end will be,
   (a) $\frac{ML}{24EI}$
   (b) $\frac{ML}{12EI}$
   (c) $\frac{ML}{6EI}$
   (d) $\frac{ML^2}{2EI}$
   (e) None of the above

6. IF a cantilever beam of length **L** and flexural rigidity **EI** is carrying a concentrated load **P** at the free end, the total strain energy will be,
   (a) $\frac{P^2L^3}{2EI}$
   (b) $\frac{P^2L^3}{3EI}$
   (c) $\frac{P^2L^3}{6EI}$
   (d) $\frac{P^2L^3}{12EI}$
   (e) None of the above

7. A uniform simply supported beam is subjected to a clock-wise moment M at the left end. The moment required at the right end of the beam so that the rotation of the right end is zero is equal to
   (a) 2M
   (b) M
   (c) M/2
   (d) M/3
   (e) None of the above

8. The fixed end moment M_{FAB} for the beam shown below is



(a) Zero
(b) M/2
(c) M/4
(d)M/8
(e) None of the above

9. The moment required to rotate the near end of a prismatic beam through unit angle, without translation, the far-end being fixed is
(a) EI/L
(b) 2EI/L
(c) 3EI/L
(d)4EI/L
(e) None of the above

10. The flexibility coefficient for shaft of length **L** and torsional rigidity **GJ** under torsion at mid-point is
(a) $L^2/6GJ$
(b) L/2GJ
(c) L/3GJ
(d) L/GJ
(e) None of the above

11. Generally the actions in a grid member are,
(a) Axial force, twisting moment and bending moment
(b) Shear force, twisting moment and bending moment
(c) Axial force, shear force and bending moment
(d) Shear force and bi-axial bending moment
(e) None of the above

12. The number of unknowns to be determined in the stiffness method is equal to
(a) Static indeterminacy
(b) Kinematic indeterminacy
(c) Sum of static and kinematic indeterminac
(d) Maximum of static indeterminacy and kinematic indeterminacy
(e) None of the above

13. The force required to produce a unit translation displacement (without rotation) of one-third point of a fixed beam of span L and of uniform flexural rigidity EI is
(a) $729EI/2L^3$
(b) $729EI/L^3$
(c) $724EI/L^3$
(d) $724EI/3L^3$
(e) None of the above

14. The assumption that plane section remains plane under pure bending which is valid for linear elastic material is not exactly true for plastic bending
(a) True
(b) False
(c) True if the material is nonlinear elastic
(d) True if the deformations are continuous
(e) None of the above

15. Which of the following sections will have the maximum shape factor
(a) Square
(b) Circular
(c) Diamond
(d) Triangle
(e) None of the above

16. The moment capacity of a section at plastic hinge is

(a) Zero
(b) Yield moment
(c) Twice of yield moment
(d) Fully plastic moment
(e) None of the above

17. The variation of influence line for the stress function in a statically determinate structure is

(a) Linear
(b) Parabolic
(c) Circular
(d) Rectangular
(e) None of the above

18. The area of the influence line diagram for the fixed end moment of a fixed beam of span L is

(a) $L^2/8$
(b) $L^2/12$
(c) $L^2/16$
(d) $L^2/24$
(e) None of the above

19. A three-hinged parabolic arch is subjected to a uniform load **w** per unit horizontal length, the maximum bending moment is

(a) $wL^2/4$
(b) $wL^2/8$
(c) $wL^2/12$
(d) Zero
(e) None of the above

20. The maximum design stress and the area of the concrete stress block at Ultimate Limit State of flexure in a singly reinforced rectangular section are

(a) 0.447 f_{ck} and $0.362f_{ck}bx_u$
(b) 0.362 f_{ck} and $0.447f_{ck}bx_u$
(c) 0.67 f_{ck} and $0.447f_{ck}bx_u$
(d) 0.87 f_{ck} and $0.362f_{ck}bx_u$
(e) None of the above

21. The concept of locating neutral axis as a centroidal axis (in a reinforced concrete section under flexure) is

(a) True for WSM and not LSM
(b) True for both linear and nonlinear material behaviors
(c) True for both elastic and plastic materials
(d) True for elastic materials only
(e) None of the above

22. The minimum flexural reinforcement of Fe 250 steel in the slabs according to IS 456: 2000 is

(a) 0.0012 times gross area of concrete
(b) $0.85/f_y$ times the gross area of concrete
(c) $0.4/(0.87f_y)$ times the gross area of concrete
(d) 0.6% of the gross area of concrete
(e) None of the above

23. The maximum permissible shear stress in a steel structural member as per IS 800-1984 is

(a) 0.6 f_y
(b) 0.66 f_y
(c) 0.45 f_y
(d) 0.75 f_y
(e) None of the above

24. The effective length of the compression flange of cantilever beam which is built-in at the support and free at the end is

(a) L
(b) 0.85L
(c) 0.5L
(d) 2L
(e) None of the above

25. The maximum slenderness ratio of a member of a steel structure, subjected to compressive forces resulting from wind/earthquake forces is

(a) 180 (b) 250
(c) 300 (d) 350
(e) None of the above

26. Granite is an

(a) Igneous rock (b) Metamorphic rock
(c) Sedimentary rock (d) All the above
(e) None of the above

27. Refractory bricks resist

(a) High temperature (b) Chemical action
(c) dampness (d) all the above
(e) None of the above

28. Seasoning of timber is done for

(a) Increasing moisture content (b) Decreasing moisture content
(c) Increasing strength of timber (d) Decreasing strength of timber
(e) None of the above

29. Cast iron is used for

(a) Structural works in beams (b) Small sized water pipes
(c) Columns and struts (d) a & c
(e) None of the above

30. Rapid hardening cement contains

(a) Tri-calcium silicate (b) Tri-calcium aluminate
(c) Tetra-calcium alumino ferrite (d) Di-calcium silicate
(e) None of the above

31. Black cotton soil is unsuitable for foundations because

(a) Its bearing capacity is low
(b) Its Permeability is uncertain
(c) Its Particles are cohesive
(d) It undergoes volumetric changes due to changes in moisture content
(e) None of the above

32. A cavity wall is generally provided for

(a) Heat insulation (b) Sound insulation
(c) Prevention of dampness (d) All the above
(e) None of the above

33. Weep holes are provided in retaining walls and breast walls

(a) To drain off the water from the filling (b) To ventilate the stone masonry
(c) To reduce the weight of the earth retained (d) To increase the compaction of the earth retained
(e) None of the above

34. If all the dimensions of a bar are increased in the proportion **n:1** , the proportion with which the maximum stress produced in the prismatic bar by its own weight, will increase in the ratio

(a) $1:n$ (b) $n:1$

(c) $1:\frac{1}{n}$ (d) $1:\sqrt{n}$

(e) None of the above

35. If **Z** and **I** are the section modulus and moment of inertia of the section, the shear force **F** and the bending moment **M** at a section are related by

(a) $F = \frac{My}{I}$ (b) $F = \frac{M}{Z}$

(c) $F = \frac{dM}{dx}$ (d) $F = \int M\,dx$

(e) None of the above

36. Simple bending equation is

(a) $\frac{M}{I} = \frac{R}{E} = \frac{F}{Y}$ (b) $\frac{I}{M} = \frac{E}{R} = \frac{Y}{F}$

(c) $\frac{M}{I} = \frac{E}{R} = \frac{F}{Y}$ (d) $\frac{M}{I} = \frac{R}{E} = \frac{Y}{F}$

(e) None of the above

37. The shear stress at any section of a shaft is maximum

(a) At the center of the section (b) At a distance r/2 from the center

(c) At the top of the surface (d) At a distance ¾ r from the center

(e) None of the above

38. If a solid shaft is subjected to a torque **T** at its end such that the maximum shear stress does not exceed $\mathbf{f_s}$, the diameter of the shaft will be

(a) $\frac{16T}{\pi f_s}$ (b) $\sqrt{\frac{16T}{\pi f_s}}$

(c) $\sqrt[3]{\frac{16T}{\pi f_s}}$ (d) $\frac{8T}{\pi f_s}$

(e) None of the above

39. In a tension test, the yield stress is 30 N/mm^2 , the octahedral shear stress at the point is

(a) $10\sqrt{2}$ N/mm^2 (b) $15\sqrt{2}$ N/mm^2

(c) $20\sqrt{2}$ N/mm^2 (d) $25\sqrt{2}$ N/mm^2

(e) None of the above

40. For a channel section the shear center lies at a distance of

(a) $\frac{b d t}{2I}$ (b) $\frac{d^2 b t}{3I}$

(c) $\frac{d^2 b^2 t}{4I}$ (d) $\frac{d b^2 t}{3I}$

(e) None of the above

(*d, b* and *t* are the total depth of the section, width of the flange and common thickness of flange and web respectively)

41. For a given material Young's modulus is 200 GN/m^2 and modulus of rigidity is 80 GN/m^2. The value of Poisson's ratio is
(a) 0.15 (b) 0.20
(c) 0.35 (d) 0.40
(e) None of the above

42. A rectangular log of wood is floating in water with a load of 100 N at its centre. The maximum shear force in the wooden log is
(a) 50 N at each end (b) 50 N at the centre
(c) 100 N at the centre (d) Zero
(e) None of the above

43. The width of a beam of uniform strength *f* having a constant depth **d** and length **L**, simply supported at the ends with a central load **W** is
(a) $\frac{2WL}{3fd^2}$ (b) $\frac{3WL}{2fd^2}$
(c) $\frac{2fL}{3Wd^2}$ (d) $\frac{3fL^2}{2Wd}$
(e) None of the above

44. Beams of uniform strength are preferred to those of uniform section because these are economical for
(a) Large spans (b) Heavy weights
(c) Light weights (d) Short spans
(e) None of the above

45. The ratio of the flexural strengths of two square beams one placed with its two sides horizontal and the other placed with one diagonal vertical is
(a) $\sqrt{2}$ (b) $\sqrt{3}$
(c) $\sqrt{5}$ (d) $\sqrt{7}$
(e) None of the above

46. A bar *L* meter long and having its area of cross section **A**, is subjected to a gradually applied tensile load **W**. The strain energy stored in the bar is
(a) $\frac{W^2L}{2AE}$ (b) $\frac{W^2L}{AE}$
(c) $\frac{W^2L}{AE}$ (d) $\frac{W^2L}{2AE}$
(e) None of the above

47. In case of principal axes of a section
(a) Sum of moment of inertia is zero (b) Difference of moment of inertia is zero
(c) Product of moment of inertia is zero (d) All the above
(e) None of the above

48. The ratio of maximum shear stress to average shear stress on a rectangular section is
(a) 1 (b) 1.25
(c) 1.5 (d) 2
(e) None of the above

49. The ratio of the maximum deflections of a simply supported beam with central load W and of a cantilever of same length and with a load W at its free end, is
(a) 1/8 (b) 1/10
(c) 1/12 (d) 1/16
(e) None of the above

50. The equivalent length of a column of length L having one end fixed and the other end free, is
(a) 2L (b) L
(c) L/2 (d) L/√2
(e) None of the above

51. Expansion joints are provided if the length of concrete structure exceeds
(a) 10m (b) 15 m
(c) 35 m (d) 45 m
(e) None of the above

52. The aggregate impact value of aggregate used in
(a) Building concrete is less than 45 (b) Road pavement concrete is less than 30
(c) Runway concrete is less than 30 (d) All the above
(e) None of the above

53. Workability of concrete may be improved by adding
(a) Fly ash (b) Hydrated lime
(c) Calcium chloride (d) All the above
(e) None of the above

54. In a singly reinforced beam, the effective depth is measured from its extreme compression edge to
(a) Tensile edge (b) Tensile reinforcement
(c) Neutral axis of the beam (d) Longitudinal central axis
(e) None of the above

55. The anchorage value of a hook is assumed 16 times the diameter of the bar if the angle of the bend is
(a) 30□ (b) 40□
(c) 45□ (d) All the above
(e) None of the above

56. The stresses developed in concrete and steel in reinforced concrete beam of 250 mm width and 700 mm effective depth, are 6.25 MPa and 25 MPa respectively. If m=15, the depth of it neutral axis is
(a) 200 mm (b) 250 mm
(c) 300 mm (d) 400 mm
(e) None of the above

57. A column is regarded as a long column if the ratio of its effective length and lateral dimension, exceeds
(a) 10 (b) 12
(c) 20 (d) 30
(e) None of the above

58. The ratio of the diameter of reinforcing bars and the slab thickness is
(a) ¼ (b) 1/5
(c) 1/6 (d) 1/8
(e) None of the above

59. Diagonal tension in beam
(a) Is maximum at neutral axis
(b) Decreases below neutral axis and increases above the neutral axis
(c) Increases below the neutral axis and decreases above the neutral axis
(d) Remains same
(e) None of the above

60. High carbon content in steel causes
(a) Decrease in tensile strength but increase in ductility
(b) Increase in tensile strength but decrease in ductility
(c) Decrease in both tensile strength and ductility
(d) Increase in both tensile strength and ductility
(e) None of the above

61. Prestressing losses in post-tensioned and pre-tensioned beams are respectively
(a) 15% and 20%
(b) 20% and 15%
(c) 15% and 15%
(d) 20% and 20%
(e) None of the above

62. At limit state of collapse in shear in case of web-shear cracks, it is assumed that the concrete cracks when the maximum principal tensile stress exceeds a value of f_t equal to
(a) $0.25\sqrt{f_{ck}}$
(b) $0.20\sqrt{f_{ck}}$
(c) $0.16\sqrt{f_{ck}}$
(d) $0.30\sqrt{f_{ck}}$
(e) None of the above

63. Deep beams are designed for
(a) Shear force only
(b) Bending moment only
(c) Both shear force and bending moment
(d) Bearing
(e) None of the above

64. Design of one-way RC slabs for concentrated load is done by
(a) Using Pigeaud's moment coefficients
(b) Taking slab strip of unit width containing the load
(c) Taking slab strip of width effective in resisting the load
(d) Taking orthogonal slab strips of unit width containing the load
(e) None of the above

65. The final deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of supports, roofs and all other horizontal members should not exceed
(a) Span/350
(b) Span/300
(c) Span/250
(d) Span/200
(e) None of the above

66. The assumption that the plane sections normal before bending remain normal after bending is used
(a) Only in working stress method of design
(b) Only in limit state method of design
(c) In both working stress and limit state methods of design
(d) Only in ultimate load method of design
(e) None of the above

67. The state of the two dimensional stresses acting on a concrete lamina consists of a direct tensile stress, $\sigma_x = 1.5$ N/mm^2, and shear stress $\tau = 1.20$ N/mm^2, which causes cracking of concrete. Then the tensile strength of concrete in N/mm^2, is

(a) 1.50
(b) 2.08
(c) 2.17
(d) 2.29
(e) None of the above

68. The following two statements are made with reference to a simply supported under-reinforced RCC beam:

I. Failure takes place by crushing of concrete before the steel has yielded
II. The neutral axis moves up as the load is increased beyond yielding of steel

With reference to the above statements, which of the following applies?

(a) Both the statements are false
(b) 1st is true but 2nd is false
(c) Both the statements are true
(d) 1st is false but 2nd is true
(e) None of the above

69. A simply supported prestressed concrete beam is 6 m long and 300 mm wide. Its gross depth is 600 mm. It is prestressed by horizontal cable tendons at a uniform eccentricity of 100 mm. The prestressing tensile force in the cable tendons is 1000 kN. Neglect the self-weight of the beam. The maximum normal compressive stress in the beam at transfer is

(a) Zero
(b) 5.55 N/mm^2
(c) 11.11 N/mm^2
(d) 15.68 N/mm^2
(e) None of the above

70. Which of the following deformations are important in case of deep beams when compared to flexure alone

(a) Shear
(b) Axial
(c) Torsional
(d) Bearing
(e) None of the above

71. The losses in prestress in pre-tensioning system are due to

1. Elastic deformation of concrete
2. Friction
3. Shrinkage and creep of concrete

Select the correct answer using the codes, given below:

(a) 1, 2 and 3
(b) 2 and 3
(c) 1 alone
(d) 1 and 3
(e) None of the above

72. The critical section for two-way shear of footing is at the

(a) Face of the column
(b) Distance d from the column face
(c) Distance $d/2$ from the column face
(d) Distance $2d$ from the column face
(e) None of the above

(where d is the effective depth of the footing)

73. A reinforced concrete beam is to be post-tensioned in such a way that no tensile stress develops at the time of post-tensioning. The distance of the tendon from the nearest face must be:

(a) Between $d/5$ and $d/4$
(b) $< d/6$
(c) Between $d/4$ and $d/3$
(d) $> d/3$
(e) None of the above

(where d is the depth of the beam)

74. An RC short column with 300 mm x 300 mm square cross section is made of M20 concrete and has 4 number of 20 mm diameter longitudinal bars of Fe 415 steel . It is under the action of a concentric axial compressive load. Ignoring the reduction in the area of concrete due to steel bars, the ultimate axial load carrying capacity of the column is

(a) 1659 kN
(b) 1548 kN
(c) 1198 kN
(d) 1069 kN
(e) None of the above

75. For avoiding the limit state of collapse, the safety of RC structures is checked for appropriate load combinations of dead load (DL), imposed load or live load (LL), wind load (WL) and earthquake load (EL). Which of the following load combinations is NOT considered?

(a) 0.9 DL + 1.5 WL
(b) 1.5 DL + 1.5 WL
(c) 1.5 DL + 1.5 WL + 1.5 EL
(d) 1. 2 DL + 1.2 IL + 1.2 WL
(e) None of the above

76. If 'b' is the width if plate and 'd' is the diameter of rivet , then the efficiency of a riveted joint having diamond riveting is given by

(a) $\frac{b-d}{b}$
(b) $\frac{b-d}{d}$
(c) $\frac{b-2d}{b}$
(d) $\frac{b-2d}{d}$
(e) None of the above

77. When the effect of wind or earthquake load is taken into account, the permissible stress as specified in rivets may be increased by

(a) 33.33%
(b) 50%
(c) 10%
(d) 25%
(e) None of the above

78. A column base is subjected to moment. If the intensity of bearing pressure due to axial load is equal to stress due to moment, then the bearing pressure between the base and the concrete is

(a) Uniform compression through out
(b) Zero at one end and compression at other end
(c) Tension at one end and compression at the other end
(d) Uniform tension through out
(e) None of the above

79. If a tension member is subjected to axial load and bending moment, then

(a) $\frac{\sigma_{at,cal}}{0.66 f_y} + \frac{\sigma_{bt,cal}}{0.6 f_y} \leq 1$
(b) $\frac{\sigma_{at,cal}}{0.6 f_y} + \frac{\sigma_{bt,cal}}{0.66 f_y} \leq 1$
(c) $\frac{\sigma_{at,cal}}{0.6 f_y} + \frac{\sigma_{bt,cal}}{0.66 f_y} \leq 1.4$
(d) $\frac{\sigma_{at,cal}}{0.66 f_y} + \frac{\sigma_{bt,cal}}{0.6 f_y} \leq 1.4$
(e) None of the above

80. Ratio of plastic section modulus to elastic section modulus for circular section is

(a) $\frac{14}{3\pi}$
(b) $\frac{16}{5\pi}$
(c) $\frac{16}{3\pi}$
(d) $\frac{9}{5\pi}$
(e) None of the above

81. The value of the collapse load for a fixed beam of span **l**, plastic moment $\mathbf{M_p}$, subjected to a concentrated load **W** at the mid-span, will be

(a) $\frac{4M_p}{L}$ (b) $\frac{8M_p}{L}$

(c) $\frac{6M_p}{L}$ (d) $\frac{8M_p}{L}$

(e) None of the above

82. A cantilever steel beam of 3 m span carries a uniformly distributed load of 20 kN-m (inclusive of self weight). The beam comprises ISLB 200 @198 N/m, flange 100 mm x 7.3 mm, web thickness 5.4 mm, I_{xx} = 1696. 6 mm^4, I_{yy} = 115.4 cm^4. Bending and shear stresses in the beam, respectively

(a) 530.47 N/mm^2 and 55.55 N/mm^2 (b) 3899.48 N/mm^2 and 82.19 N/mm^2

(c) 132.62 N/mm^2 and 27.78 N/mm^2 (d) 1949.74 N/mm^2 and 41.10 N/mm^2

(e) None of the above

83. The problem of lateral buckling can arise only in those steel beams which has

(a) Moment of inertia about the bending axis larger than the other

(b) Moment of inertia about the bending axis smaller than the other

(c) Fully supported compression flange

(d) Concentric axial force

(e) None of the above

84. For a standard 45° fillet weld, the ratio of fillet to throat thickness is

(a) 1:1 (b) 1:$\sqrt{2}$

(c) $\sqrt{2}$:1 (d) 2:1

(e) None of the above

85. For a compression with double angle section, which of the following section will give larger value of minimum radius of gyration?

(a) Equal angles back to back (b) Unequal legged angles with long legs back to back

(c) Unequal legged angles with short legs back to back (d) Both (b) or (c)

(e) None of the above

86. Angle of inclination of the lacing bar with the longitudinal axis of the column should preferably be between

(a) 10° to 30° (b) 30° to 40°

(c) 40° to 70° (d) 90°

(e) None of the above

87. Battens provided for a compression member shall be designed to carry a transverse shear equal to

(a) 2.5% of the axial force in the member (b) 5% of the axial force in the member

(c) 10% of the axial force in the member (d) 20% of the axial force in the member

(e) None of the above

88. As per IS: 800, for compression flange, the outstand of flange plates should not exceed

(a) 12 t (b) 16 t

(c) 20 t (d) 25 t

(e) None of the above

89. The web crippling due to excessive bearing stresses can be avoided by
(a) Increasing the web thickness
(b) Providing suitable stiffeners
(c) increasing the length of the bearing plate
(d) All the above
(e) none of the above

90. Intermediate vertical stiffeners are provided in plate girders to
(a) eliminate web buckling
(b) eliminate local buckling
(c) transfer concentrated loads
(d) prevent excessive deflections
(e) None of the above

91. The static theorem of plastic analysis satisfies
(a) Equilibrium and mechanism conditions
(b) Equilibrium and plastic moment conditions
(c) Mechanism and plastic moment conditions
(d) Equilibrium condition only
(e) None of the above

92. The external wind pressure acting on a roof depends on
(a) Degree of permeability of roof
(b) Slope of roof
(c) Both (a) and (b)
(d) Direction of slope of roof
(e) None of the above

93. In the design of lacing system for a built-up steel column, the maximum allowable slenderness ratio of lacing bar is
(a) 120
(b) 145
(c) 180
(d) 250
(e) None of the above

94. Which of the following loads are to be considered in the design of a gantry girder in an industrial building
1. Gravity loads
2. Lateral loads
3. Longitudinal loads
4. Wind loads

Select the correct answer using the codes given below:
(a) 1 and 2
(b) 1, 2 and 3
(c) 1 and 3
(d) 2, 3 and 4
(e) None of the above

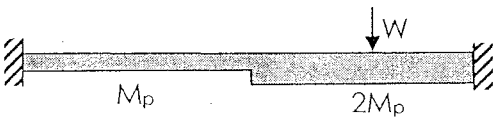
95. A structure has two degrees of indeterminacy. The number of plastic hinges that would be formed at complete collapse
(a) Zero
(b) 1
(c) 2
(d) 3
(e) None of the above

96. A steel column in a multi-storied building carries an axial load of 125 N. It is built up of 2 ISMC 350 channels b lacing. The lacing carries a load of
(a) 125 N
(b) 12.5 N
(c) 3.125 N
(d) Zero
(e) None of the above

97. A member is subjected to axial compression. Effective length is 3000 mm. Size of the angle used is 100 x 100 x 10. What is the maximum capacity (if f_y = 250 MPa)

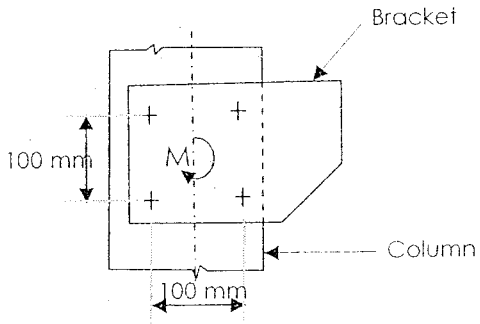
(a) 101.2 kN
(b) 81.7 kN
(c) 59.2 kN
(d) 95.1 kN
(e) None of the above

98. Figure given below shows a fixed beam of steel. At the point of collapse, the value of the load W will be



(a) $\frac{10M_p}{L}$
(b) $\frac{15M_p}{L}$
(c) $\frac{20M_p}{L}$
(d) $\frac{25M_p}{L}$
(e) None of the above

99. A moment M of magnitude 50 kN-m is transmitted to a column flange through a bracket by using four 20 mm diameter rivets as shown in the figure. The shear force induced in each rivet is



(a) 250 kN
(b) 175.8 kN
(c) 125 kN
(d) 88.4 kN
(e) None of the above

100. The tension member of a roof truss consists of two unequal angles 70 x 45 x 8 with the longer legs connected by 16 mm diameter rivets. If the angles are one on either side of the gusset plate, then the safe tension for the member will be (assuming permissible stress in tension = 150 MPa)

(a) 205 kN
(b) 215.4 kN
(c) 310.4 kN
(d) 320 kN
(e) None of the above