

## MULTIPLE CHOICE OBJECTIVE TYPE QUESTIONS

1. Main advantage of a steel member is that it
  - (a) has high strength and long life
  - (b) can be replaced easily
  - (c) is water tight and gas leak proof
  - (d) all the above
2. Weight of steel per cubic metre is taken to be
  - (a) 7900 kg
  - (b) 3000 kg
  - (c) 1200 kg
  - (d) 800 kg
3. The structures are
  - (a) means of transferring load to the substructure
  - (b) used to resist external load and moments
  - (c) means of transferring forces and moments only
  - (d) all the above are correct
4. When width and thickness of a structure are small in comparison to its length, they are then classified as
  - (a) one-dimensional
  - (b) two-dimensional
  - (c) three-dimensional
  - (d) none of the above
5. The structures made of rigid curved surfaces are known as
  - (a) surface structure
  - (b) frame structure
  - (c) shell structure
  - (d) space structure
6. A strut is a
  - (a) flexible member
  - (b) compression member
  - (c) torsion member
  - (d) tension member
7. A tie is a
  - (a) flexible member
  - (b) compression member
  - (c) torsion member
  - (d) tension member
8. The density of steel used in the structural members should be
  - (a) 1 gm/mm<sup>3</sup>
  - (b) 6.4 gm/mm<sup>3</sup>
  - (c) 7.9 gm/mm<sup>3</sup>
  - (d) 13.6 gm/mm<sup>3</sup>
9. The tensile strength of steel used in mild steel sections ranges in between
  - (a) 1400 to 1800 kg/cm<sup>2</sup>
  - (b) 1400 to 1800 kg/mm<sup>2</sup>
  - (c) 4200 to 5400 kg/cm<sup>2</sup>
  - (d) 5500 to 5800 kg/cm<sup>2</sup>
10. The live load on a floor of any type of structure cannot be less than
  - (a) 200 kg/m<sup>2</sup>
  - (b) 400 kg/m<sup>2</sup>
  - (c) 1000 kg/m<sup>2</sup>
  - (d) 50 kg/m<sup>2</sup>
11. Which operation can not be done easily on mild steel?
  - (a) Drilling
  - (b) Punching
  - (c) Cutting
  - (d) Hardening
12. The minimum percentage elongation for mild steel is
  - (a) 1%
  - (b) 2%
  - (c) 12.3%
  - (d) 23%
13. The percentage of carbon in structural steel is
  - (a) 0.20 to 0.27%
  - (b) 0.70 to 0.80%
  - (c) 1.20 to 1.27%
  - (d) 1.70 to 1.80%

14. The percentage of sulphur in structural steel is restricted to  
(a) 0.055 (b) 0.15 (c) 0.55 (d) 0.75
15. Junction between the flange and web of a beam is known as  
(a) lap joint (b) butt joint  
(c) fillet (d) shear joint
16. A channel section consists of  
(a) two webs (b) two flanges  
(c) two webs and two flanges  
(d) one web and two flanges
17. A piece of round steel forged in place to connect two or more steel members is known as a  
(a) bolt (b) rivet (c) screw (d) nail
18. The size of the rivet is expressed by the  
(a) length of shank (b) diameter of shank  
(c) type of head (d) none of the above
19. The hot driven rivets are  
(a) power driven shop rivets  
(b) hand driven rivets  
(c) power driven field rivets  
(d) all the above
20. The rivets which are driven at atmospheric temperature are known as  
(a) power driven shop rivets  
(b) hand driven rivets  
(c) cold driven rivets  
(d) none of the above
21. The most commonly used rivet head is  
(a) snap head (b) pan head  
(c) flat head  
(d) all the above are correct
22. For structural steel works, the diameter of hot driven rivets is  
(a) 16 mm (b) 18 mm  
(c) 20 mm or 22 mm (d) all the above
23. The diameter of cold driven rivets ranges from  
(a) 6 mm to 12 mm (b) 12 mm to 22 mm  
(c) 22 mm to 32 mm (d) 32 mm to 42 mm
24. Snap head of a rivet can also be termed as  
(a) round head (b) button head  
(c) both of the above are wrong  
(d) both (a) and (b) are correct
25. While rivetting different types of members of a structure, if flush surface is required on the structural member, then the rivet used will be of the type of  
(a) round head (b) counter sunk head  
(c) pan head (d) snap head
26. If the diameter of a rivet body is 'D', then the diameter of snap head or pan head will be  
(a) 1.4 D (b) 1.5 D (c) 1.6 D (d) 2 D
27. For rivet diameter upto 25 mm, the diameter of rivet hole is larger than the diameter of rivet by  
(a) 1 mm (b) 5 mm (c) 2 mm (d) 2.5 mm
28. The diameter of a rivet hole is made larger than the diameter of rivet by 2 mm for rivet diameters  
(a) upto 12 mm (b) upto 22 mm  
(c) upto 15 mm (d) exceeding 25 mm
29. The distance between two consecutive rivets of adjacent chains and measured at right angles to the direction of force in the structural member is known as  
(a) pitch of rivet  
(b) staggered pitch of rivet  
(c) gauge distance of rivet  
(d) any one of the above
30. The rivet line is also known as  
(a) scribe line (b) back line  
(c) gauge line (d) all the above
31. The distance measured along one rivet line from the centre of a rivet on it to the centre of the adjoining rivet on the adjacent parallel rivet line is known as  
(a) staggered pitch (b) alternate pitch  
(c) reeled pitch (d) any one of the above
32. As per I.S. 800-1971 the working shear stress on gross area of power driven rivets is  
(a) 785 kg/cm<sup>2</sup> (b) 945 kg/cm<sup>2</sup>  
(c) 1025 kg/cm<sup>2</sup> (d) 1575 kg/cm<sup>2</sup>
33. When the load line coincides with the centroid of the rivet group, the rivets are subjected to  
(a) Shear only (b) tension only  
(c) bending only (d) shear as well as tension  
(IES 2012)
34. Pitch of tacking rivets, when double angles connected back and acting as tension member should not be more than  
(a) 2.5 times the nominal diameter of bar  
(b) 500 mm  
(c) 600 mm (d) 1000 mm
35. The maximum shear stress of steel member in flexure shall not exceed  
(a)  $0.4 f_y$  (b)  $0.66 f_y$   
(c)  $0.5 f_y$  (d)  $0.45 f_y$
36. The bearing stress is calculated on the  
(a) cross-sectional area of contact  
(b) mean of cross-sectional area and the net projected area of contact  
(c) net project area of contact  
(d) none of the above
37. Slenderness ratio of a compression member is the ratio of effective length of member to the  
(a) critical load (b) radius of gyration  
(c) area of cross-section (d) weight of section
38. In the plate girder, the vertical stiffeners are provided when the ratio of clear depth to the thickness of web exceeds  
(a) 50 (b) 85 (c) 75 (d) 65



39. When the distance between centers of two adjacent rivets connecting the members subjected to either compression or tension exceeds the maximum pitch, then the additional rivets which are not subjected to the calculated stresses are known as  
 (a) Packing rivets (b) Long-grip rivets  
 (c) Tacking rivets (d) Auxiliary rivets  
 (IES 2011)
40. As per ISI rolled steel beam sections are classified into  
 (a) two section (b) three section  
 (c) four section (d) five section
41. The greatest grip of long rivets shall not exceed  
 (a)  $2d$  (b)  $4d$  (c)  $8d$  (d)  $6d$
42. Rolled steel angle sections are classified  
 (a) equal angles (b) unequal angles  
 (c) bulb angles (d) all the above
43. For field rivets, the permissible stresses are reduced by what percentage?  
 (a) 10% (b) 15% (c) 25% (d)  $33\frac{1}{3}\%$   
 (IES 2006)
44. The gross dia of rivet is the dia of  
 (a) cold rivet measured before driving  
 (b) rivet measured after driving  
 (c) rivet hole  
 (d) none of above
45. What is the maximum permissible longitudinal pitch in staggered riveted compression joints?  
 (a) 500 mm (b) 400 mm (c) 300 mm (d) 100 mm
46. Strength of riveted joint against bearing of rivets is given by  
 (a)  $P_s = N \times d^2 \times f_s$   
 (b)  $P_s = N \times d \times t \times f_s$   
 (c)  $P_s = N \times (p - d) \times t \times f_s$   
 (d)  $P_s = N \times (p + d) \times t \times f_s$
47. The greater clear dimension of web thickness 't' should not exceed  
 (a)  $180t$  (b)  $200t$  (c)  $240t$  (d)  $270t$
48. What is the ratio of the yield stress in power driven shop rivets relative to the permissible bearing stress of mild steel?  
 (a) 1.0 (b) 0.8 (c) 0.6 (d) 0.4  
 (IES 2005)
49. When one member is placed above the other and they are connected by means of rivets, the joint is known as  
 (a) lap joint (b) single cover butt joint  
 (c) double cover butt joint  
 (d) both (a) and (b)
50. The distance between centre to centre of two adjacent rivet holes should not be less than  
 (a) 1.5 times the diameter of rivet hole  
 (b) 1.5 times the diameter of rivet  
 (c) 1.5 times the diameter of rivet head  
 (d) 2.5 times the diameter of rivet  
 (GATE 2007)
51. A riveted joint may experience  
 (a) shear failure (b) shear failure of plates  
 (c) bearing failure (d) bearing failure of rivets  
 (e) all the above (GATE 2008)
52. When two members of a structure are joined by rivets in the form of a lap joint, then the riveted joint may fail due to  
 (a) shear failure of rivets (b) tearing of plates  
 (c) bearing failure of plates  
 (d) all the above are correct
53. As compared to chain riveting, diamond riveting is preferred because  
 (a) width of the plate required is less  
 (b) saving in the material  
 (c) efficiency is more  
 (d) all the above are correct
54. In a structural connection, if the member is subjected to compression, then maximum pitch of the joint should be least of 200 mm or  
 (a)  $12t$  (b)  $16t$  (c)  $32t$  (d)  $16d$
55. Generally the diameter of rivets used in structural members is not less than  
 (a) 6 mm (b) 12 mm (c) 16 mm (d) 20 mm
56. The number of rivets required for a joint are calculated by dividing the stress calculated in a member with the rivet value, but at any joint the number of rivets should not be less than  
 (a) one (b) two  
 (c) three (d) as per the design
57. Generally in bridges, rivets used are of the diameter ranging in between  
 (a) 12 to 16 mm (b) 16 to 22 mm  
 (c) 22 to 25 mm (d) 25 to 40 mm  
 (GATE 2009)
58. The metal added at the joint while welding is known as  
 (a) weld metal (b) filler  
 (c) fillet metal  
 (d) all the above are correct (GATE 2009)
59. When the welding between metals is done in a plastic stage by applying some external pressure, then that type of welding is known as  
 (a) fusion welding (b) pressure welding  
 (c) thermit welding (d) union melt welding
60. Generally for structural steel connections, the process of welding adopted is  
 (a) carbon arc welding (b) oxy-hydrogen welding  
 (c) pressure welding (d) metal arc welding
61. The advantage of welding lies in  
 (a) quick and economic process  
 (b) better appearance of joints  
 (c) rigid joints  
 (d) all the above
62. The disadvantages of welded joints are  
 (a) members are likely to distort in the process of welding



- (b) more possibility of brittle fracture in welding than in riveting  
(c) inspection of welded joints is more difficult and expensive and requires skilled mechanic  
(d) more skilled operators are required  
(e) all the above
63. The fusible material used in welding to dissolve and facilitate the removal of oxides and other undesirable substances is known as  
(a) inert material (b) inert gases  
(c) flux (d) catalytic agent  
(Civil Service Exam. 2008)
64. The coating on wires to be used as electrodes is done in order to  
(a) stabilize the arc and to use A.C. current  
(b) speed up the welding operation by increasing melting of the material  
(c) form a slag over the weld in order to protect the metal from atmospheric contamination  
(d) all the above are correct
65. As compared to riveting, welding is preferred these days because  
(a) it is a silent process (b) it is more economical  
(c) it has more efficiency (d) all the above are correct
66. In automatic welding, the electrodes used for welding are  
(a) coated wires  
(b) simple wires without coating and surrounded with inert gases or powdered flux  
(c) coated wires surrounded with inert gases  
(d) coated wires surrounded with powdered flux  
(GATE 2010)
67. If a structure is under fatigue stresses then the welded joints as compared to rivetted joints will fail  
(a) earlier (b) later  
(c) at the same time (d) not at all
68. As compared to welding, riveting is preferred due to  
(a) ease in construction and maintenance  
(b) ease in the inspection of rivetted joints  
(c) safety of the operator  
(d) all the above are correct
69. Which of the following does not describe a weld type?  
(a) Butt (b) plug  
(c) zig-zag (d) Lap (IES 2003)
70. The type of weld used for joining two surfaces approximately at right angles to each other is known as  
(a) fillet weld (b) U groove weld  
(c) double V groove weld  
(d) single J butt weld  
(GATE 2011)
71. A fillet weld is known as standard fillet weld if the cross-section of the fillet weld is a triangle of the angle of  
(a)  $45^\circ$  (b)  $60^\circ$  (c)  $30^\circ$  (d)  $75^\circ$   
(IES 2010)
72. As per recommendations of I.S. 816, the minimum size of single run fillet weld for a plate of thickness 10 mm or less than 10 mm should be  
(a) 3 mm (b) 7 mm (c) 14 mm (d) 5 mm
73. Fillet weld is not used for joining the parts, when the angle between fusion faces is  
(a) greater than  $120^\circ$   
(b) less than  $60^\circ$   
(c) both (a) and (b) are correct  
(d) both (a) and (b) are wrong
74. For the structural members exposed to atmosphere, the most unsuitable type of weld is  
(a) slot weld (b) butt weld  
(c) intermittent fillet weld (d) plug weld
75. The size of a butt weld is specified by  
(a) throat thickness  
(b) the effective throat thickness  
(c) thickness of thickest part joined  
(d)  $7/8$  of the thickness of thickest part joined
76. The effective length of the fillet weld is  
(a) Total length  $- 2 \times$  throat size  
(b) Total length  $- 2 \times$  weld size  
(c)  $0.7 \times$  total length  
(d) Total length  $- \left( \frac{\text{Weld size}}{\sqrt{2}} \right)$
77. The effective length of intermittent weld, in respect of the thickness of the thinner part joined, should not be less than  
(a) two times (b) four times  
(c) ten times (d) sixteen times
78. The following observations relate to designing of laced column:  
1. Single lacing systems on opposite planes shall preferably be in the same direction so that one is the shadow of the other  
2. Lacing bar should only be a flat  
3. The slenderness ratio of the lacing bars for compression shall only be a flat  
4. Laced compression members are to be provided with tie plates at ends  
Of these observations  
(a) 1, 2, 3 and 4 are correct  
(b) 1, 3 and 4 are correct  
(c) 2 and 3 are correct  
(d) 1 and 4 are correct
79. When the effect of wind or earthquake load is taken into account in the design of a riveted connection, the permissible stresses in rivets may be exceeded by  
(a) 16.66% (b) 33.33% (c) 25% (d) 25%  
(GATE 2011)
80. A mild steel flat subjected to a tensile force of 840 kN is connected to a gusset plate using rivets. If the permissible forces required per pitch length (i) to shear a single rivet, (ii) to crush the rivet and (iii) to tear the



- plate are 50 kN, 80 kN and 60 kN respectively, then the number of rivets required is  
 (a) 12 (b) 14  
 (c) 16 (d) 17 (IES 2012)
81. The effective throat thickness of a fillet weld depends upon  
 (a) angle between fusion faces  
 (b) length of weld  
 (c) permissible shear stress  
 (d) type of weld (IES 2012)
82. For a certain longitudinal span, a beam in an industrial building requires section modulus of  $423.00 \text{ cm}^3$ . Which one of the following sets of sections would be most suitable for this purpose?  
 (a) ISWB 250 @ 40.9 kg/m  
 $Z_{xx} = 475.4 \text{ cm}^3$ ,  $Z_{yy} = 85.7 \text{ cm}^3$   
 (b) ISLB 300 @ 37.7 kg/m  
 $Z_{xx} = 488.8 \text{ cm}^3$ ,  $Z_{yy} = 50.2 \text{ cm}^3$   
 (c) ISLB 325 @ 43.1 kg/m  
 $Z_{xx} = 607.7 \text{ cm}^3$ ,  $Z_{yy} = 61.9 \text{ cm}^3$   
 (d) ISWB 600 @ 145.1 kg/m  
 $Z_{xx} = 38542 \text{ cm}^3$ ,  $Z_{yy} = 423.9 \text{ cm}^3$
83. A single angle steel tie is connected to gusset plates at both ends using rivets. For determining the load carrying capacity of the tie the allowable tensile stress should be multiplied by the  
 (a) gross area of the angle  
 (b) net area of the angle  
 (c) net area of the connected leg plus the effective area of the outstanding leg  
 (d) effective area of connected leg plus gross area of the outstanding leg (Civil Service Exam. 2010)
84. The channels or angles in the compression chords of the steel truss girder bridges are turned outward in order to increase  
 (a) cross-sectional area (b) section modulus  
 (c) torsional constant (d) radius of gyration (GATE 2011)
85. For a propped cantilever subjected to a point load at mid span, the value of collapse loads given by  
 (a)  $8 M_p/L$  (b)  $12 M_p/L$   
 (c)  $6 M_p/L$  (d)  $4 M_p/L$
86. Consider the following factors :  
 1. Large number of loading cycles  
 2. Large variations in stress  
 3. Large stress concentrations  
 Those associated with fatigue failure would include  
 (a) 1 and 2 (b) 1 and 3  
 (c) 2 and 3 (d) 1, 2 and 3
87. In industrial buildings in the northern hemisphere, the advantage of a north-light roof is that it  
 (a) allows sunlight into the building  
 (b) fully exploits the Aurora Borealis  
 (c) permits diffused daylight into the building and helps avoid glare of direct sunlight  
 (d) allows both sunlight and the preventing northern breeze in the following
88. Given that  
 $t$  = thickness of the plates  
 $b$  = width of plates  
 $d$  = diameter of the rivets  
 $n$  = number of rivets in a line  
 $\sigma$  = permissible tensile stress  
 The tearing strength of the joint is given by  
 (a)  $t(b - nd)\sigma$  (b)  $t(b + nd)\sigma$   
 (c)  $\left(bt - \frac{nd}{t}\right)\sigma$  (d)  $\left(bt + \frac{nd}{t}\right)\sigma$
89. Which one of the following statements is correct ?  
 (a) The tensile strength of both structural and rivet steels are same  
 (b) The tensile strength of rivet steel is slightly higher than that of structural steel  
 (c) The tensile strength of rivet steel is slightly lower than that of structural steel  
 (d) The tensile strength of structural steel should be much less than when compared to that of rivet steel
90. Consider the following assumptions  
 1. The shearing stress in all the rivets is uniform  
 2. The bearing stress is not uniform  
 3. Bending of rivets can be neglected  
 The assumption made while designing a riveted joint would include  
 (a) 1, 2 and 3 (b) 1 and 2  
 (c) 2 and 3 (d) 1 and 3
91. The effective throat thickness in mm of a 6 mm size fillet weld with an angle of  $75^\circ$  between the fusion faces is  
 (a) 3.6 (b) 4.0 (c) 4.2 (d) 4.5
92. For compression members with double angle section, unequal angles are preferred to equal angles because  
 (a) easy for connection  
 (b) leads to large value of minimum radius of gyration  
 (c) have lesser effective length  
 (d) saving in gusset plate material
93. In case of intermittent butt weld, the longitudinal space between the effective length of welds is taken not more than  
 (a) four times the thickness of thinner part  
 (b) ten times the thickness of thinner part  
 (c) sixteen times the thickness of thinner part  
 (d) thirty two times the thickness of thinner part (GATE 2009)
94. The width or diameter of slot weld should not be less than  
 (a)  $3 \times$  thickness or 25 mm whichever is greater  
 (b)  $2 \times$  thickness or 20 mm whichever is greater  
 (c)  $4 \times$  thickness or 40 mm whichever is greater  
 (d) none of the above (Civil Service Exam. 2010)



95. As per IS : 816, if the angle between fusion faces of a fillet weld is  $60^\circ - 90^\circ$ , the effective throat thickness is equal to  
 (a)  $0.5 \times \text{size of weld}$  (b)  $0.6 \times \text{size of weld}$   
 (c)  $0.7 \times \text{size of weld}$  (d)  $0.8 \times \text{size of weld}$
96. The size of deep penetration fillet weld is specified as minimum leg length plus  
 (a) 1.2 mm (b) 2.4 mm (c) 3.6 mm (d) 4.8 mm
97. The effective length of fillet should not be less than  
 (a) the size of weld  
 (b) two times the size of weld  
 (c) three times the size of weld  
 (d) four times the size of weld
98. The effective length of fillet should not be less than  
 (a) two times (b) four times  
 (c) ten times (d) sixteen times
99. A structural member subjected to compressive force in a direction parallel to its longitudinal axis is called  
 (a) post (b) stanchion  
 (c) column (d) any one of the above
100. A strut is a structural member subjected to  
 (a) tension in a direction parallel to its longitudinal axis  
 (b) tension in a direction perpendicular to its longitudinal axis  
 (c) compression in a direction perpendicular to its longitudinal axis  
 (d) compression in a direction perpendicular to its longitudinal axis (IES 2012)
101. When compression members are overloaded, then their failure takes place because of  
 (a) direct compression (b) excessive bending  
 (c) bending combined with twisting  
 (d) any one of the above
102. The axial load on column which results in a slight deflected shape of column is called  
 (a) critical load (b) crippling load  
 (c) buckling load (d) any of the above
103. The failure of a column depends upon  
 (a) weight of column (b) length of column  
 (c) slenderness ratio  
 (d) cross sectional area of column
104. When a column is effectively held in position and restrained in direction at one end and at the other end effectively restrained in direction but not held in position, then the effective length of the column will be  
 (a)  $0.670 \times L$  (b)  $0.85 \times L$   
 (c)  $L$  (d)  $2.0 \times L$
105. When a column is effectively held in position and restrained in direction at one end but not held in position or restrained in direction at the other end, then the effective length of the column will be  
 (a)  $2L$  (b)  $L$   
 (c)  $0.75L$  (d)  $0.67L$
106. Slenderness ratio of the column will be  
 (a)  $l \times r$  (b)  $l/r$   
 (c)  $(l+r)^2$  (d)  $\sqrt{l/r}$   
 where  $l$  is effective length as  $r$  is radius of gyration.
107. As per I.S. 800 – 1971, the thickness of an outstanding unstiffened member in compression as compared to its outstanding length should be  
 (a)  $1/14$  (b)  $1/18$  (c)  $1/16$  (d)  $1/24$   
 (GATE 2011)
108. While designing compression members, the slenderness ratio for rolled steel beam sections is assumed as 70 to 90 and so the corresponding working stress is assumed as  
 (a)  $600 \text{ kg/cm}^2$  (b)  $1,000 \text{ kg/cm}^2$   
 (c)  $1,400 \text{ kg/cm}^2$  (d)  $10,000 \text{ kg/cm}^2$   
 (Civil Service Exam. 2008)
109. As per I.S. 800 – 1971, if the diameter of rivets is 16 mm then the minimum width of lacing bar should be  
 (a) 40 mm (b) 50 mm (c) 60 mm (d) 70 mm
110. In a structure generally wires and cables are used as  
 (a) compression member (b) tension member  
 (c) compression or tension  
 (d) to resist shear stresses only
111. In a structure, generally the members used as tension members are  
 (a) wires and cables (b) rods and bars  
 (c) angle and tee section (d) all the above are correct
112. The area used for designing a tension member is the gross cross-sectional area of the member less the area of holes made for connections.  
 For calculating area of the hole, thickness of the member is multiplied  
 (a) by area of the hole  
 (b) by diameter of the hole  
 (c) by circumference of the hole  
 (d) by radius of the hole
113. The maximum value of slenderness ratio of compression members carrying loads resulting from dead loads and superimposed load is  
 (a) 100 (b) 180 (c) 150 (d) 200
114. The formula adopted by Indian Standards Institution for the determination of allowable stress in axial compression is  
 (a) Rankine Golden formula  
 (b) Perry Robertson formula  
 (c) Secant formula  
 (d) Straight line formula
115. The most economical section for a column is  
 (a) square section (b) circular section  
 (c) tubular section (d) hexagonal section
116. Effective length of a column is the length between the points of  
 (a) maximum moments (b) zero shear  
 (c) zero moment (d) none of the above



117. A structural member subjected to tensile force in the direction parallel to its longitudinal axis is called  
 (a) a tension member or a tie  
 (b) strut  
 (c) stanchion  
 (d) none of the above

(IES 2007)

118. In a structure generally wires and cables are used as  
 (a) compression member  
 (b) tension member  
 (c) compression or tension  
 (d) to resist shear stresses only

119. Consider the following statements :

1. The collapse load found in the plastic analysis of a continuous beam is affected by sinking of supports
2. Large elastic stresses are caused at the supports due to sinking of supports

Of these statements

- (a) both 1 and 2 are true  
 (b) 1 is true but 2 is false  
 (c) both 1 and 2 are false  
 (d) 1 is false but 2 is true

120. Consider the following statements regarding tensile test diagrams for carbon steels with varying carbon contents:

As the carbon content increases

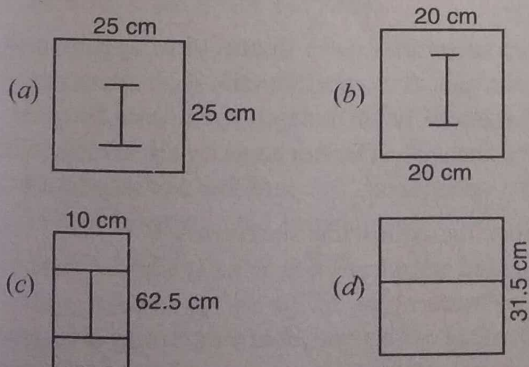
1. the ultimate strength of steel decreases
2. the elongation before fracture increases
3. the ductility of the metal decreases
4. the ultimate strength increases

Of these statements

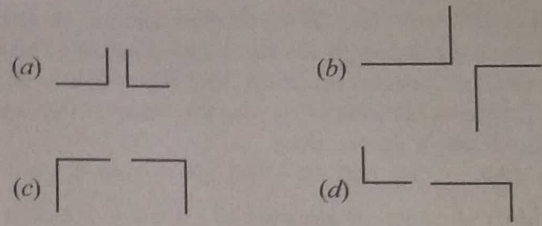
- (a) 3 and 4 are correct  
 (b) 1 and 3 are correct  
 (c) 1, 2 and 3 are correct  
 (d) 1 and 2 are correct

(GATE 2007)

121. A base plate of area  $625 \text{ cm}^2$  has to be provided for an axially loaded column ISMB 200 (flange width 100). Which one of the arrangements shown in the following figures would results in least base plate thickness ?



122. Which one of the following four shapes for a compound column of the same effective height formed with two equal angles, has the highest axial compression load carrying capacity ?



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

- (a)  $2\frac{1}{2}\%$  of axial force in member  
 (b) 5% of axial force in member  
 (c) 10% of axial force in member  
 (d) 20% of axial force in member

124. Which of the following conditions is to be satisfied both in elastic and plastic analysis?

- (a) Equilibrium condition  
 (b) Yield condition  
 (c) Plastic moment condition  
 (d) Mechanism condition

(IES 2011)

125. The area used for designing a tension member is the gross cross-sectional area of the member less the area of holes made for connections. For calculating area of the hole, thickness of the member is multiplied

- (a) by area of the hole  
 (b) by diameter of the hole  
 (c) by circumference of the hole  
 (d) by radius of the hole

126. The single channel section, used as tension member have

- (a) low rigidity in the direction of web and high rigidity in the direction of flange  
 (b) high rigidity in the direction of web and low rigidity in the direction of flange  
 (c) equal rigidity in the direction of web and flange both  
 (d) none of the above

(GATE 2009)

127. The net sectional area of a tension member is equal to  
 (a) gross sectional area minus the maximum deduction for rivet holes

- (b) gross sectional area plus maximum deduction for rivet holes  
 (c) two times the gross sectional area  
 (d) gross sectional area

128. In a tension member, when one or more than one rivet hole is off the line, then the failure of the plate depends upon

- (a) diameter of rivet hole (b) pitch of rivets  
 (c) gauge of rivets (d) all of the above

(GATE 2007)

129. As per I.S. 800 – 1971, for rolled I-beams and channels the allowable stress in axial tension is

- (a)  $1500 \text{ kg/cm}^2$  (b)  $1400 \text{ kg/cm}^2$   
 (c)  $1000 \text{ kg/cm}^2$  (d)  $1200 \text{ kg/cm}^2$



130. As per IS 800-1971, if the tension member is acting at tie member in roof truss and it is subjected to possible reversal of stresses resulting from the action of wind or seismic forces then the slenderness ratio of the member should not be more than  
(a) 150 (b) 200 (c) 300 (d) 350

131. When the radius of gyration of a tension member is  $r$ , the maximum allowable bending stress in tension is  $f_b$ , the distance to the extreme fibre from the neutral axis is  $y$  and the bending moment is  $M$  when the member is subjected to pure bending, then the cross-sectional area ( $A$ ) is given by

(a)  $\frac{My}{f_b \cdot r^2}$  (b)  $\frac{f_b \cdot y^2}{M \cdot y}$  (c)  $\frac{Mr^2}{f_b \cdot y}$  (d)  $\frac{f_b \cdot y}{M \cdot r^2}$

(GATE 2006)

132. As per I.S. 800-1971, for plates, bars and columns if the diameter of their thickness is 20 mm, then the allowable stress in axial tension is 1500 kg/cm<sup>2</sup>, but when the diameter becomes more than 20 mm then this stress will remain as

- (a) 1500 kg/cm<sup>2</sup> (b) 1000 kg/cm<sup>2</sup>  
(c) 1600 kg/cm<sup>2</sup> (d) 1420 kg/cm<sup>2</sup>

133. While designing a tension member, some allowance has to be made for holes required for rivets or bolts. If a tension member consists of two angle sections, then the allowance made is

- (a) one hole for each angle  
(b) two holes for each angle  
(c) half hole for each angle  
(d) none of a, b, c are correct

134. The main beam is a beam which supports

- (a) floor construction (b) joists  
(c) secondary beam (d) both (b) and (c)

135. Any major beam in a structure is known as

- (a) subsidiary beam (b) joist  
(c) girder (d) secondary beam

136. The lighter sections of structural members subjected to transverse loading are called as

- (a) struts (b) tie  
(c) joists (d) stancions (GATE 2008)

137. In roof trusses, the horizontal beams spanning between the two adjacent trusses are known as

- (a) principal rafter (b) cammon rafter  
(c) purlin (d) all the above

138. The beams at the outside wall of a building supporting its share of the floor and also the wall up to the floor above it are known as

- (a) stringers (b) spandrel beams  
(c) trimmers (d) headers

139. In bridge floors, the longitudinal beams supported by floor beams are also called as

- (a) headers (b) trimmers  
(c) stringers (d) rafters

140. The beams resting on purlins are known as

- (a) spandrel beams (b) common rafters  
(c) trimmers (d) stringers

141. Out of all the available rolled steel sections the most commonly used section as beam is

- (a) T-section (b) L-section  
(c) I-section (d) channel section

142. As per IS. 800-1971, the allowable bending stresses (compressive) in rolled I-beams and channels should be

- (a) 700 kg/cm<sup>2</sup> (b) 1650 kg/cm<sup>2</sup>  
(c) 120 kg/cm<sup>2</sup> (d) 2000 kg/cm<sup>2</sup>

143. The maximum shear stress occurs at the neutral axis of the section. For flats, sections and bars, the maximum value should not exceed

- (a) 1650 kg/cm<sup>2</sup> (b) 1575 kg/cm<sup>2</sup>  
(c) 1420 kg/cm<sup>2</sup> (d) 1100 kg/cm<sup>2</sup>

144. When the load is acting downward in a simply supported beam, the bending stress is

- (a) maximum at the extreme fibre  
(b) compressive above the neutr l axis  
(c) tensile above the neutral axis  
(d) both (a) and (b)

145. The allowable shear stress in the web of mild steel beams decreases with

- (a) Decrease in h/t ratio  
(b) Increase in h/t ratio  
(c) Decreases in thickness  
(d) Increase in height

(IES 2011)

146. The following observations refer to two metal specimens 'A' and 'B' of the same size subjected to uni-axial tension test upto failure:

1. The elastic strain energy of A is more than that of B
  2. Area under stress-strain curve of A is less than that of B
  3. The yield strength of A is more than that of B
  4. The percentage elongation of A and B are equal
- Which are of the following statements is true in this regard?

- (a) Specimen A is more ductile than specimen B  
(b) Specimen B is more ductile than specimen A  
(c) The ductility of the two specimens is equal  
(d) The data is sufficient to compare the ductilities of two specimens (Civil Service Exam. 2011)

147. Consider the following statements :

1. Welded structures are usually lighter than riveted structures
  2. Welding allows the arrangement of structural components in such a manner that the joint provides maximum efficiency
  3. During welding, the members do not get distorted
- Of these statements

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



148. In the riveted connection shown in Fig. 12.83, the rivets subjected to maximum stress would include

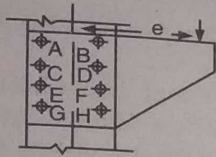


Fig. 12.83.

- (a) A, B, C and D (b) C, D, E and F  
(c) E, F, G and H (d) A, B, G and H
149. For the bolt system shown in Fig. 12.84, force in the maximum stressed bolt is

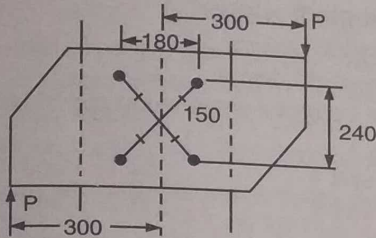


Fig. 12.84.

- (a) 0 (b)  $\frac{p}{4}$  (c)  $\frac{2}{3}p$  (d)  $p$
150. The average shear stress for rolled beams is calculated by dividing the shear force at the cross-section by the
- (a) depth of beam (b) web thickness  
(c) gross-section of web (d) width of flange
151. The gross-section of web of a beam is equal to
- (a) Depth of beam  $\times$  Web thickness  
(b)  $\frac{\text{Depth of beam}}{\text{Web thickness}}$   
(c)  $\frac{2 \times \text{Depth of beam}}{\text{Web thickness}}$  (d)  $\frac{\text{Depth of beam}}{2 \times \text{Web thickness}}$
152. For cantilever beams built in at the support and free at the end, the effective length ( $l$ ) will be equal to
- (a)  $0.85 \times$  length of the beam  
(b) length of the beam  
(c)  $2 \times$  length of the beam  
(d)  $0.75 \times$  length of the beam
153. For cantilever beam continuous at the support, unrestrained against torsion at the support and free at the end, effective length ( $l$ ) will be equal to
- (a)  $0.85 \times$  length of the beam  
(b) length of the beam  
(c)  $2 \times$  length of the beam  
(d)  $3 \times$  length of the beam
154. The effective length of an angle member in a riveted truss is equal to which one of the following?
- (a)  $l$  (b)  $0.85 l$   
(c)  $0.65 l$  (d)  $0.5 l$
- Where  $l$  is the centre to centre distance between the joint. (IES 2007)
155. A rolled I section provides
- (a) Large moment of inertia about X axis with less cross-sectional area  
(b) large moment of resistance as compared to other sections  
(c) greater lateral stability  
(d) all the above
156. For a beam in equilibrium the moment of resistance is
- (a) one-half of the bending moment at the section  
(b) equal to the bending moment at the section  
(c) twice the bending moment at the section  
(d) none of the above.
157. The spacing of rolled steel beams in a jack arch roof is generally in between 1.0 to 1.4 metres, but in any case it should not exceed by
- (a) 1.5 metres (b) 2 metres  
(c) 3 metres (d) 5 metres
158. As per I.S. 2118, in Jack Arch roof, the deflection of the beams shall not exceed by
- (a)  $1/200$  of the span (b)  $1/300$  of the span  
(c)  $1/480$  of the span (d)  $1/600$  of the span
159. While fixing beam with the stanchion, a construction/clearance gap provided is
- (a) 5 mm wide (b) 8 mm wide  
(c) 10 mm wide (d) 13 mm wide
160. The deep structural members subjected to transverse loads are called
- (a) beams (b) columns  
(c) plate girders (d) trusses
161. The maximum span upto which plate girders can be used economically is
- (a) 15 m (b) 10 m  
(c) 30 ms (d) 40 m
162. The vertical plate of a plate girder is termed as
- (a) web plate (b) flange plate  
(c) cover plate (d) none of the above
163. The girders having two or more than two webs are called
- (a) plate girder (b) box girder  
(c) gantry girder  
(d) all the above are correct
164. The horizontal plates connected with the flange angle are known as
- (a) web-plates (b) cover plates  
(c) flange plates  
(d) both (b) and (c) are correct
165. As compared to span, depth of plate girder is generally kept as
- (a)  $1/4$  to  $1/5$  (b)  $1/8$  to  $1/10$   
(c)  $1/10$  to  $1/12$  (d)  $1/20$  to  $1/24$
166. A girder is called shallow plate girder, if its depth is
- (a) less than 50 cm (b) more than 50 cm  
(c) more than 75 cm (d) less than 75 cm



167. The minimum thickness of web plate from corrosion point of view should be  
(a) 3 mm (b) 6 mm (c) 12 mm (d) 20 mm
168. As per I.S. 800-1972, transverse stiffeners are required throughout the length of the plate girder provided the ratio between depth and thickness of the web plate ( $d/t_w$ ) is  
(a) greater than 85 (b) lesser than 85  
(c) greater than 32 (d) lesser than 32
169. The framed structure in which separate straight members are so arranged and connected at their ends that the external load applied at the joints will cause only direct forces in the members is known as  
(a) beam (b) truss  
(c) plate girder (d) portal frame
170. The arrangement of members in a truss is made in such a way so that they should form  
(a) rectangles (b) triangles  
(c) quadrilaterals (d) polygons
171. In single storeyed industrial buildings roof trusses are preferred because they provide  
(a) wider variety of roof shapes  
(b) greater unobstructed interior floor  
(c) economical in cost  
(d) all the above are correct
172. Generally in a simply supported truss, the principal rafter will carry  
(a) compressive forces  
(b) tensile forces  
(c) sometimes compressive and sometimes tensile forces  
(d) all the above are correct
173. In a corrugated galvanized iron sheet, the length of the sheet as per I.S. 277-1962 should be  
(a) 1.8 m and 2.2 m (b) 2.5 m and 2.8 m  
(c) 3.2 m (d) all the above are correct
174. A single angle tie in a welded steel roof truss of an industrial building is subjected to an axial tensile force of 60 kN. If the yield stress of the material is 250 MPa, then the section that would best satisfy the requirement of IS : 800 is  
(a) ISA 50 50 5 (b) ISA 50 50 6  
(c) ISA 55 55 5 (d) ISA 55 55 6
175. Apart from gravity loads, which of the following loads are also considered in the design of a gantry girder located within an industrial building ?  
1. Wind loads 2. Longitudinal loads  
3. Lateral loads  
Select the correct answer using the codes given below:  
**Codes :**  
(a) 1 and 2 (b) 1 and 3  
(c) 2 and 3 (d) 1, 2 and 3
176. The angle of dispersion of a concentrated load on the flange to the web plate of a steel beam is  
(a)  $90^\circ$  with the horizontal  
(b)  $60^\circ$  with the vertical  
(c)  $45^\circ$  with the horizontal  
(d)  $30^\circ$  with the vertical
177. The main disadvantage of deck bridge over through bridge is that  
(a) the tension flange is not laterally supported  
(b) vehicular traffic is directly exposed to wind pressure  
(c) it is not possible to provide portal bracings  
(d) the road has to be taken to a higher level
178. Which of the following methods of design would be suitable for metal structures subjected to stress reversals and impact ?  
1. Simple working stress design  
2. Rigid-plastic design  
3. Semi-rigid design  
4. Elastic-rigid design  
Select the correct answer using the codes given below:  
**Codes :**  
(a) 1, 2, and 4 (b) 1, 3 and 4  
(c) 1, 2, and 3 (d) 2, 3 and 4
179. A steel welded plate girder is subjected to a maximum bending moment of 150 tm. If the maximum permissible bending stress is  $1650 \text{ kg/cm}^2$ , then the most economical depth of the girder will be :  
(a) 60 cm (b) 80 cm (c) 100 cm (d) 120 cm
180. A continuous steel beam is shown in Fig. 12.85. It is subjected to a set of working loads as shown. The plastic design moment of the beam is

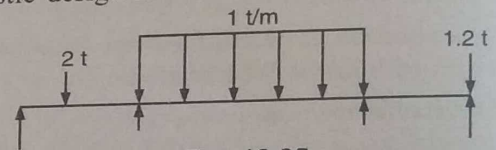


Fig. 12.85.

- (a) 1.20 tm (b) 1.50 tm (c) 1.70 tm (d) 2.04 tm
181. In a C.G.I. sheet the pitch of corrugation, as per I.S. 277-1962 should be  
(a) 18 mm (b) 75 mm (c) 146 mm (d) 32 mm
182. As compared to plan area, while designing a roof truss, the weight of bracing is assumed as  
(a)  $7 \text{ kg/m}^2$  (b)  $10 \text{ kg/m}^2$   
(c)  $1.5 \text{ kg/m}^2$  (d)  $0.90 \text{ kg/m}^2$
183. As per I.S. 875-1964, where the access is not provided, except for maintenance, live load on roofs, while designing a truss, in respect of its plan area is adopted as  
(a)  $10 \text{ kg/m}^2$  (b)  $40 \text{ kg/m}^2$   
(c)  $75 \text{ kg/m}^2$  (d)  $150 \text{ kg/m}^2$
184. As per I.S. 800-1971, if the slope of truss is less than  $30^\circ$  then the ratio of width of purlin to the length of purlin is.  
(a)  $1/30$  (b)  $1/45$  (c)  $1/60$  (d)  $1/90$
185. In a truss, if equal angle section are used, then they should not be  
(a) less than  $50 \times 50 \times 6 \text{ mm}$   
(b) more than  $50 \times 50 \times 6 \text{ mm}$   
(c) less than  $100 \times 100 \times 10 \text{ mm}$   
(d) more than  $100 \times 100 \times 10 \text{ mm}$



186. Top chord of a truss is continuous over joints / a part. Effective lengths of the member in the plane perpendicular to the truss is  
 (a)  $0.7l$  (b)  $0.85l$  (c)  $l$  (d)  $1.5l$

187. If the shape factor of a section is 1.5 and the factor of safety to be adopted is 2, then the load factor will be  
 (a) 3 (b) 4 (c) 1.5 (d) 2

188. Which of the following has influence on the strength of timber?  
 (a) Moisture content (b) Presence of defects  
 (c) Types of grains (d) All of the above

189. Which of the following steel sections should preferably be used at places where torsion occurs?  
 (a) Box-type section (b) Channel section  
 (c) Angle section (d) Any of the above

190. One cubic metre of teak wood weights approximately  
 (a) 200 kg (b) 625 kg  
 (c) 1250 kg (d) 1800 kg

191. A plate used for connecting two or more structural members intersecting each other is termed as  
 (a) Template (b) Gusset plate  
 (c) Base plate (d) Shoe plate (IES 2003)

192. What is the failure of a section shown in the figure above called?

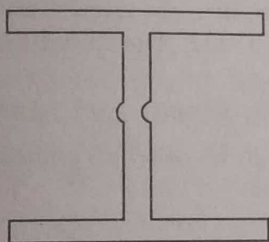


Fig. 12.86.

- (a) Web buckling (b) Web crippling  
 (c) Web crimpling (d) Column buckling  
 Select the correct answer using the codes given below:  
 (a) 1 and 2 (b) 2 and 3  
 (c) 1 and 4 (d) 2 and 4 (IES 2008)

193. A steel beam is connected to a steel column by means of two angles placed on the two sides of the web of the beam. What is it called?  
 (a) Stiffened seat connection  
 (b) Unstiffened seat connection  
 (c) Framed connection  
 (d) Rigid connection (IES 2009)

194. In a cantilever beam, the maximum deflections of the beam should not be greater than

- (a)  $\frac{1}{180}$  (b)  $\frac{1}{120}$  (c)  $\frac{1}{360}$  (d)  $\frac{1}{240}$

195. Consider the following definitions:

1.  $\frac{\text{Collapse load}}{\text{Service load}}$  2.  $\frac{\text{Collapse load}}{\text{Service load} - 1}$

3.  $\frac{\text{Ultimate stress}}{\text{Permissible stress}}$  4.  $\frac{\text{Ultimate stress}}{\text{Permissible stress}} - 1$

Of these definitions, those which relate to 'margin of safety' would include

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

196. Which one of the following methods of design is not suitable for structures subjected to impact and fatigue?  
 (a) Simple design (b) Semi-rigid design  
 (c) Rigid design (d) Plastic design

197. Consider the following systems:

1. Trusses and purlins
2. Suspension system
3. Flat grid roof
4. Shells

When these are used in single deck industrial structures, the correct sequence in increasing order of spans will be

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

198. Ties are load carrying members of a frame which are subjected to  
 (a) transverse loads (b) axial tension loads  
 (c) axial compressive loads  
 (d) torsional loads

199. A mild steel flat subjected to a tensile force of 84 tonnes is connected to a gusset plate using rivets. If the forces required to shear a single rivet, to crush the rivet and to tear the plate per pitch length are 5000 kg, 8000 kg and 6000 kg respectively, then the number of rivets required is  
 (a) 12 (b) 14 (c) 16 (d) 17

200. In a fillet weld the weakest section is the  
 (a) smaller side of the fillet  
 (b) throat of the fillet  
 (c) side perpendicular to force  
 (d) side parallel to force

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

- (a)  $\frac{d}{200}$  (b)  $\frac{d}{85}$  (c)  $\frac{d}{100}$  (d)  $\frac{d}{160}$

202. What is the effective net width of plate shown in Fig. 12.87, for carrying tension?

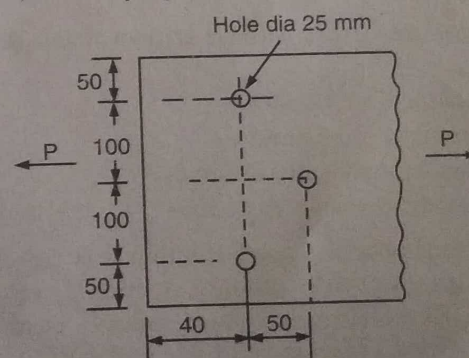


Fig. 12.87.



- (a) 212.5 mm (b) 237.5 mm  
(c) 250 mm (d) 275 mm

203. A single angle tie of a welded steel truss in an industrial shed is required to be designed for an axial tension of 50 kN. If the permissible tensile stress is 150 MPa, then the most suitable section satisfying IS 800 codal requirements will be

- (a) ISA 75 50 6 (b) ISA 60 40 5  
(c) ISA 50 30 4 (d) ISA 45 30 5

204. The given Fig. 12.88 shows a typical section of a crane girder. Consider the following statements in this regard:

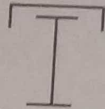


Fig. 12.88.

The function of the top channel is to

1. increase moment of inertia about vertical axis
2. reduce moment of inertia about horizontal axis
3. increase torsional stiffness
4. increase lateral buckling strength

Of these statements

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

205. For a propped cantilever beam of span  $L$  with a central concentrated load  $P$ , the elastic and plastic moment diagrams are shown in Fig. 12.89.

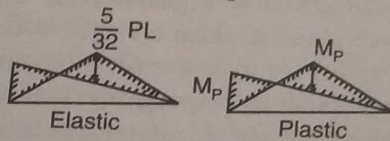


Fig. 12.89.

From these diagrams, it is clear that

- (a) maximum moments are distributed more advantageously in elastic case  
(b) maximum moments are distributed more advantageously in plastic case  
(c) bending moment distribution in both the cases is equally advantageous  
(d) no definite conclusion can be drawn

206. For an I beam the shape factor is 1.12. The factor of safety in bending is 1.5. If the allowable stress is increased by 20% for wind and earthquake loads, then the load factor is

- (a) 1.10 (b) 1.25 (c) 1.35 (d) 1.40

207. Intermediate vertical stiffeners are provided in plate girders to

- (a) eliminate web buckling  
(b) eliminate local buckling  
(c) transfer concentrated loads  
(d) prevent excessive deflection

208. The effective section of a fillet weld is represented by a triangle ABC with sides  $S_1$ ,  $S_2$  and  $S_3$  such that  $S_3 > S_2 > S_1$ . If the allowable shear stress in weld materials is  $\tau$ , the resistance of weld per unit length is :

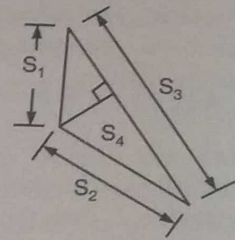


Fig. 12.90.

- (a)  $S_1 \tau$  (b)  $S_2 \tau$  (c)  $S_3 \tau$  (d)  $S_4 \tau$

209. A group of rivets at a joint is subjected to inplane torsion moment  $M$ . The rivets have finished areas of cross-section  $A_i$  ( $i = 1, 2, \dots, n$ ) and distance  $r_i$  ( $i = 1, 2, \dots, n$ ) from CG of the rivet group as shown in Fig. 12.91. The shear force developed in the  $i$ th rivet is proportional to

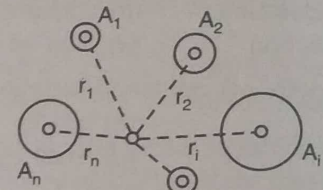


Fig. 12.91.

- (a) area of cross-section,  $A_i$  only  
(b) distance from CG of group,  $r_i$  only  
(c) both  $A_i$  and  $r_i$   
(d) polar moment of inertia of group for areas  $A_i$

210. The steel parts, at right angles, are welded with fillet weld of 10 mm size. The throat thickness of the field weld should be

- (a) 7 mm (b) 10 mm (c) 12 mm (d) 5 mm

211. Critical stress in an axially compressed plate of width 'b' and thickness 't' is

- (a) directly proportional to  $b/t$   
(b) inversely proportional to  $b/t$   
(c) directly proportional to  $(b/t)^2$   
(d) inversely proportional to  $(b/t)^2$

212. For unstiffened flange of a beam in flexural compression the maximum allowable outstand is equal to

- (a)  $20 t$  (b)  $16 t$  (c)  $32 t$  (d)  $14 t$

213. A welded steel plate girder consisting of two flange plates of 350 mm  $\times$  16 mm and a web plate of 1000 mm  $\times$  6 mm requires

- (a) no stiffeners  
(b) vertical stiffeners  
(c) intermediate vertical stiffeners  
(d) vertical and horizontal stiffeners

214. The weakest part in a fillet weld is

- (a) a side parallel to the force  
(b) a side normal to the force  
(c) the one along the throat  
(d) the one normal to the throat

215. The plastic moment capacity of the beam shown in Fig. 12.92 is  $M_o$  the collapse load of the beam is



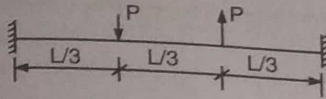


Fig. 12.92.

- (a)  $3 M_o/L$  (b)  $6 M_o/L$   
(c)  $8 M_o/L$  (d)  $12 M_o/L$

216. The common assumption that all rivets share equally a non-eccentric load is valid at a load  
(a) below the working load  
(b) equal to the working load  
(c) above the working load  
(d) equal to the failure load

217. In the plastic analysis which of the following pairs is/are correctly matched ?

(Geometry of steel section) (Shape factor)

- |              |     |
|--------------|-----|
| 1. Rectangle | 2.0 |
| 2. Round     | 1.7 |
| 3. Square    | 1.0 |

Select the correct answer using the codes given below:

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

218. At the location of plastic hinge

- (a) radius of curvature is infinite  
(b) curvature is infinite  
(c) moment of infinite  
(d) flexural stress in infinite

219. A rectangular steel section of width 'b' and depth 'h' has been stressed upto yield point ( $\sigma_y$ ) upto a depth of  $h/4$  from both the top and bottom face under the action of moment 'M'. The magnitude of the moment 'M' is

- (a)  $\frac{10}{24} b h^2 \sigma_y$  (b)  $\frac{1}{4} b h^2 \sigma_y$   
(c)  $\frac{11}{48} b h^2 \sigma_y$  (d)  $\frac{12}{36} b h^2 \sigma_y$

220. A simply supported beam of span 'L' supports a concentrated load 'W' at its midspan. If the cross-section of the beam is an I-section, then the length of elastic-plastic zone of the plastic hinge will be

- (a)  $L/8$  (b)  $L/4$   
(c)  $L/2$  (d)  $3L/4$

221. A continuous beam of constant  $M_p$  has three equal spans and carries total uniformly distributed load 'w' on each span. The value of collapse load for the beam will be

- (a)  $12 M_p/L$  (b)  $11.656 M_p/L$   
(c)  $8.65 M_p/L$  (d)  $4 M_p/L$

222. A channel section is placed in an inclined position carrying vertical loads as shown in Fig. 12.93. If the applied moment for the channel is 'M' due to vertical load than  $M_{xx}$  is given by

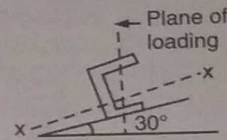


Fig. 12.93.

- (a)  $\frac{\sqrt{3}}{2} M$  (b)  $\frac{1}{2} M$  (c)  $\frac{1}{\sqrt{2}} M$  (d)  $2 M$

223. Z-purlins may be fixed in either orientation, A or B in the Fig. 12.94.

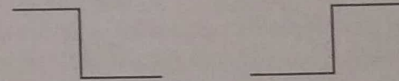


Fig. 12.94.

Which one of the following statement is correct in this regard

- (a) Orientation A is structurally more efficient than orientation B  
(b) Orientation B is structurally more efficient than orientation A.  
(c) Both the orientations are structurally equally efficient  
(d) Neither of the two orientations is structurally efficient

224. A steel plate is 30 cm wide and 10 mm thick. A rivet of nominal diameter 18 mm is driven. The net sectional area of the plate is

- (a) 18.00 cm<sup>2</sup> (b) 28.20 cm<sup>2</sup>  
(c) 28.05 cm<sup>2</sup> (d) 32.42 cm<sup>2</sup>

225. A cantilever steel beam of 3 m span carried a uniformly distributed load of 20 kN/m impulsive of self-weight. The beam comprises ISL B 200 @ 198 N/m, flange 100 mm × 7.3 mm, web thickness 5.4 mm,  $I_{xx} = 1696.6 \text{ cm}^4$ ,  $I_{yy} = 115.4 \text{ cm}^4$ . Bending and shear stress in the beam are respectively.

- (a) 530.47 N/mm<sup>2</sup> and 55.55 N/mm<sup>2</sup>  
(b) 3899.48 N/mm<sup>2</sup> and 82.19 N/mm<sup>2</sup>  
(c) 132.62 N/mm<sup>2</sup> and 27.78 N/mm<sup>2</sup>  
(d) 1949.74 N/mm<sup>2</sup> and 41.10 N/mm<sup>2</sup>

226. Two steel parts, at right angles, are welded with fillet weld of 10 mm size. The throat thickness of the fillet weld should be

- (a) 7 mm (b) 10 mm (c) 12 mm (d) 5 mm

227. Shear centre for an angle — purlin (Fig. 12.95) is located at

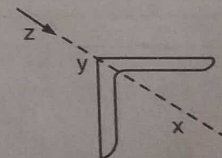


Fig. 12.95.

- (a) X (b) Y  
(c) Z (d) none

228. The deflection of a cantilever beam at free end B applied with a moment M at the same point is



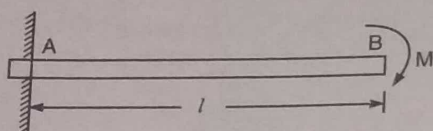


Fig. 12.96.

- (a)  $M l^2/EI$  (b)  $M l^2/2EI$   
 (c)  $M l^2/3EI$  (d)  $M l^2/4EI$

229. When a column is fixed at both ends corresponding Euler's critical load is

- (a)  $\frac{\pi^2 EI}{L^2}$  (b)  $\frac{2\pi^2 EI}{L^2}$   
 (c)  $\frac{3\pi^2 EI}{L^2}$  (d)  $\frac{4\pi^2 EI}{L^2}$

where  $L$  is the length of the column.

230. A cantilever beam curved in plan and subjected to lateral loads will develop at any section

- (a) bending moment and shearing force  
 (b) bending moment and twisting moment  
 (c) twisting moment and shearing force  
 (d) bending moment, twisting moment & shearing force

231. A cantilever beam of span  $l$  subjected to a uniformly distributed load  $w$  per unit length resting on a rigid prop at the tip of the cantilever. The magnitude of the reaction at the prop is

- (a)  $1/8 w l$  (b)  $2/8 w l$   
 (c)  $3/8 w l$  (d)  $4/8 w l$

232. The shape factor of a rectangular section is

- (a) 1.00 (b) 1.50 (c) 2.00 (d) 2.50

233. In a linear structural element

- (a) stiffness is directly proportional to flexibility  
 (b) stiffness is inversely proportional to flexibility  
 (c) stiffness is equal to flexibility  
 (d) stiffness and flexibility are not related

234. For a given shear force across a symmetrical I-section, the intensity of shear stress is maximum at

- (a) extreme fibres  
 (b) centroid of the section  
 (c) at the junction of the flange and the web but on the web  
 (d) at the junction of the flange and the web but on the flange

235. The plastic moment at collapse is

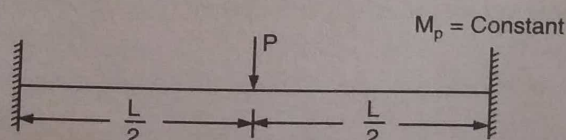


Fig. 12.97.

- (a)  $\frac{PL}{6}$  (b)  $\frac{PL}{8}$   
 (c)  $\frac{PL}{12}$  (d)  $\frac{PL}{16}$

(IES 2012)

236. If  $YY$  is the centroidal axis of a  $T$  beam section subjected to plastic moment,  $M_p$ , the neutral axis lies

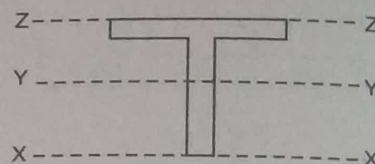


Fig. 12.98.

- (a) above the line  $ZZ$   
 (b) between the lines  $YY$  and  $ZZ$   
 (c) between the lines  $XX$  and  $YY$   
 (d) below the line  $XX$

237. Generally the maximum deflection/span ratio of a steel member should not exceed

- (a)  $\frac{1}{750}$  (b)  $\frac{1}{500}$  (c)  $\frac{1}{325}$  (d)  $\frac{1}{250}$

238. The force in members  $UL$  is

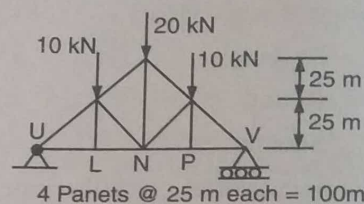


Fig. 12.99.

- (a) 25 kN tension (b) 25 kN compression  
 (c)  $25\sqrt{2}$  kN tension (d)  $15\sqrt{2}$  kN compression

239. Twisting is a problem in welding thin materials because of

- (a) low torsional resistance  
 (b) low shear strength of thin sheets  
 (c) stress concentration at the ends  
 (d) low radius of gyration of thin sections

240. For allowable tensile stress of  $150 \text{ N/mm}^2$  the capacity of single ISA  $100 \times 100 \times 10 \text{ mm}$  as tension member connected by one leg using  $21.5 \text{ mm}$  gross diameter riverts is (GATE 2005)

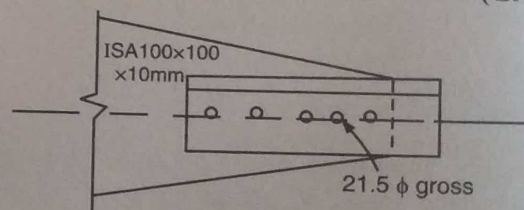


Fig. 12.100.

- (a) 214 kN (b) 285 kN  
 (c) 252.75 kN (d) 1500 kN

241. For the lap connection  $20 \text{ mm}$  nominal diameter rivets are used in  $21.5 \text{ mm}$  diameter holes in plates. For allowable shear stress of  $94.5 \text{ N/mm}^2$  and allowable bearing stress of  $212.5 \text{ N/mm}^2$  in rivet material, the rivert value is

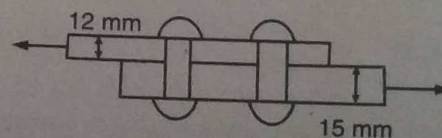


Fig. 12.101.

- (a) 68.6 kN (b) 29.7 kN  
 (c) 54.8 kN (d) 34.3 kN



242. The web buckling in beams may be avoided by  
 (a) stiffening the web  
 (b) limiting the stress that can be used for given  $d_1/t_w$  ratio  
 (c) increasing the span  
 (d) any of the above methods
243. The deflection of a beam may be reduced by  
 (a) decreasing the depth of beam  
 (b) increasing the span  
 (c) providing greater end restraint  
 (d) any of the above methods
244. Size of rivet is specified by  
 (a) shape (b) diameter of head  
 (c) shank diameter (d) weight
245. The shock absorbing capacity of a bolt is increased by  
 (a) proper tightening  
 (b) use of spring washer  
 (c) making shank diameter equal to the core diameter  
 (d) preventing stress concentration anywhere in the bolt
246. The net effective cross sectional area calculated in the steel angle tension member design, accounts for  
 (a) the tensile force and bolt holes  
 (b) the eccentricity of the end connections and the bolt holes  
 (c) the effectiveness of the tack connection along the length  
 (d) the effectiveness of the end connection
247. The maximum allowable compressive stress corresponding to lateral buckling, in a discretely laterally supported symmetrical I beam does not depend upon  
 (a) the modulus of elasticity  
 (b) the radius of gyration about the minor axis  
 (c) the span length of the beam  
 (d) the ratio of overall depth to thickness of the flange
248. The basic assumption of plane sections normal to the neutral axis before bending, remaining plane and normal to the neutral axis after bending, leads to  
 (a) uniform strain over the beam cross section  
 (b) uniform stress over the beam cross section  
 (c) linearly varying strain over the cross sections  
 (d) stress which are proportional to strain at all cross section
249. As per IS 800-1984 the minimum pitch of rivets in a row is recommended as the diameter of the rivet times  
 (a) 2.0 (b) 2.5 (c) 3.0 (d) 4.0
250. As per IS 800-1984 the maximum allowable slenderness ratio of compression members carrying forces resulting from dead load and superimposed load is  
 (a) 180 (b) 250 (c) 300 (d) 400
251. Which one of the following conditions, both elastic and plastic methods of analysis of indeterminate structures have to satisfy ?  
 (a) yield condition  
 (b) mechanism condition  
 (c) equilibrium  
 (d) compatibility of deformation
252. In laced columns, end tie-plates are provided to  
 (a) check the buckling column  
 (b) keep the column components in position  
 (c) check the distortion of column sections at ends because of unbalanced horizontal force from lacings  
 (d) prevent rotation of elements (IES 2012)
253. For heavy vibrating loads in industrial buildings, the roof trusses are provided with  
 (a) diagonal bracing in the plane of lower chord members  
 (b) diagonal bracing in the plane of upper chord members  
 (c) knee bracing  
 (d) sway bracing (IES 2012)
254. Which of the following elements of a pitched roof industrial steel building primarily resists lateral load parallel to the ridge ?  
 (a) Bracing (b) Purlin (c) Truss (d) Column (IES 2012)
255. Purlins are to be chosen for a roof truss of 20 m span, 4 m rise. Trusses are spaced at 4.5 m centre-to-centre. A most efficient design results from the use of  
 (a) angle sections  
 (b) channel section  
 (c) circular hollow sections  
 (d) square hollow sections (IES 2011)
256. The T-beam bridge is generally constructed as  
 (a) deck bridge (b) through bridge  
 (c) semi-through bridge  
 (d) none of the above is correct (GATE 2011)
257. Through which of the following responses may a steel tubular hinged strut fail ?  
 1. Compression 2. Bending  
 3. Overall buckling 4. Torsion  
 5. Skin buckling  
 (a) 2, 4, and 5 (b) 1, 2, and 3  
 (c) 3, 4 and 5 (d) 1, 3 and 5 (IES 2010)
258. The end supports of a bridge are called  
 (a) piers (b) abutments  
 (c) wing walls (d) abutment piers
259. The purlins in roof trusses are placed at the panel points essentially to avoid  
 (a) Axial force in rafter (b) Shear force in rafter  
 (c) Deflection in rafter (d) Bending moment in rafter (IES 2008)
260. The pair of walls constructed on both sides of abutments to retain the earth banks are called  
 (a) wing walls (b) breast walls  
 (c) retaining walls (d) curtain walls
261. Which one of the following is correct? Steel structures are ideally suitable for impact loads because they have high  
 (a) toughness value (b) elastic modulus  
 (c) design stress (d) plastic modulus (IES 2007)
262. According to IRC recommendations, the bridge approaches should be straight for a minimum length of  
 (a) 25 m (b) 30 m  
 (c) 50 m (d) 15 m



263. How are structural members composed of two angles back to back connected throughout their length?

- (a) By locking rivets (b) By spacing rivets  
(c) By gripping rivets (d) By tacking rivets

(IES 2008)

264. The intermediate supports in a bridge are called

- (a) bearing wall (b) abutment  
(c) wing wall (d) piers

265. Fixed plate bearing are suitable for spans

- (a) less than 8 m (b) upto 12 m  
(c) 12 to 20 m (d) more than 20 m

266. Deep cast base bearings are suitable for span

- (a) less than 8 m (b) upto 12 m  
(c) 12 to 20 m (d) more than 20 m

267. Rocker bearings are suitable for spans

- (a) less than 8 m (b) upto 12 m  
(c) 12 to 20 m (d) more than 20 m

268. Sliding plate bearings are suitable for spans

- (a) less than 8 m (b) upto 12 m  
(c) 12 to 20 m (d) more than 20 m

269. If one end of a bridge has rocker and roller bearing then other end of the bridge will be

- (a) fixed end bearing (b) rocker bearing  
(c) deep cast base bearing  
(d) rocker and roller bearing

270. By providing side plate bearing, the movement of the bridge due to variation in temperature and loading will be in

- (a) angular direction (b) longitudinal direction  
(c) angular and longitudinal direction  
(d) vertical direction.

271. Trussed bridges are usually constructed as

- (a) deck bridges (b) through bridges  
(c) semi-through bridges (d) any type of bridge

272. Steel girder bridges are mainly used on railway bridges and their maximum span should not exceed

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

273. Towers are constructed to support

- (a) floating bridges  
(b) arch type of bridges  
(c) suspension type of bridges  
(d) bowstring type of bridges

274. The method of erection by assembling the girder on the levelled bed of the river and then lifting in position is adopted when the steel girders are having span upto

- (a) 10 m (b) 15 m (c) 50 m (d) 30 m

275. Special maintenance of bridges is carried out once in

- (a) 3 to 6 months (b) 1 to 2 years  
(c) 2 to 4 years (d) 3 to 5 years

276. Useful life of permanent bridges is considered to be

- (a) 15 years (b) 25 years  
(c) 50 years (d) 100 years

277. A portal frame subjected to central concentrated load and horizontal load is shown in Fig. 12.102. Likely positions where plastic hinges can form in combined mechanism would include.

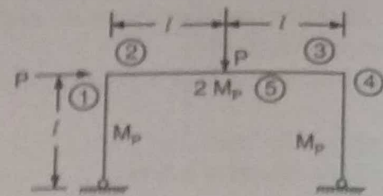


Fig. 12.102.

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

278. Three types of continuous beams supporting a concentrated load at the central span are shown in Fig. 12.102 (a), (b) and (c). Collapse loads ( $P_u$ ) corresponding to Fig. 12.103 (a), (b) and (c) respectively are  $P_1$ ,  $P_2$  and  $P_3$ . Which one of the following conclusions is correct?

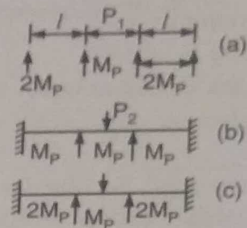


Fig. 12.103.

- (a)  $P_3 > P_2 > P_1$  (b)  $P_3 = P_2$  and  $P_2 > P_1$   
(c)  $P_1 = P_2 = P_3$  (d)  $P_1 = P_3$  and  $P_1 > P_2$

279. Which one of the following diagrams corresponds to the load-deflection characteristics upto plastic collapse of the beam shown below?

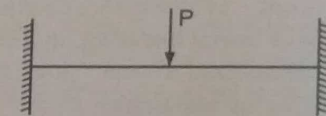
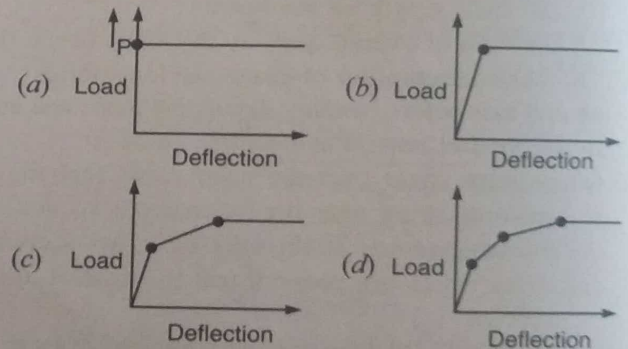


Fig. 12.104.



(IES 2010)

280. All the location of a plastic hinge.

- (a) radius of curvature is infinite  
(b) curvature is infinite  
(c) moment is infinite  
(d) flexible stress is infinite.

(IES 2010)

281. Consider the following stipulations in designing a laced column

1. Single lacing systems on opposite planes shall preferably be in the same direction so that one is the shadow of the other.
2. Lacing bar should be a flat section.
3. The slenderness ratio of the lacing bars for compression shall not exceed 180.



4. Laced compression members are to be provided with tie plates at ends.

Which of these observations is/are correct ?

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

(IES 2010)

282. For the continuous beam shown in figure below, what is the reaction at A at collapse, by plastic analysis ?

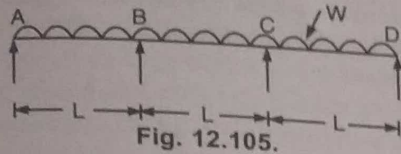


Fig. 12.105.

- (a)  $\frac{5wL}{12}$  (b)  $\frac{wL}{2}$  (c)  $\frac{7wL}{12}$  (d)  $\frac{13wL}{24}$   
(IES 2010)

283. Consider the following statements:

1. Shape factor
2. Length of the beam
3. Type of loading
4. Yield strength of material

Which of these affect the influence length of plastic hinge in a beam ?

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

(IES 2010)

284. A propped cantilever of span  $L$  is subjected to a concentrated load at midspan. If  $M_p$  is the plastic moment capacity of the beam, the value of collapse load will be

- (a)  $\frac{12M_p}{L}$  (b)  $\frac{8M_p}{L}$  (c)  $\frac{6M_p}{L}$  (d)  $\frac{4M_p}{L}$   
(IES 2010)

## ANSWERS

- |          |          |          |          |          |          |          |          |          |          |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1. (a)   | 2. (a)   | 3. (c)   | 4. (a)   | 5. (c)   | 6. (b)   | 7. (d)   | 8. (c)   | 9. (c)   | 10. (a)  |
| 11. (d)  | 12. (d)  | 13. (a)  | 14. (a)  | 15. (c)  | 16. (d)  | 17. (b)  | 18. (b)  | 19. (d)  | 20. (c)  |
| 21. (a)  | 22. (d)  | 23. (b)  | 24. (d)  | 25. (b)  | 26. (c)  | 27. (b)  | 28. (d)  | 29. (c)  | 30. (d)  |
| 31. (d)  | 32. (b)  | 33. (a)  | 34. (d)  | 35. (d)  | 36. (c)  | 37. (b)  | 38. (b)  | 39. (c)  | 40. (d)  |
| 41. (c)  | 42. (d)  | 43. (a)  | 44. (b)  | 45. (c)  | 46. (b)  | 47. (d)  | 48. (b)  | 49. (a)  | 50. (d)  |
| 51. (e)  | 52. (d)  | 53. (d)  | 54. (a)  | 55. (b)  | 56. (b)  | 57. (c)  | 58. (b)  | 59. (b)  | 60. (d)  |
| 61. (d)  | 62. (e)  | 63. (c)  | 64. (d)  | 65. (d)  | 66. (b)  | 67. (a)  | 68. (b)  | 69. (c)  | 70. (c)  |
| 71. (a)  | 72. (a)  | 73. (c)  | 74. (c)  | 75. (b)  | 76. (b)  | 77. (b)  | 78. (d)  | 79. (c)  | 80. (d)  |
| 81. (a)  | 82. (a)  | 83. (b)  | 84. (d)  | 85. (c)  | 86. (a)  | 87. (c)  | 88. (a)  | 89. (c)  | 90. (d)  |
| 91. (c)  | 92. (b)  | 93. (c)  | 94. (a)  | 95. (c)  | 96. (b)  | 97. (d)  | 98. (b)  | 99. (d)  | 100. (c) |
| 101. (d) | 102. (d) | 103. (c) | 104. (c) | 105. (a) | 106. (b) | 107. (c) | 108. (b) | 109. (b) | 110. (c) |
| 111. (d) | 112. (b) | 113. (c) | 114. (c) | 115. (c) | 116. (c) | 117. (a) | 118. (b) | 119. (a) | 120. (a) |
| 121. (b) | 122. (b) | 123. (a) | 124. (a) | 125. (b) | 126. (b) | 127. (a) | 128. (d) | 129. (a) | 130. (d) |
| 131. (a) | 132. (d) | 133. (a) | 134. (d) | 135. (c) | 136. (c) | 137. (c) | 138. (b) | 139. (c) | 140. (b) |
| 141. (c) | 142. (b) | 143. (d) | 144. (d) | 145. (b) | 146. (c) | 147. (b) | 148. (d) | 149. (d) | 150. (c) |
| 151. (a) | 152. (a) | 153. (d) | 154. (b) | 155. (d) | 156. (b) | 157. (b) | 158. (c) | 159. (c) | 160. (c) |
| 161. (d) | 162. (a) | 163. (b) | 164. (d) | 165. (c) | 166. (d) | 167. (b) | 168. (a) | 169. (b) | 170. (b) |
| 171. (d) | 172. (c) | 173. (d) | 174. (a) | 175. (c) | 176. (b) | 177. (d) | 178. (b) | 179. (d) | 180. (c) |
| 181. (b) | 182. (c) | 183. (c) | 184. (c) | 185. (a) | 186. (b) | 187. (a) | 188. (d) | 189. (a) | 190. (b) |
| 191. (b) | 192. (b) | 193. (c) | 194. (a) | 195. (a) | 196. (d) | 197. (c) | 198. (b) | 199. (d) | 200. (b) |
| 201. (b) | 202. (b) | 203. (b) | 204. (d) | 205. (b) | 206. (d) | 207. (a) | 208. (d) | 209. (b) | 210. (a) |
| 211. (d) | 212. (b) | 213. (c) | 214. (c) | 215. (b) | 216. (d) | 217. (c) | 218. (a) | 219. (c) | 220. (a) |
| 221. (b) | 222. (a) | 223. (c) | 224. (c) | 225. (c) | 226. (a) | 227. (b) | 228. (b) | 229. (d) | 230. (d) |
| 231. (c) | 232. (b) | 233. (b) | 234. (b) | 235. (b) | 236. (b) | 237. (c) | 238. (a) | 239. (a) | 240. (c) |
| 241. (c) | 242. (a) | 243. (c) | 244. (c) | 245. (c) | 246. (b) | 247. (a) | 248. (d) | 249. (b) | 250. (a) |
| 251. (d) | 252. (c) | 253. (c) | 254. (b) | 255. (b) | 256. (a) | 257. (d) | 258. (b) | 259. (d) | 260. (a) |
| 261. (a) | 262. (d) | 263. (d) | 264. (d) | 265. (c) | 266. (c) | 267. (d) | 268. (c) | 269. (b) | 270. (b) |
| 271. (b) | 272. (b) | 273. (c) | 274. (d) | 275. (d) | 276. (c) | 277. (d) | 278. (c) | 279. (c) | 280. (b) |
| 281. (d) | 282. (a) | 283. (b) | 284. (c) |          |          |          |          |          |          |