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Question Bank

of

Strength of Materials (PCME-523)

Submitted By:

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A.P(ME)

Objective Questions MET – 06

1. The property by which a body returns to its original shape after removal of the force is called
a) Plasticity
b) Elasticity
c) Ductility
d) Malleability

2. The property of a material by which it can be beaten or rolled into thin plates is called
a) Malleability
b) Plasticity
c) Ductility
d) Elasticity

3. Which law is also called as the elasticity law?
a) Bernoulli's law
b) Stress law
c) Hooke's law
d) Poisson's law

4. The materials which have the same elastic properties in all directions are called _____
a) Isotropic
b) Brittle
c) Homogeneous
d) Hard

5. A member which does not regain its original shape after removal of the load producing deformation is said _____
a) Plastic
b) Elastic
c) Rigid
d) None of the mentioned

6. The body will regain it is previous shape and size only when the deformation caused by the external forces, is within a certain limit. What is that limit?
a) Plastic limit
b) Elastic limit
c) Deformation limit
d) None of the mentioned

7. The materials which have the same elastic properties in all directions are called _____
a) Isotropic
b) Brittle
c) Homogenous
d) Hard

8. As the elastic limit reaches, tensile strain _____
a) Increases more rapidly
b) Decreases more rapidly
c) Increases in proportion to the stress
d) Decreases in proportion to the stress

9. What kind of elastic materials are derived from a strain energy density function?
a) Cauchy elastic materials
b) Hypo elastic materials
c) Hyper elastic materials
d) None of the mentioned

10. What the number that measures an object's resistance to being deformed elastically when stress is applied to it?
a) Elastic modulus
b) Plastic modulus
c) Poisson's ratio
d) Stress modulus

11. A cube subjected to three mutually perpendicular stress of equal intensity p expenses a volumetric strain
(A) $3p/ E \times (2/m - 1)$
(B) $3p/ E \times (2 - m)$
(C) $3p/ E \times (1 - 2/m)$
(D) $E/ 3p \times (2/m - 1)$

12. The strain energy stored in a solid circular shaft subjected to shear stress (τ) is:
(Where, G = Modulus of rigidity for the shaft material)
(A) $\tau^2/ 2G \times$ Volume of shaft
(B) $\tau/ 2G \times$ Volume of shaft
(C) $\tau^2/ 4G \times$ Volume of shaft
(D) $\tau/ 4G \times$ Volume of shaft

13. The strain energy stored in a solid circular shaft in torsion, subjected to shear stress (τ), is:
(Where, G = Modulus of rigidity for the shaft material)
(A) $\tau^2/ 2G \times$ Volume of shaft
(B) $\tau/ 2G \times$ Volume of shaft
(C) $\tau^2/ 4G \times$ Volume of shaft
(D) $\tau/ 4G \times$ Volume of shaft

14. The stress induced in a body, when suddenly loaded, is _____ the stress induced when the same load is applied gradually.
(A) Equal to
(B) One-half
(C) Twice
(D) Four times

15. A material obeys hook's law up to
(A) Plastic limit
(B) Elastic limit
(C) Yield point
(D) Limit of proportionality

16. The torque transmitted by a solid shaft of diameter (D) is (where τ = Maximum allowable shear stress)
(A) $\pi /4 \times \tau \times D^3$
(B) $\pi /16 \times \tau \times D^3$
(C) $\pi /32 \times \tau \times D^3$
(D) $\pi /64 \times \tau \times D^3$

17. The torque transmitted by a hollow shaft of outer diameter (d_1) and inner diameter (d2) is (where, τ = Maximum allowable shear stress)
(A) $\pi /4 \times \tau \times (d_1^4 - d^4_2)/ d_1$
(B) $\pi /16 \times \tau \times (d_1^4 - d^4_2)/ d_1$
(C) $\pi /32 \times \tau \times (d_1^4 - d^4_2)/ d_1$
(D) $\pi /64 \times \tau \times (d_1^4 - d^4_2)/ d_1$

18. If Th is the torque resisting capacity of a hollow shaft and Ts is that of a solid shaft, of the same material, length and weight. Then,
(A) Th>Ts
(B) Th<Ts
(C) Th = Ts
(D) None of these

19. If Kh is the torque resisting capacity of a hollow shaft and Ks is that of a solid shaft, of the same material, length and weight. Then,
(A) Kh> Ks
(B) Kh< Ks
(C) Kh = Ks
(D) None of these

20. After reaching the yielding stage while testing a mild steel specimen, strain
(A) Becomes constant
(B) Starts decreasing
(C) Increases without any increase in load
(D) None of the above

21. Principal planes are planes having
(A) Maximum shear stress
(B) No shear stress
(C) Minimum shear stress
(D) None of the above

22. If the slenderness ratio for a column is 100, then it is said to be a _____ column.
(A) Long
(B) Medium
(C) Short
(D) None of these

23. A body is subjected to a tensile stress of 1200 MPa on one plane and another tensile stress of 600 MPa on a plane at right angles to the former. It is also subjected to a shear stress of 400 MPa on the same planes. The maximum normal stress will be
(A) 400 MPa
(B) 500 MPa
(C) 900 MPa
(D) 1400 MPa

24. Young's modulus of a wire is defined as the stress which will increase the length of wire compared to its original length by
(A) Half
(B) Same amount
(C) Double
(D) One-fourth

25. True stress strain-curve for materials is plotted between
(A) Load/original cross-sectional area and change in length/original length
(B) Load/ instantaneous cross-sectional area and loge (original area/ instantaneous area)
(C) Load/ instantaneous cross-sectional area and change in length/ original length
(D) Load/ instantaneous area and instantaneous area/original area

26. A hollow shaft of same cross-section area as compared to a solid shaft transmit
(A) Same torque
(B) Less torque
(C) More torque
(D) Unpredictable

27. A steel bar of 5 mm is heated from 25°C to 45°C and it is free to expand. The bar will induce
(A) No stress
(B) Shear stress
(C) Tensile stress
(D) Compressive stress

28. Two shafts 'A' and 'B' transmit the same power. The speed of shaft 'A' is 250 r.p.m. and that of shaft 'B' is 300 r.p.m.
(A) The shaft 'B' has the greater diameter
(B) The shaft 'A' has the greater diameter
(C) Both are of same diameter
(D) None of these

29. The intensity of stress which causes unit strain is called
(A) Unit mass
(B) Modulus of rigidity
(C) Bulk modulus
(D) Modulus of Elasticity

30. A thick cylindrical shell having ro and ri as outer and inner radii, is subjected to an internal pressure (p). The maximum tangential stress at the inner surface of the shell is
(A) $(ro^2 - ri^2)/ 2p\ ri^2$
(B) $2p\ ri^2/ (ro^2 - ri^2)$
(C) $p\ (ro^2 + ri^2)/ (ro^2 - ri^2)$
(D) $p\ (ro^2 - ri^2)/ (ro^2 + ri^2)$

31. A vertical column has two moments of inertia (i.e. Ixx and Iyy). The column will tend to buckle in the direction of the
(A) Axis of load
(B) Perpendicular to the axis of load
(C) Maximum moment of inertia
(D) Minimum moment of inertia

32. Strain energy is the
(A) Energy stored in a body when strained within elastic limits
(B) Energy stored in a body when strained up to the breaking of a specimen
(C) Maximum strain energy which can be stored in a body
(D) Proof resilience per unit volume of a material

33. The neutral axis of the cross-section a beam is that axis at which the bending stress is
(A) Zero
(B) Minimum
(C) Maximum
(D) Infinity

34. A composite bar made up of steel and copper bars of equal lengths are heated through 100°C. The stresses developed shall be
(A) Tensile in both the material
(B) Tensile in steel and compressive in copper
(C) Compressive in steel and tensile in copper
(D) Compressive in both the materials

35. Euler's formula holds good only for
(A) Short columns
(B) Long columns
(C) Both short and long columns
(D) Weak columns

36. The bending moment at a point on a beam is the algebraic _____ of all the moments on either side of the point.
(A) Sum
(B) Difference
(C) Multiplication
(D) None of the above

37. The maximum diameter of the hole that can be punched from a plate of maximum shear stress 1/4th of its maximum crushing stress of punch, is equal to (where t = Thickness of the plate)
(A) t
(B) 2t
(C) 4t
(D) 8t

38. Within elastic limit, stress is
(A) Inversely proportional to strain
(B) Directly proportional to strain
(C) Square root of strain
(D) Equal to strain

39. Two closely coiled helical springs 'A' and 'B' are equal in all respects but the number of turns of spring 'A' is half that of spring 'B' The ratio of deflections in spring 'A' to spring 'B' is
(A) 1/8
(B) 1/4
(C) 1/2
(D) 2

40. The deformation per unit length is called
(A) Tensile stress
(B) Compressive stress
(C) Shear stress
(D) Strain

41. The shape of cantilever for uniformly distributed load will be
(A) Straight line
(B) Parabolic
(C) Elliptical
(D) Cubic

42. For a simply supported beam of length ‘l’, when a concentrated load W is applied in the center of the beam, the maximum deflection is
(A) $5WL^3/ 384EI$
(B) $WL^3/384EI$
(C) $WL^3/ 348EI$
(D) $WL^3/ 48EI$

43. The point of contra flexure is a point where
(A) Shear force changes sign
(B) Shear force is maximum
(C) Bending moment changes sign
(D) Bending moment is maximum

44. The maximum stress produced in a bar of tapering section is at
(A) Smaller end
(B) Larger end
(C) Middle
(D) Anywhere

45. The ultimate tensile stress of mild steel compared to ultimate compressive stress is
(A) Same
(B) More
(C) Less
(D) Unpredictable

46. The energy stored in a body when strained within elastic limit is known as
(A) Resilience
(B) Proof resilience
(C) Strain energy
(D) Impact energy

47. Modular ratio of two materials is the ratio of
(A) Strains
(B) Stress and strain
(C) Shear stress and shear strain
(D) Moduli and elasticity

48. In compression test, the fracture in cast iron specimen would occur along
(A) The axis of load
(B) An oblique plane
(C) At right angles to the axis of specimen
(D) Would not occur

49. A coil is cut into two halves, the stiffness of cut coil will be
(A) Double
(B) Half
(C) Same
(D) None of these

50. The bending stress in a beam is _____ section modulus.
(A) Inversely proportional to two times
(B) Directly proportional to
(C) Inversely proportional to
(D) None of these

51. When shear force at a point is zero, then bending moment is _____ at that point.
(A) Zero
(B) Minimum
(C) Maximum
(D) Infinity

52. Elasticity of Mild Steel specimen is defined by
(A) Hooke's law
(B) Yield point
(C) Plastic flow
(D) Proof stress

53. When a bar is cooled to -5°C, it will develop
(A) No stress
(B) Shear stress
(C) Tensile stress
(D) Compressive stress

54. If the radius of wire stretched by a load is doubled, then its Young's modulus will be
(A) Doubled
(B) Halved
(C) Becomes four times
(D) None of the above

55. In order to know whether a column is long or short, we must know its
(A) Ultimate shear stress of the column
(B) Factor of safety
(C) Torque resisting capacity
(D) Slenderness ratio

56. A masonry dam may fail due to
(A) Tension in the masonry of the dam and its base
(B) Overturning of the dam
(C) Crushing of masonry at the base of the dam
(D) Any one of the above

57. Impact strength of a material is an index of its
(A) Toughness
(B) Tensile strength
(C) Capability of being cold worked
(D) Hardness

58. In order to prevent crushing of masonry at the base of the dam, the maximum stress should be _____ the permissible stress of the soil.
(A) Equal to
(B) Less than
(C) More than
(D) None of these

59. Volumetric strain for a rectangular specimen of length 'l', breadth 'b' and thickness 't' subjected to a pull of 'P' is given by
(A) e (1 - 2m)
(B) e (1 - 2/m)
(C) e (m - 2)
(D) e (2/m - 1)

60. When a body is subjected to two equal and opposite pushes, as a result of which the body tends to reduce its length, then
(A) The stress and strain induced is compressive
(B) The stress and strain induced is tensile
(C) Both A and B is correct
(D) None of these

61. A thin cylindrical shell of diameter (d) and thickness (t) is subjected to an internal pressure (p). The ratio of longitudinal strain to volumetric strain is
(A) (m - 1)/ (2m - 1)
(B) (2m - 1)/ (m - 1)
(C) (m - 2)/ (3m - 4)
(D) (m - 2)/ (5m - 4)

62. Modulus of rigidity is defined as the ratio of
(A) Longitudinal stress to longitudinal strain
(B) Volumetric stress to volumetric strain
(C) Lateral stress to Lateral strain
(D) Shear stress to shear strain

63. In the torsion equation $T/J = \tau/r = G\theta/ L$, the term J/R is called
(A) Shear modulus
(B) Section modulus
(C) Polar modulus
(D) None of these

64. Strain re-setters are used to
(A) Measure shear strain
(B) Measure linear strain
(C) Measure volumetric strain
(D) Relieve strain

65. When a rectangular beam is loaded transversely, the maximum compressive stress is developed on the
(A) Top layer
(B) Bottom layer
(C) Neutral axis
(D) Every cross-section

66. In a uniform bar, supported at one end in position, the maximum stress under self weight of bar shall occur at the
(A) Middle of bar
(B) Supported end
(C) Bottom end
(D) None of these

67. When both ends of a column are fixed, the effective length is
(A) Its own length
(B) Twice its length
(C) Half its length
(D) $1/\sqrt{2} \times$ its length

68. A composite shaft consisting of two stepped portions having spring constants K_1 and K_2 is held between two rigid supports at the ends. Its equivalent spring constant is
(A) $K_1 K_2$
(B) $(K_1 + K_2)/ 2$
(C) $(K_1 + K_2)/ K_1 K_2$
(D) $K_1 K_2/ (K_1 + K_2)$

69. Slenderness of a column is zero when
(A) Ends are firmly fixed
(B) Column is supported on all sides throughout the length
(C) Length is equal to radius of gyration
(D) Length is twice the radius of gyration

70. Resilience is the
(A) Energy stored in a body when strained within elastic limits
(B) Energy stored in a body when strained up to the breaking of the specimen maximum strain
(C) Energy which can be stored in a body
(D) None of the above

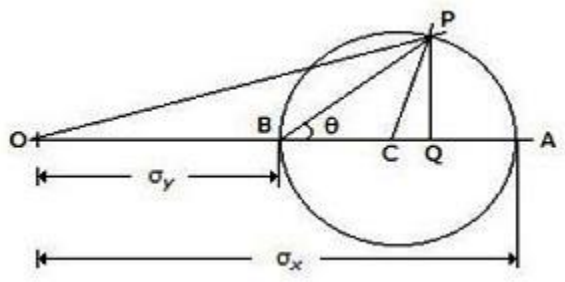
71. A shaft revolving at ω rad/s transmits torque (T) in Nm. The power developed is
(A) T.ω watts
(B) 2π. T.ω watts
(C) 2π. T.ω/75 watts
(D) 2π. T.ω/4500 watts

72. The buckling load for a given material depends on
(A) Slenderness ratio and area of cross-section
(B) Poisson's ratio and modulus of elasticity
(C) Slenderness ratio and modulus of elasticity
(D) Slenderness ratio, area of cross-section and modulus of elasticity

73. When a beam is subjected to a bending moment, the strain in a layer is _____ the distance from the neutral axis.
(A) Equal to
(B) Directly proportional to
(C) Inversely proportional to
(D) Independent of

74. In the tensile test, the phenomenon of slow extension of the material, i. e. stress increasing with the time at a constant load is called
(A) Creeping
(B) Yielding
(C) Breaking
(D) Plasticity

75. The given figure shows the Mohr's circle of stress for two unequal and like principal stresses (σx and σy) acting at a body across two mutually perpendicular planes. The normal stress on an oblique section making an angle θ with the minor principle plane is given by



(A) OC
(B) OP
(C) OQ
(D) PQ

76. A double strap butt joint with equal straps is
(A) Always in single shear
(B) Always in double shear
(C) Either in single shear or double shear
(D) None of these

77. The stress induced in a body due to suddenly applied load compared to when it is applied gradually is
(A) Same
(B) Half
(C) Two times
(D) Four times

78. The rivets are used for _____ fastenings.
(A) Permanent
(B) Temporary
(C) Semi-permanent
(D) None of these

79. When two plates are butt together and riveted with cover plates with two rows of rivets, the joint is known as
(A) Lap joint
(B) Butt joint
(C) Single riveted single cover butt joint
(D) Double riveted double cover butt joint

80. A bar of copper and steel form a composite system, which is heated to a temperature of 40°C. The stress induced in the copper bar will be
(A) Tensile
(B) Compressive
(C) Shear
(D) Zero

81. A boiler shell 200 cm diameter and plate thickness 1.5 cm is subjected to internal pressure of 1.5 MN/m, and then the hoop stress will be
A) 30 MN/m^2
(B) 50 MN/m^2
(C) 100 MN/m^2
(D) 200 MN/m^2

82. When a thin cylindrical shell is subjected to an internal pressure, the volumetric strain is (where ε_1 = Hoop strain, and ε_2 = Longitudinal strain)
(A) $2\varepsilon_1 - \varepsilon_2$
(B) $2\varepsilon_1 + \varepsilon_2$
(C) $2\varepsilon_2 - \varepsilon_1$
(D) $2\varepsilon_2 + \varepsilon_1$

83. Shear stress induced in a shaft subjected to tension will be
(A) Maximum at periphery and zero at center
(B) Maximum at center
(C) Uniform throughout
(D) None of the above

84. The relation between equivalent length (L) and actual length (l) of a column for both ends fixed is
(A) $L = l/2$
(B) $L = l/\sqrt{2}$
(C) $L = l$
(D) $L = 2l$

85. Strain is defined as the ratio of
(A) Change in volume to original volume
(B) Change in length to original length
(C) Change in cross-sectional area to original cross-sectional area
(D) Any one of the above

86. The percentage reduction in area of a cast iron specimen during tensile test would be of the order of
(A) More than 50%
(B) 25-50%
(C) 10-25%
(D) Negligible

87. The deformation of a bar under its own weight is _____ the deformation, if the same body issubjected to a direct load equal to weight of the body.
(A) Equal to
(B) Half
(C) Double
(D) Quadruple

88. The ratio of maximum shear stress developed in a rectangular beam and a circular beam of the samecross-sectional area is
(A) 2/3
(B) 3/4
(C) 1
(D) 9/8

89. Formula based on IS codes is based on
(A) Straight line formula
(B) Euler's formula
(C) Rankine's formula
(D) Secant formula

90. Resilience of a material is considered when it is subjected to
(A) Frequent heat treatment
(B) Fatigue
(C) Creep
(D) Shock loading

91. The buckling load for a given column depends upon
(A) Area of cross-section of the column
(B) Length and least radius of gyration of the column
(C) Modulus of elasticity for the material of the column
(D) All of the above

92. The shear force at the center of a simply supported beam with a gradually varying load from zero atboth ends to w per meter at the center, is
(A) Zero
(B) wl/4
(C) wl/2
(D) $wl^2/2$

93. A riveted joint in which the number of rivets decrease from innermost to outer most rows is called
(A) Chain riveted joint
(B) Diamond riveted joint
(C) Crisscross riveted joint
(D) Zigzag riveted joint

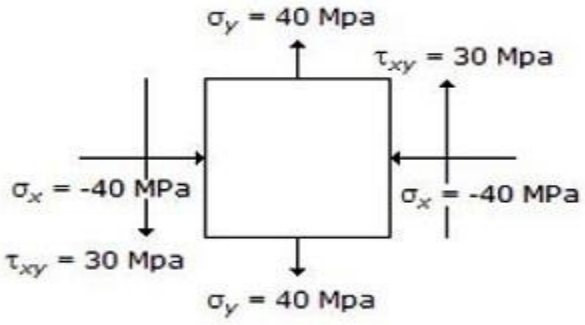
94. A closely-coiled helical spring is cut into two halves. The stiffness of the resulting spring will be
(A) Same
(B) Double
(C) Half
(D) One-fourth

95. The torsional rigidity of a shaft is expressed by the
(A) Maximum torque it can transmit
(B) Number of cycles it undergoes before failure
(C) Elastic limit up to which it resists torsion, shear and bending stresses
(D) Torque required to produce a twist of one radian per unit length of shaft

96. The limit of eccentricity for no tensile conditions for a column of circular section of diameter (d) is
(A) d/4
(B) d/8
(C) d/12
(D) d/16

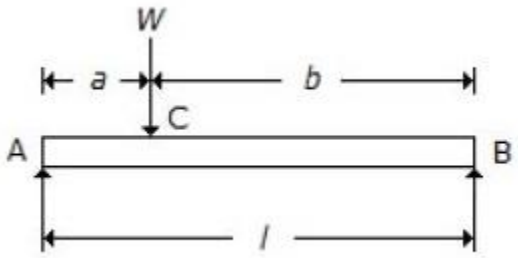
97. The property of a material by virtue of which a body returns to its original, shape after removal of the load is called
(A) Plasticity
(B) Elasticity
(C) Ductility
(D) Malleability

98. The state of stress at a point in a loaded member is shown in the below figure. The magnitude of maximum shear stress is



(A) 10 MPa
(B) 30 MPa
(C) 50 MPa
(D) 100 MPa

99. For a beam, as shown in the below figure, the deflection at C is (where E = Young's modulus for the beam material, and I = Moment of inertia of the beam section.)



(A) Wl3/48 EI
(B) $Wa^2b^2/3EIl$
(C) $[Wa/(a\sqrt{3}) \times EIl] \times (l^2 - a^2)3/2$
(D) 5Wl3/384 EI

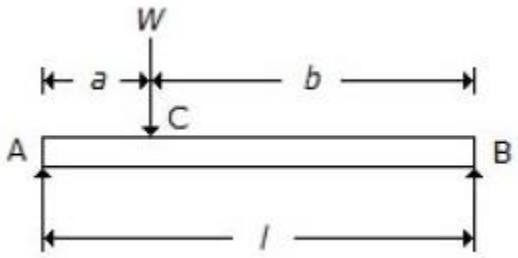
100. A concentrated load is one which
(A) Acts at a point on a beam
(B) Spreads non-uniformly over the whole length of a beam
(C) Spreads uniformly over the whole length of a beam
(D) Varies uniformly over the whole length of a beam

101. The stress necessary to initiate yielding is
(A) Considerably greater than that necessary to continue it
(B) Considerably lesser than that necessary to continue it
(C) Greater than that necessary to stop it
(D) Lesser than that necessary to stop it

102. A lap joint is always in _____ shear.
(A) Single
(B) Double
(C) Both A and B
(D) None of these

103. When it is indicated that a member is elastic, it means that when force is applied, it will
(A) Not deform
(B) Be safest
(C) Stretch
(D) Not stretch

104. For a beam, as shown in the below figure, when the load W is applied in the center of the beam, the maximum deflection is

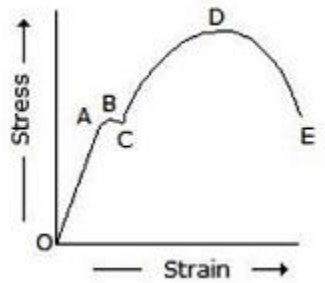


(A) Wl3 / 48EI
(B) 5Wl3 / 384EI
(C) Wl3 / 392EI
(D) Wl3 / 384EI

105. The relation between Young's modulus (E), shear modulus (C) and bulk modulus (K) is given by
(A) E = 3K.C/(3K + C)
(B) E = 6K.C/(3K + C)
(C) E = 9K.C/(3K + C)
(D) E = 12K.C/(3K + C)

106. The distance between the centers of the rivets in adjacent rows of zigzag riveted joint is known as
(A) Pitch
(B) Back pitch
(C) Diagonal pitch
(D) Diametric pitch

107. In the below figure, the stress corresponding to point ‘D’ is



(A) Yield point stress
(B) Breaking stress
(C) Ultimate stress
(D) Elastic limit

108. A body is subjected to a direct tensile stress of 300 MPa in one plane accompanied by a simple shear stress of 200 MPa. The maximum shear stress will be
(A) -100 MPa
(B) 250 MPa
(C) 300 MPa
(D) 400 MPa

109. A cylindrical section having no joint is known as
(A) Joint less section
(B) Homogeneous section
(C) Perfect section
(D) Seamless section

110. A beam which is fixed at one end and free at the other is called
(A) Simply supported beam
(B) Fixed beam
(C) Overhanging beam
(D) Cantilever beam

111. The neutral axis of a transverse section of a beam passes through the centre of gravity of the section and is
(A) In the vertical plane
(B) In the horizontal plane
(C) In the same plane in which the beam bends
(D) At right angle to the plane in which the beam bends

112. The value of Poisson's ratio for steel is between
(A) 0.01 to 0.1
(B) 0.23 to 0.27
(C) 0.25 to 0.33
(D) 0.4 to 0.6

113. The columns whose slenderness ratio is less than 80, are known as
(A) Short columns
(B) Long columns
(C) Weak columns
(D) Medium columns

114. The stress developed in a material at breaking point in extension is called
(A) Breaking stress
(B) Fracture stress
(C) Yield point stress
(D) Ultimate tensile stress

115. For riveting, the size of hole drilled in plates is _____ shank diameter of rivet.
(A) Equal to
(B) Less than
(C) Greater than
(D) None of these

116. Proof resilience per material is known as
(A) Resilience
(B) Proof resilience
(C) Modulus of resilience
(D) Toughness

117. The capacity of a strained body for doing work on the removal of the straining force, is called
(A) Strain energy
(B) Resilience
(C) Proof resilience
(D) Impact energy

118. In a tensile test on mild steel specimen, the breaking stress as compared to ultimate tensile stress is
(A) More
(B) Less
(C) Same
(D) More/less depending on composition

119. A column of length (l) with both ends fixed may be considered as equivalent to a column of length _____ with both ends hinged.
(A) l/8
(B) l/4
(C) l/2
(D) l

120. If the depth is kept constant for a beam of uniform strength, then its width will vary in proportional to
(A) Bending moment (i.e. M)
(B) Bending moment^2 (i.e. M^2)
(C) Bending moment^3 (i.e. M^3)
(D) Bending moment^4 (i.e. M^4)

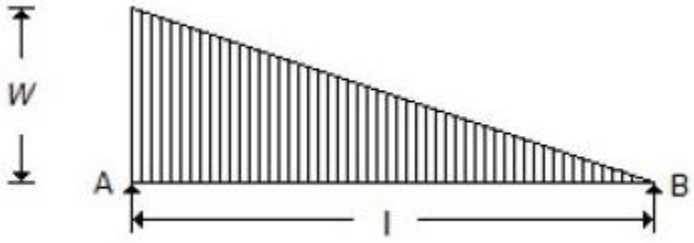
121. In a tensile test, near the elastic limit zone, the
(A) Tensile strain increases more quickly
(B) Tensile strain decreases more quickly
(C) Tensile strain increases in proportion to the stress
(D) Tensile strain decreases in proportion to the stress

122. The pull required to crush the rivet per pitch length is
(A) p.t.σt
(B) d.t.σc
(C) $\pi/4 \times d^2 \times \sigma t$
(D) $\pi/4 \times d^2 \times \sigma c$

123. The total strain energy stored in a body is termed as
(A) Resilience
(B) Proof resilience
(C) Modulus of resilience
(D) Toughness

124. The extension of a circular bar tapering uniformly from diameter d_1 at one end to diameter d_2 at the other end and subjected to an axial pull of 'P' is given by
(A) $\delta l = 4PE/ \pi l^2$
(B) $\delta l = 4\pi ld^2/PE$
(C) $\delta l = 4Pl/\pi Ed_1d_2$
(D) $\delta l = 4PlE/ \pi d_1d_2$

125. The maximum bending moment for the beam shown in the below figure, is



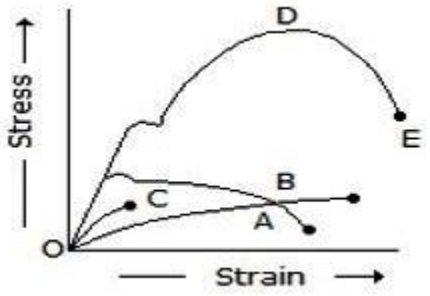
(A) $wl^2/3\sqrt{3}$
(B) $wl^2/6\sqrt{3}$
(C) $wl^2/9\sqrt{3}$
(D) $wl^2/12\sqrt{3}$

126. Efficiency of a riveted joint is the ratio of its strength (max. load it can resist without failure) to the strength of the unpunched plate in
(A) Tension
(B) Compression
(C) Bearing
(D) Any one of the above

127. The pull required to tear off the plate per pitch length is (where p = Pitch of rivets, t = Thickness of plates, and σt, τ and σc = Permissible tensile, shearing and crushing stresses respectively)
(A) $(p - 2d)\, t \times \sigma c$
(B) $(p - d)\, t \times \tau$
(C) $(p - d)\, t \times \sigma t$
(D) $(2p - d)\, t \times \sigma t$

128. In a belt drive, the pulley diameter is doubled, the belt tension and pulley width remaining same. The changes required in key will be
(A) Increase key length
(B) Increase key depth
(C) Increase key width
(D) Double all the dimensions

129. In the below figure, curve D represents_____.

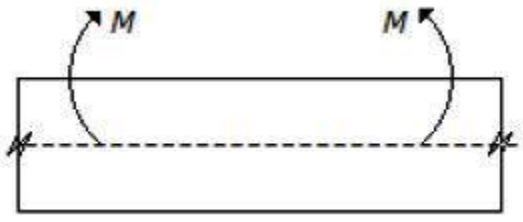


(A) Mild steel
(B) Cast iron
(C) Concrete
(D) Bone of these

130. The bending moment of a cantilever beam of length 'l' and carrying a uniformly distributed load of 'w' per unit length is _____ at the fixed end.
(A) wl/4
(B) wl/2
(C) wl
(D) $wl^2/2$

131. Young's modulus is defined as the ratio of
(A) Volumetric stress and volumetric strain
(B) Lateral stress and lateral strain
(C) Longitudinal stress and longitudinal strain
(D) Shear stress to shear strain

132. The layer at the center of gravity of the beam as shown in the below figure, will be



(A) In tension
(B) In compression
(C) Neither in tension nor in compression
(D) None of these

133. When a body is subjected to a direct tensile stress (σx) in one plane accompanied by a simple shear stress (τxy), the minimum normal stress is
(A) $(\sigma x/2) + (1/2) \times \sqrt{(\sigma x^2 + 4\ \tau^2 xy)}$
(B) $(\sigma x/2) - (1/2) \times \sqrt{(\sigma x^2 + 4\ \tau^2 xy)}$
(C) $(\sigma x/2) + (1/2) \times \sqrt{(\sigma x^2 - 4\ \tau^2 xy)}$
(D) $(1/2) \times \sqrt{(\sigma x^2 + 4\ \tau^2 xy)}$

134. Tensile strength of a material is obtained by dividing the maximum load during the test by the
(A) Area at the time of fracture
(B) Original cross-sectional area
(C) Average of (A) and (B)
(D) Minimum area after fracture

135. The section modulus of a circular section about an axis through its C.G., is
(A) $\pi d^2/4$
(B) $\pi d^2/16$
(C) $\pi d3/16$
(D) $\pi d3/32$

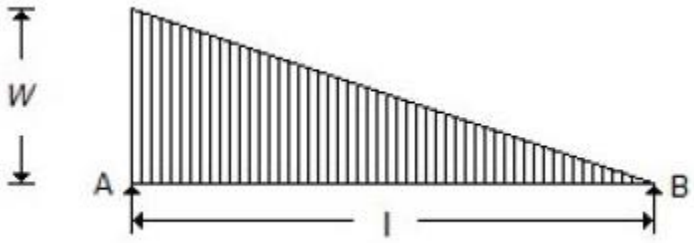
136. If a part is constrained to move and heated, it will develop
(A) Principal stress
(B) Tensile stress
(C) Compressive stress
(D) Shear stress

137. The moment of resistance of a balanced reinforced concrete beam is based on the stresses in
(A) Steel only
(B) Concrete only
(C) Steel and concrete both
(D) None of these

138. The property of a material by virtue of which it can be beaten or rolled into plates is called
(A) Malleability
(B) Ductility
(C) Plasticity
(D) Elasticity

139. In case of an under-reinforced beam, the depth of actual neutral axis is _____ that of the critical neutral axis.
(A) Same as
(B) Less than
(C) Greater than
(D) None of these

140. The energy absorbed in a body, when it is strained within the elastic limits, is known as
(A) Strain energy
(B) Resilience
(C) Proof resilience
(D) Modulus of resilience
141. A simply supported beam with a gradually varying load from zero at 'B' and 'w' per unit length at 'A' is shown in the below figure. The shear force at 'B' is equal to



(A) wl/6
(B) wl/3
(C) wl
(D) 2wl/3

142. A fletched beam is used to
(A) Change the shape of the beam
(B) Effect the saving in material
(C) Equalize the strength in tension and compression
(D) Increase the cross-section of the beam

143. Percentage reduction in area performing tensile test on cast iron may be of the order of
(A) 50%
(B) 25%
(C) 20%
(D) 30%

144. A beam is loaded as cantilever. If the load at the end is increased, the failure will occur
(A) In the middle
(B) At the tip below the load
(C) At the support
(D) Anywhere

145. The assumption made in Euler's column theory is that
(A) The failure of column occurs due to buckling alone
(B) The length of column is very large as compared to its cross-sectional dimensions
(C) The column material obeys Hooke's law
(D) All of the above

146. If the rivets in adjacent rows are staggered and the outermost row has only one rivets, the arrangement of the rivets is called
(A) Chain riveting
(B) Zigzag riveting
(C) Diamond riveting
(D) Crisscross riveting

147. The point of contraflexure is a point where
(A) Shear force changes sign
(B) Bending moment changes sign
(C) Shear force is maximum
(D) Bending moment is maximum

148. The value of shear stress which is induced in the shaft due to the applied couple varies
(A) From maximum at the center to zero at the circumference
(B) From zero at the center to maximum at the circumference
(C) From maximum at the center to minimum at the circumference
(D) From minimum at the center to maximum at the circumference

149. The extremities of any diameter on Mohr's circle represent
(A) Principal stresses
(B) Normal stresses on planes at 45°
(C) Shear stresses on planes at 45°
(D) Normal and shear stresses on a plane

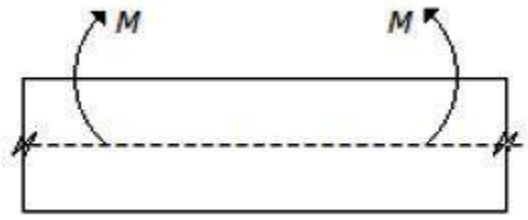
150. The materials having same elastic properties in all directions are called
(A) Ideal materials
(B) Uniform materials
(C) Isotropic materials
(D) Piratical materials

151. The ratio of the largest load in a test to the original cross-sectional area of the test piece is called
(A) Elastic limit
(B) Yield stress
(C) Ultimate stress
(D) Breaking stress

152. A column is said to be a short column, when
(A) Its length is very small
(B) Its cross-sectional area is small
(C) The ratio of its length to the least radius of gyration is less than 80
(D) The ratio of its length to the least radius of gyration is more than 80

153. The total elongation produced in a bar of uniform section hanging vertically downwards due to its own weight is equal to that produced by a weight
(A) Of same magnitude as that of bar and applied at the lower end
(B) Half the weight of bar applied at lower end
(C) Half of the square of weight of bar applied at lower end
(D) One fourth of weight of bar applied at lower end

154. The lower layer of the beam as shown in the below figure, will be



(A) In tension
(B) In compression
(C) Neither in tension nor in compression
(D) None of these

155. The tensile strength of the welded joint for double fillet is (where s = Leg or size of the weld, l = Length of weld, and σt = Allowable tensile stress for weld metal)
(A) 0.5 s.l.σt
(B) s.l.σt
(C) √2 s.l.σt
(D) 2.s.l.σt

156. If a material expands freely due to heating it will develop
(A) Thermal stresses
(B) Tensile stress
(C) Bending
(D) No stress

157. When a body is subjected to biaxial stress i.e. direct stresses (σx) and (σy) in two mutually perpendicular planes accompanied by a simple shear stress (τxy), then maximum normal stress is
(A) $(\sigma x + \sigma y)/2 + (1/2) \times \sqrt{[(\sigma x - \sigma y)^2 + 4\ \tau^2 xy]}$
(B) $(\sigma x + \sigma y)/2 - (1/2) \times \sqrt{[(\sigma x - \sigma y)^2 + 4\ \tau^2 xy]}$
(C) $(\sigma x - \sigma y)/2 + (1/2) \times \sqrt{[(\sigma x + \sigma y)^2 + 4\ \tau^2 xy]}$
(D) $(\sigma x - \sigma y)/2 - (1/2) \times \sqrt{[(\sigma x + \sigma y)^2 + 4\ \tau^2 xy]}$

158. The stress at which extension of the material takes place more quickly as compared to the increase in load is called
(A) Elastic point of the material
(B) Plastic point of the material
(C) Breaking point of the material
(D) Yielding point of the material

159. A cantilever beam is one which is
(A) Fixed at both ends
(B) Fixed at one end and free at the other end
(C) Supported at its ends
(D) Supported on more than two supports

160. In a prismatic member made of two materials so joined that they deform equally under axial stress, the unit stresses in two materials are
(A) Equal
(B) Proportional to their respective moduli of elasticity
(C) Inversely proportional to their moduli of elasticity
(D) Average of the sum of moduli of elasticity

161. The ductility of the material _____ with the decrease in percentage elongation of a specimen under tensile test.
(A) Increases
(B) Decreases
(C) Remain same
(D) None of these

162. The length of a conical bar is l, diameter of base is d and weight per unit volume is w. It is fixes at its upper end and hanging freely. The elongation of the bar under the action of its own weight will be
(A) $wl^2/2E$
(B) $wl^2/4E$
(C) $wl^2/6E$
(D) $wl^2/8E$

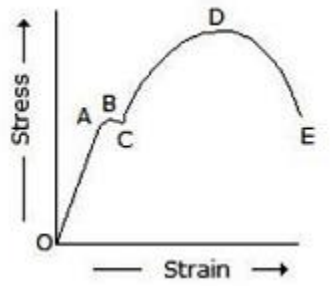
163. The ratio of linear stress to the linear strain is called
(A) Modulus of rigidity
(B) Modulus of elasticity
(C) Bulk modulus
(D) Poisson's ratio

164. For no tension condition in the base of a short column of circular section, the line of action of the load should be within a circle of diameter equal to _____ of the main circle.
(A) One-half
(B) One-third
(C) One-fourth
(D) One-eighth

165. The shear modulus of most materials with respect to the modulus of elasticity is
(A) Equal to half
(B) Less than half
(C) More than half
(D) None of these

166. Whenever a material is loaded within elastic limit, stress is _____ strain.
(A) Equal to
(B) Directly proportional to
(C) Inversely proportional to
(D) None of these

167. In the below figure, Hook's law holds good, for the portion from_____.



(A) O to A
(B) B to D
(C) D to E
(D) None of these

168. The point of contraflexure occurs in
(A) Cantilever beams
(B) Simply supported beams
(C) Overhanging beams
(D) Fixed beams

169. The bending moment of a cantilever beam of length l and carrying a gradually varying load from zero at free end and w per unit length at the fixed end is _____ at the fixed end.
(A) wl/2
(B) wl
(C) $wl^2/2$
(D) $wl^2/6$

170. The maximum deflection of a cantilever beam of length 'l' with a uniformly distributed load of 'w' per unit length is (where W = wl)
(A) $Wl^3/3EI$
(B) $Wl^3/8EI$
(C) $Wl^3/16EI$
(D) $Wl^3/48EI$

171. When a bar of length l, width b and thickness t is subjected to a pull of P, its
(A) Length, width and thickness increases
(B) Length, width and thickness decreases
(C) Length increases, width and thickness decreases
(D) Length decreases, width and thickness increases

172. A beam of T-section is subjected to a shear force of F. The maximum shear force will occur at the
(A) Top of the section
(B) Bottom of the section
(C) Neutral axis of the section
(D) Junction of web and flange

173. The maximum deflection of a fixed beam of length l carrying a central point load W is
(A) $wl^3/48$ EI
(B) $wl^3/96$ EI
(C) $wl^3/192$ EI
(D) $wl^3/384$ EI

174. The torque transmitted by a hollow shaft of outer diameter (D) and inner diameter (d) is
(A) $(\pi/4) \times \tau [(D^2 - d^2)/d]$
(B) $(\pi/16) \times \tau [(D^3 - d^3)/d]$
(C) $(\pi/16) \times \tau [(D^4 - d^4)/d]$
(D) $(\pi/32) \times \tau [(D^4 - d^4)/d]$

175. At the neutral axis of a beam
(A) The layers are subjected to maximum bending stress
(B) The layers are subjected to minimum bending stress
(C) The layers are subjected to compression
(D) The layers do not undergo any strain

176. The bending moment of a cantilever beam of length l and carrying a uniformly distributed load of w per unit length is _____ at the free end.
(A) Zero
(B) wl/4
(C) wl/2
(D) wl

177. For a shaft, the shear stress at a point is _____ the distance from the axis of the shaft.
(A) Equal to
(B) Directly proportional to
(C) Inversely proportional to
(D) None of these

178. The bending moment diagram for a simply supported beam carrying a uniformly distributed load of 'w' per unit length, will be
(A) A horizontal line
(B) A vertical line
(C) An inclined line
(D) A parabolic curve

179. When one plate overlaps the other and the two plates are riveted together with two rows of rivets, the joint is known as
(A) Single riveted lap joint
(B) Double riveted lap joint
(C) Double riveted single cover butt joint
(D) Double riveted double cover butt joint

180. When a body is subjected to a direct tensile stress (σ) in one plane, the maximum shear stress is _____ the maximum normal stress.
(A) Equal to
(B) One-half
(C) Two-third
(D) Twice

181. The ductility of a material _____ with the increase in percentage reduction in area of a specimen under tensile test.
(A) Increases
(B) Decreases
(C) Remains same
(D) None of these

182. Rivets are generally specified by
(A) Thickness of plates to be joined
(B) Overall length
(C) Shank diameter
(D) Diameter of head

183. The simply supported beam 'A' of length ‘l’ carries a central point load ‘W’. Another beam 'B' is loaded with a uniformly distributed load such that the total load on the beam is ‘W’. The ratio of maximum deflections between beams 'A' and 'B' is

(A) 5/8
(B) 8/5
(C) 5/4
(D) 4/5

184. The rectangular beam 'A' has length ‘l’, width ‘b’ and depth ‘d’. Another beam 'B' has the same length and depth but width is double that of 'A'. The elastic strength of beam 'B' will be _____ as compared to beam ‘A’.

(A) Same
(B) Double
(C) Four times
(D) Six times

185. The bending moment in the center of a simply supported beam carrying a uniformly distributed load of w per unit length is

(A) Zero
(B) $wl^2/2$
(C) $wl^2/4$
(D) $wl^2/8$

186. The polar modulus for a solid shaft of diameter (D) is

(A) $\pi D^2/4$
(B) $\pi D^3/16$
(C) $\pi D^3/32$
(D) $\pi D^4/64$

187. The slenderness ratio is the ratio of

(A) Area of column to least radius of gyration
(B) Length of column to least radius of gyration
(C) Least radius of gyration to area of column
(D) Least radius of gyration to length of column

188. A simply supported beam 'A' of length ‘l’, breadth ‘b’ and depth ‘d’ carries a central load ‘W’. Another beam 'B' of the same dimensions carries a central load equal to 2W. The deflection of beam 'B' will be _____ as that of beam 'A'.
(A) One-fourth
(B) One-half
(C) Double
(D) Four times

189. When a bar of length ‘l’ and diameter ‘d’ is rigidly fixed at the upper end and hanging freely, then the total elongation produced in the bar due to its own weight is (where w = Weight per unit volume of the bar)
(A) $wl/2E$
(B) $wl^2/2E$
(C) $wl^3/2E$
(D) $wl^4/2E$

190. In a riveted joint, when the rivets in the various rows are opposite to each other, the joint is said to be
(A) Chain riveted
(B) Zig-zag riveted
(C) Diamond riveted
(D) None of these

191. When a rectangular bar of length l, breadth b and thickness t is subjected to an axial pull of P, then linear strain (ε) is given by (where E = Modulus of elasticity)
(A) $\varepsilon = P/b.t.E$
(B) $\varepsilon = b.t.E/P$
(C) $\varepsilon = b.t/P.E$
(D) $\varepsilon = P.E/b.t$

192. Which of the following statement is correct?
(A) The size of hole drilled in riveting plates is less than the actual size of rivet.
(B) The center to center distance between two consecutive rivets in a row is called margin.
(C) Rivets are generally specified by its shank diameter.
(D) Tearing of plates can be avoided by taking the pitch of rivets equal to 1.5 times the diameter of rivet hole.

193. A beam of triangular section is placed with its base horizontal. The maximum shear stress occurs at
(A) Apex of the triangle
(B) Mid of the height
(C) Center of gravity of the triangle
(D) Base of the triangle

194. The Young's modulus of a material is 125 GPa and Poisson’s ratio is 0.25. The modulus of rigidity of me material is
(A) 30 GPa
(B) 50 GPa
(C) 80 GPa
(D) 100 GPa

195. In the above question, the normal stress on an oblique section will be maximum, when θ is equal to
(A) 0°
(B) 30°
(C) 45°
(D) 90°

196. In a simply supported beam carrying a uniformly distributed load w per unit length, the point of contraflexure
(A) Lies in the center of the beam
(B) Lies at the ends of the beam
(C) Depends upon the length of beam
(D) Does not exist

197. In case of eccentrically loaded struts _____ is preferred.
(A) Solid section
(B) Hollow section
(C) Composite section
(D) Reinforced section

198. In a thin cylindrical shell subjected to an internal pressure p, the ratio of longitudinal stress to the hoop stress is
(A) 1/2
(B) 3/4
(C) 1
(D) 1.5

199. The unit of modulus of elasticity is same as those of
(A) Stress, strain and pressure
(B) Stress, force and modulus of rigidity
(C) Strain, force and pressure
(D) Stress, pressure and modulus of rigidity

200. The stress at which the extension of the material takes place more quickly as compared to the increase in load, is called
(A) Elastic limit
(B) Yield point
(C) Ultimate point
(D) Breaking point

201. Two bars of different materials and same size are subjected to the same tensile force. If the bars have unit elongation in the ratio of 2:5, then the ratio of modulus of elasticity of the two materials will be
(A) 2 : 5
(B) 5 : 2
(C) 4 : 3
(D) 3 : 4

202. In a thick cylindrical shell subjected to an internal pressure (p), the maximum radial stress at the inner surface of the shell is
(A) Zero
(B) p (tensile)
(C) -p (compressive)
(D) 2p (tensile)

203. When a body is subjected to direct tensile stresses (σx and σy) in two mutually perpendicular directions, accompanied by a simple shear stress τxy, then in Mohr's circle method, the circle radius is taken as
(A) $[(\sigma x - \sigma y)/2] + \tau$
(B) $[(\sigma x + \sigma y)/2] + \tau$
(C) $(1/2) \times \sqrt{[(\sigma x - \sigma y)^2 + 4\tau^2 xy]}$
(D) $(1/2) \times \sqrt{[(\sigma x + \sigma y)^2 + 4\tau^2 xy]}$

204. A section of beam is said to be in pure bending, if it is subjected to
(A) Constant bending moment and constant shear force
(B) Constant shear force and zero bending moment
(C) Constant bending moment and zero shear force
(D) None of the above

205. Modular ratio of the two materials is the ratio of
(A) Linear stress to linear strain
(B) Shear stress to shear strain
(C) Their modulus of elasticities
(D) Their modulus of rigidities

206. The polar moment of inertia of a hollow shaft of outer diameter (D) and inner diameter (d) is
(A) $\pi/16\ (D^3 - d^3)$
(B) $\pi/16\ (D^4 - d^4)$
(C) $\pi/32\ (D^4 - d^4)$
(D) $\pi/64\ (D^4 - d^4)$

207. The springs in brakes and clutches are used to
(A) To apply forces
(B) To measure forces
(C) To store strain energy
(D) To absorb shocks

208. A beam encastered at both the ends is called
(A) Simply supported beam
(B) Fixed beam
(C) Cantilever beam
(D) Continuous beam

209. A spring used to absorb shocks and vibrations is
(A) Conical spring
(B) Torsion spring
(C) Leaf spring
(D) Disc spring

210. The bending moment at the free end of a cantilever beam is
(A) Zero
(B) Minimum
(C) Maximum
(D) None of these

211. The hoop stress in a thin cylindrical shell is
(A) Longitudinal stress
(B) Compressive stress
(C) Radial stress
(D) Circumferential tensile stress

212. In a stress-strain diagram as shown in the below figure, the curve 'A' represents
(A) Mild steel
(B) Soft brass
(C) Low carbon steel
(D) Cold rolled steel

213. The ratio of bulk modulus to Young's modulus for a Poisson's ratio of 0.25 will be
(A) 1/3
(B) 2/3
(C) 1
(D) 3/2

214. The ratio of shear modulus to the modulus of elasticity for a Poisson's ratio of 0.4 will be
(A) 5/7
(B) 7/5
(C) 5/14
(D) 14/5

215. A column of length (l) with both ends fixed may be considered as equivalent to a column of length _____ with one end fixed and the other end free.
(A) l/8
(B) l/4
(C) l/2
(D) l

216. The pull required to shear off a rivet, in double shear, per pitch length is
(A) $\pi/4 \times d^2 \times \sigma t$
(B) $\pi/4 \times d^2 \times \tau$
(C) $\pi/2 \times d^2 \times \sigma t$
(D) $\pi/2 \times d^2 \times \tau$

217. The bending stress in abeam is _____ bending moment.
(A) Equal to
(B) Less than
(C) More than
(D) Directly proportional to

218. When a change in length takes place, the strain is known as
(A) Linear strain
(B) Lateral strain
(C) Volumetric strain
(D) Shear strain

219. The volumetric strain is the ratio of the
(A) Original thickness to the change in thickness
(B) Change in thickness to the original thickness
(C) Original volume to the change in volume
(D) Change in volume to the original volume

220. A welded joint as compared to a riveted joint has _____ strength.
(A) Same
(B) Less
(C) More
(D) None of these

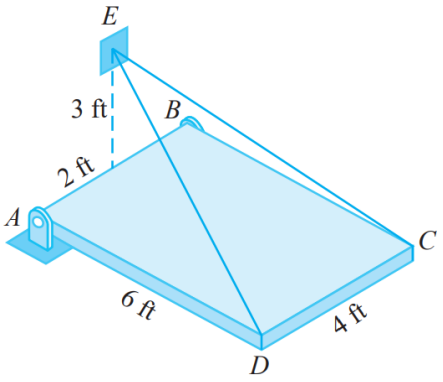
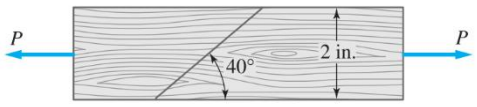
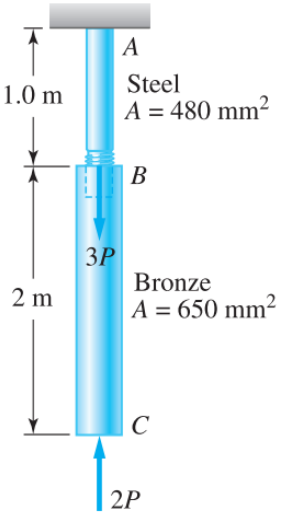
Short Answer questions

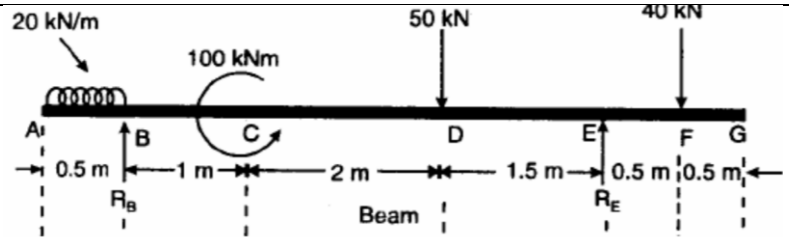
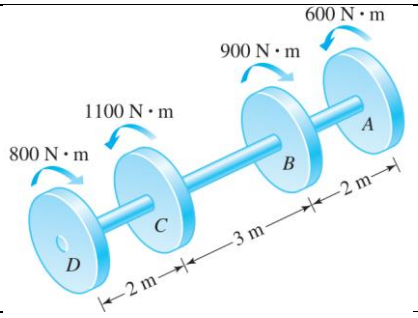
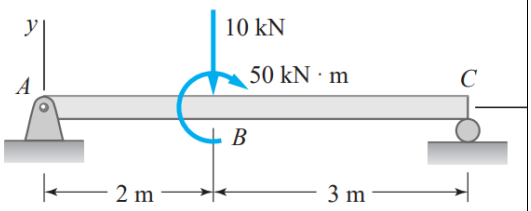
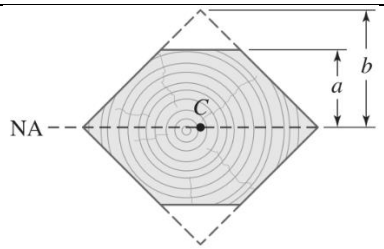
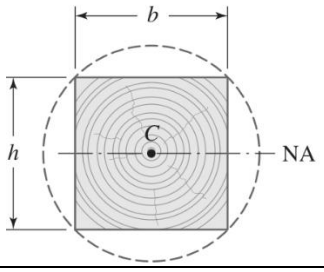
1. A rod of diameter 30mm and length 400mm was found to elongate 0.35mm when it was subjected to a load of 65KN. compute the modulus of elasticity of the material of this rod
2. What is strain energy and write its unit in S.I. System?
3. State Hooke's law.
1. Define Bulk modulus.
2. Define Poison's Ratio.
3. What is Thermal stress?
4. The strain induced in an MS bar of rectangular section having width equal to twice the depth is $2.5x10^{-5}$. The bar is subjected to a tensile load of 4KN. Find the section dimensions of the bar Take $E=0.2x10^{6}$ N/mm².
5. Define Proof Resilience and Modulus of Resilience.
6. The Young's modulus and the shear modulus of material are 120Gpa and 45Gpa respectively. What is its Bulk modulus?
7. Calculate the instantaneous stress produced in a bar of cross-sectional area 1000 mm² and 3m Long by the sudden application of a tensile load of unknown magnitude, if the instantaneous Extension is 1.5 mm. Also find the corresponding load. Take E = 200 G pa.
8. Give the relation between modulus of elasticity and modulus of rigidity.
9. Write the concept used for finding stresses in compound bars.
10. Define Factor of safety.
11. What do you understand by a compound bar?
12. What are the types of elastic constants?
13. State the principle of superposition.
14. State Volumetric strain.
15. Define modulus of rigidity
16. Give example for gradually applied load and suddenly applied load.
17. What is resilience?
18. Distinguish between suddenly applied and impact load.
19. Define proof resilience?
20. State principal plane.
21. What are the different types of loads?
22. What are the different types of beams?
23. Define Shear force and bending moment.
24. What are the assumptions in the theory of simple bending?
25. Define point of contra flexure.
26. Define flexural rigidity.
27. Define section modulus.
28. Where will be the maximum bending moment in simply supported beam?
29. Where will be the maximum bending stress in the beam?
30. Where will be the maximum Shear stress in a beam?
31. What is the value of bending moment corresponding to a point having a zero-shear force?
32. What are SF and BM diagrams?
33. Write the relation between SF and BM?

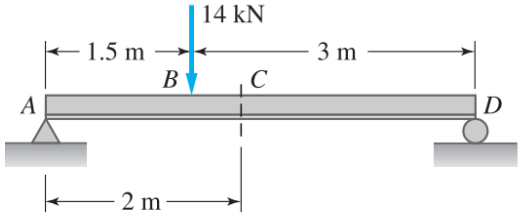
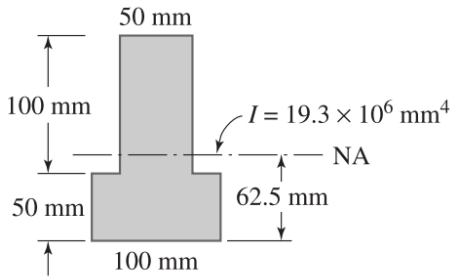
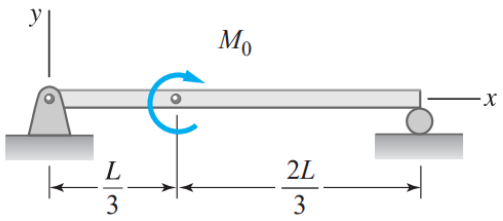
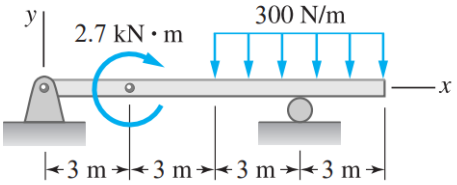
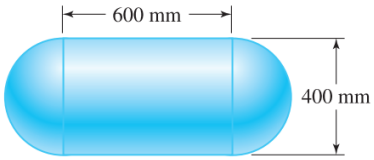
34. In SSB, how do you locate the point of maximum bending moment?
35. State the theory of simple bending?
36. Is bending stress a direct stress or shear stress?
37. Write down the bending moment equation.
38. A rectangular beam 150 mm wide and 200 mm deep is subjected to a shear force of 40 KN. Determine the average shear stress and maximum shear stress.
39. Write down relations for maximum shear force and bending moment in case of a Cantilever beam subjected to uniformly distributed load running over entire span.
40. A cantilever beam of 3 m long carries a load of 20 KN at its free end. Calculate the shear force and bending moment at a section 2 m from the free end.
41. Mention and sketch any two types of supports for the beams.
42. A simply supported beam is subjected to u.d.l of w per unit length throughout its length write the value maximum bending moment.
43. Define clear span and effective span.
44. What is moment of resistance?
45. Define neutral axis of a cross section.
46. What will be the shape of bending moment and shear force diagrams for different types of load.
47. What are the uses of closed coiled helical spring?
48. What is meant by spring constant or spring index?
49. What is meant by spring?
50. Classify the spring.
51. Define torsional rigidity.
52. How does the shear stress vary across a solid shaft?
53. For same weight, which shaft will carry more torque, a solid one or a hollow one? Why?
54. Define Wahl's factor.
55. What are the conditions to design a circular shaft?
56. Define torsional energy or torsional resilience.
57. 35.Define polar modulus.
58. Define torsional rigidity.
59. Define stiffness of a spring? In what unit it is measured?
60. Write the equation for strain energy stored in a shaft due to torsion.
61. What different stresses set-up in a bolt due to initial tightening, while used as a fastener? Name all the stresses in detail.
62. What is crippling load? Give the effective length of columns when both ends hinged and when both ends fixed?
63. State any two assumptions made in Euler's column theory.
64. Define Slope Theorem & Deflection Theorem.
65. What is a conjugate beam?
66. What are the different types of ends and their equivalent length in the column?
67. What are the types of column failure?
68. What is slenderness ratio (buckling factor)? What is its relevance in column?
69. What are the factors affect the strength column?
70. What is meant by Double-Integration method?

71. Write the maximum value of deflection for a cantilever beam of length of length L, constant EI and carrying concentrated load W at the end.
72. What are the different methods used for finding deflection and slope of beams?
73. What is meant by elastic curve?
74. When Mecaulay's method is preferred?
75. Define crippling load?

Long Answer questions

1.	The 1200-lb uniform plate ABCD can rotate freely about the hinge AB. The plate is supported by the cables DE and CE. If the working stress in the cables is 18 000 psi, determine the smallest safe diameter of the cables	
2.	The two pieces of wood, 2 in. by 4 in., are glued together along the 40° joint. Determine the maximum safe axial load P that can be applied if the shear stress in the glue is limited to 250 psi.	
3.	The member consists of the steel rod AB that is screwed into the end of the bronze rod BC. Find the largest value of P that meets the following design criteria: (i) the overall length of the member is not to change by more than 3 mm; and (ii) the stresses are not to exceed 140 MPa in steel and 120 MPa in bronze. The moduli of elasticity are 200 GPa for steel and 80 GPa for bronze.	
4.	The magnitude of normal stress on two mutually perpendicular planes, at a point in an elastic body are 60 MPa (compressive) and 80 MPa (tensile) respectively. Find the magnitudes of shearing stresses on these planes if the magnitude of one of the principal stresses is 100 MPa (tensile). Find also the magnitude of the other principal stress at this point.	
5.	A steel tube of inner diameter 100 mm and wall thickness 5 mm is subjected to a torsional moment of 1000 Nm. Calculate the principal stresses and orientations of the principal planes on the outer surface of the tube.	
6.	A simply supported beam of length 10 m carries a uniformly varying load whose intensity varies from a maximum value of 5 kN/m at both ends to zero at the centre of the beam. It is desired to replace the beam with another simply supported beam which will be subjected to the same maximum 'bending moment' and 'shear force' as in the case of the previous one. Determine the length and rate of loading for the second beam if it is subjected to a uniformly distributed load over its whole length. Draw the variation of 'SF' and 'BM' in both the cases.	
7.	Construct the bending moment and shearing force diagrams for the beam shown in the figure.	

		
8.	A tube 40 mm outside diameter; 5 mm thick and 1.5 m long simply supported at 125 mm from each end carries a concentrated load of 1 kN at each extreme end. (i) Neglecting the weight of the tube, sketch the shearing force and bending moment diagrams; (ii) Calculate the radius of curvature and deflection at mid-span. Take the modulus of elasticity of the material as 208 GN/m2	
9.	Four pulleys are attached to the 50-mm-diameter aluminium shaft. If torques are applied to the pulleys as shown in the figure, determine the angle of rotation of pulley D relative to pulley A. Use G = 28 GPa for aluminium	
10	For the beam shown, derive the expressions for V and M, and draw the shear force and bending moment diagrams. Neglect the weight of the beam.	
11	A beam of square cross section is positioned so that the neutral axis coincides with one of the diagonals. The section modulus of this beam can be increased by removing the top and bottom corners as shown. Find the ratio a/b that maximizes the section modulus	
12	The beam of rectangular cross section is cut from a round log. Find the ratio b=h that maximizes the section modulus of the beam.	
13	For the beam shown in the figure, find the shear stress at a point 30 mm above the bottom of the beam at section C.	

	 
14	The simply supported beam carries two end couples, each of magnitude M_0 but oppositely directed. Find the location and magnitude of the maximum deflection.
15	Compute the location and maximum value of EI d for the simply supported beam carrying the couple M_0 at the midspan. (Hint: By skew-symmetry, the deflection at midspan is zero.
16	Derive the equation of the elastic curve for the simply supported beam that is loaded by the concentrated couple M_0. (b) Compute the value of EI at the point of application of M_0. 
17	(a) Determine the equation of the elastic curve for the overhanging beam; and (b) calculate the value of EIδ midway between the supports. 
18	A spherical shell with 70-in. outer diameter and 67-in. inner diameter contains helium at a pressure of 1200 psi. Compute the stress in the shell.
19	A cylindrical steel pressure vessel has a 400-mm inner radius and 8-mm-thick walls. Find the change in the inner radius when the vessel is pressurized to 1.2 MPa. Use E = 200 GPa and $\mu =$ 0.3 for steel.
20	The cylindrical pressure vessel with hemispherical end-caps is made of steel. The vessel has a uniform thickness of 18 mm and an outer diameter of 400 mm. When the vessel is pressurized to 3.6 MPa, determine the change in the overall length of the vessel. Use E = 200 GPa and $\mu = 0.3$ for steel. Neglect localized bending. 
21	An aluminium tube of length 8 m is used as a simply supported column carrying a 1.2-kN axial load. If the outer diameter of the tube is 50 mm, compute the inner diameter that would provide a factor of safety of 2 against buckling. Use E = 70 GPa for aluminium.
22	A 40-mm by 80-mm timber, 2.2 m long, is used as a column with built-in ends. If E = 10 GPa and $\sigma_{p_l} = 30\ MPa$, determine the largest axial load that can be carried with a factor of safety of 2