# CIVIL ENGINEERING

## UNIT-I

# STRUCTURAL ENGINEERING

## MECHANICS

### Stress-Strain Relationships – Principal stresses and Principal strain in two dimension and three dimension. Composite Bars – Composite Beams – Elastic Constants.

1. **If stress values were measured during a tensile test, which of the following would have the higher value?**
   **A)** engineering stress
   **B)** true stress
2. **If strain measurements were made during a tensile test, which of the following would have the higher value?**
   **A)** engineering stain **B)** true strain
3. **Which one of the following types of stress strain relationship best describes the behaviour of brittle materials such as ceramics and thermosetting plastics?**
   **A)** elastic and perfectly plastic
   **B)** elastic and strain hardening
   **C)** perfectly elastic **D)** none of the above
4. **Which one of the following types of stress strain relationship best describes the behaviour of most metals at room temperature?**
   **A)** elastic and perfectly plastic
   **B)** elastic and strain hardening
   **C)** perfectly elastic
   **D)** none of the above
5. **The shear strength of a metal is usually**
   **A)** greater than
   **B)** less than its tensile strength
6. **The work done on a unit volume of material, as simple tensile force is gradually increased from zero to a value causing rupture, is called**
   **A)** modulus of elasticity
   **B)** modulus of toughness
   **C)** modulus of resilience
   **D)** none of these
7. **The unit of modulus of resilience is**
   **A)** $Nm^{-2}$ **B)** $Nmm^{-3}$
   **C)** $Nm^{-3}$ **D)** none of these
8. **For most metals, Poisson's ratio lies in the range**
   **A)** 0.1 to 0.9 **B)** 0.05 to 0.1
   **C)** 1 to 10 **D)** 0.25 to 0.35
9. **If a material contains same elastic properties in all directions at any point of the body then it is called**
   **A)** anisotropic **B)** orthotropic
   **C)** isotropic **D)** none of these
10. **The stress level below which a material has a high probability of not failure under reversal of stress, is known as**
    **A)** elastic limit **B)** endurance limit
    **C)** proportional limit **D)** tolerance limit
11. **In fatigue of metals the endurance limit is**
    **A)** less than yield stress
    **B)** more than yield stress
    **C)** equal to ultimate stress in a static test
    **D)** none of these

**1. (B) 2. (A) 3. (C) 4. (B) 5. (B) 6. (B) 7. (B) 8. (D) 9. (C) 10. (B) 11. (C)**

12. **Given that, $E = 2 \times 10^6$ kg/cm$^2$ and the length of the cable is 10 m. Elongation of the cable due to the load will be, A steel cable of 2 cm diameter is used to lift a load of 500 kg.**
**A)** 0.5 cm **B)** 0.25 cm
**C)** 1 cm **D)** $2\pi$ cm

13. **A mild steel bar is in two parts having equal lengths. The area of cross section of Part I is double that of Part II. If the bar carries an axial load P, then the ratio of elongation in Part I to that in Part II will be**
**A)** 2 **B)** 4
**C)** 1/2 **D)** 1/4

14. **A bar of circular cross section varies uniformly from a cross section 2D to D. If extension of the bar is calculated treating it as a bar of average diameter, then the percentage error will be**
**A)** 10 **B)** 25
**C)** 33.33 **D)** 50

15. **A bar of length L and constant cross section (A) is hanging vertically. What would be total increase in length due to self weight(W)?**
**A)** WL/AE **B)** 2WL/AE
**C)** WL/2AE **D)** none of these

16. **For an isotropic, homogeneous and elastic material obeying Hooke's law, number of independent elastic constants is**
**A)** 2 **B)** 3
**C)** 9 **D)** 1

17. **In a thin cylindrical shell, the ratio of longitudinal stress to hoop stress is**
**A)** 0.5 **B)** 1
**C)** 2 **D)** 4

18. **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
**E)** none of the above

19. **Hooke's law holds good upto**
**A)** yield point
**B)** limit of proportionality
**C)** breaking point **D)** elastic limit
**E)** plastic limit

20. **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
**E)** longitudinal stress and lateral strain

21. **The unit of Young's modulus is**
**A)** mm/mm **B)** kg/cm
**C)** kg **D)** kg/cm$^2$
**E)** kg cm$^2$

22. **Deformation per unit length in the direction of force is known as**
**A)** strain **B)** lateral strain
**C)** linear strain **D)** linear stress
**E)** unit strain

23. **It equal and opposite forces applied to a body tend to elongate it, the stress so produced is called**
**A)** internal resistance
**B)** tensile stress
**C)** transverse stress **D)** compressive stress
**E)** working stress

24. **The materials having same elastic properties in all directions are called**
**A)** ideal materials **B)** uniform materials
**C)** isotropic materials
**D)** practical materials
**E)** elastic materials

25. **A thin mild steel wire is loaded by adding loads in equal increments till it breaks. The extensions noted with increasing loads will behave as under**
**A)** uniform throughout
**B)** increase uniformly
**C)** first increase and then decrease
**D)** increase uniformly first and then increase rapidly
**E)** increase rapidly first and then uniformly

**12. (B) 13. (C) 14. (A) 15. (C) 16. (A) 17. (C) 18. (D) 19. (B) 20. (C) 21. (D) 22. (C) 23. (B) 24. (C) 25. (D)**

**26. Modulus of rigidity is defined as the ratio of**

**A)** longitudinal stress and longitudinal strain
**B)** volumetric stress and volumetric strain
**C)** lateral stress and lateral strain
**D)** shear stress and shear strain
**E)** linear stress and lateral strain

**27. If the radius of wire stretched by a load is doubled, then it's Young's modulus will be**

**A)** doubled **B)** halved
**C)** become four times
**D)** become one-fourth
**E)** remain unaffected

**28. A load is said to be suddenly applied, if it**

**A)** falls upon a body from a height
**B)** is placed upon a body at once
**C)** acts upon a body repeatedly
**D)** acts at a point of cross-section of a body

**29. A body is so loaded that the force passes through centroids of all resisting cross-sections. The body is loaded under**

**A)** bending
**B)** torsion
**C)** axial load
**D)** uniformly distributed load

**30. In which case a shaft is loaded in pure torsion?**

**A)** Forces act transverse to axis along with couples in transverse planes
**B)** Couples act upon shaft in planes which are inclined to axis at a $a < 90°$
**C)** Couples act upon shaft in planes which are parallel to axis
**D)** Couples act upon shaft in planes which are transverse to axis

**31. Find the wrong statement.**
**Principal plane is the plane on which**

**A)** direct stress is minimum
**B)** direct stress is maximum
**C)** direct stress is zero
**D)** direct stress is sum of two direct stresses on a set of two orthogonal planes

**32. Stress invariant is**

**A)** $\sigma_{xx} + \sigma_{yy}$ **B)** $\sigma_{xx} + \sigma_{yy} + \tau_{xy}$
**C)** $\sigma_{xx} - \sigma_{yy}$ **D)** $\sigma_{xx} + \sigma_{yy} - \tau_{xy}$

**33. Maximum shearing stress acts on a plane which is**

**A)** normal to planes of maximum and minimum principal stresses
**B)** free of direct stress
**C)** inclined to principal planes at any angle $0 < \theta \leq 45°$
**D)** inclined to principal planes at 45°

**34. The radius of Mohr's circle is equal to**

**A)** sum of two principal stresses
**B)** difference of two principal stresses
**C)** half of the difference of two principal stresses
**D)** half of the sum of two principal stresses

**35. The coordinates of any point on Mohr's circle represent**

**A)** state of stress at a point with reference to any arbitrary set of orthogonal axes passing through that point
**B)** principal stresses at a point
**C)** one of two direct stresses and shearing stress at a point
**D)** two direct stresses at a point

**36. Which is wrong statement? Strain at any point is**

**A)** a unitless quantity
**B)** a dimensionless quantity
**C)** expressed as m/m
**D)** expressed as μ mm/mm

**37. State of plane stress in x-y plane is accompanied by strains along**

**A)** x,y and z-axis **B)** x and y-axis
**C)** x and z-axis **D)** y and z-axis

**38. State of plane strain in x-y plane is not accompanied by**

**A)** direct strain along z-axis
**B)** shearing strain in x-y planes
**C)** shearing strain in x-z and z-y planes
**D)** direct strain along z-axis and shearing strains in x-z and z-y planes

**26. (D) 27. (E) 28. (B) 29. (C) 30. (D) 31. (D) 32. (A) 33. (D) 34. (C) 35. (C) 36. (A) 37. (A) 38. (A)**

39. **An isotropic elastic material is characterized by**
   - **A)** two independent modulus of elasticity along two mutually perpendicular directions
   - **B)** two independent modulus of elasticity along two mutually perpendicular directions and Poisson's ratio
   - **C)** a modulus of elasticity, a modulus of rigidity and a Poisson's ratio
   - **D)** any two of a modulus of elasticity, a modulus of rigidity and Poisson's ratio

40. **Modulus of elasticity and Poisson's ratio of a material are 2. 1 units and 0. 3 respectively. The modulus of rigidity of the same material is**
   - **A)** 0. 81 **B)** 1. 5
   - **C)** 1. 6 **D)** 2. 73 units

41. **A steel rod of 1 $cm^2$ cross-sectional area is 100 cm long and has a Young's modulus of elasticity $2 \times 10^6$ $kgf/cm^2$. It is subjected to an axial pull of 2000 kgf. The elongation of rod will be**
   - **A)** 0. 05 cm **B)** 0. 1 cm
   - **C)** 0. 15 cm **D)** 0. 2 cm

42. **An incompressible material is defined by Poisson's ratio of**
   - **A)** 1 **B)** 1/3
   - **C)** 1/2 **D)** 1/4

## Beams and Bending – Shear Force and Bending Moment Diagrams – Flexural and Shear Stresses. Slope and Deflection of Beams. Thin and Thick Cylinders. Torsion. Theories of Failure – Unsymmetrical Bending – Curved Beams – Theories of Columns. Combined Direct and Bending Stresses.

43. **A simply supported beam of length 1 carries a load varying uniformly from zero at left end to maximum at right end. The maximum bending moment occurs at a distance of**
   - **A)** 1/√3 from left end
   - **B)** 1/3 from left end
   - **C)** 1/√3 from right end
   - **D)** 1/3 from right end

44. **A beam of overall length 1 with equal overhangs on both sides carries a uniformly distributed load over the entire length. To have numerically equal bending moments at centre of the beam and at supports, the distance between the supports should be**
   - **A)** 0.2771 **B)** 0.4031
   - **C)** 0.5861 **D)** 0.7071

45. **A beam of triangular cross section is placed with its base horizontal. The maximum shear stress intensity in the section will be**
   - **A)** at the neutral axis
   - **B)** at the base
   - **C)** above the neutral axis
   - **D)** below the neutral axis

46. **According to Rankine's hypothesis, the criterion of failure of a brittle material is**
   - **A)** maximum principal stress
   - **B)** maximum shear stress
   - **C)** maximum strain energy
   - **D)** maximum shear strain energy

47. **A portion of a beam between two sections is said to be in pure bending when there is**
   - **A)** constant bending moment and zero shear force
   - **B)** constant shear force and zero bending moment
   - **C)** constant bending moment and constant shear force
   - **D)** none of the above

48. **Rate of change of bending moment is equal to**
   - **A)** shear force **B)** deflection
   - **C)** slope **D)** rate of loading

49. **A flitched beam consists of a wooden joist 150 mm wide and 300 mm deep strengthened by steel plates 10 mm thick and 300 mm deep one on either side of the joist. If modulus of elasticity of steel is 20 times that of wood, then the width of equivalent wooden section will be**
   - **A)** 150 mm **B)** 350 mm
   - **C)** 500 mm **D)** 550 mm

**39. (D) 40. (A) 41. (B) 42. (C) 43. (A) 44. (C) 45. (C) 46. (A) 47. (A) 48. (D) 49. (D)**

**50. The maximum bending moment due to a moving load on a fixed ended beam occurs**

**A)** at a support
**B)** always at the midspan
**C)** under the load only
**D)** none of the above

**51. Maximum bending moment in a beam occurs where**

**A)** deflection is zero
**B)** shear force is maximum
**C)** shear force is minimum
**D)** shear force changes sign

**52. A beam of square cross-section with side 100mm is placed with one diagonal vertical. If the shear force acting on the section is 10 KN, the maximum shear stress is**

**A)** 1 $N/mm^2$ **B)** 1.125 $N/mm^2$
**C)** 2 $N/mm^2$ **D)** 2.25 $N/mm^2$

**53. Which of the following statements regarding assumptions in analysis of stressed beam is false?**

**A)** The material is homogeneous and isotropic, so that it has the same elastic properties in all directions
**B)** Modulus of elasticity in tension and compression are equal
**C)** The radius of curvature of the beam before bending is equal to that of its transverse dimensions
**D)** Normal sections of the beam, which were plane before bending, remain plane after bending

**54. A steel flat 10 cm wide and 2 cm thick is bent into a circular arc of 50 metres radius. The maximum intensity of stress induced will be ($E = 2.05 \times 10^5$ $N/mm^2$)**

**A)** 31 $N/mm^2$ **B)** 41 $N/mm^2$
**C)** 51 $N/mm^2$ **D)** 61 $N/mm^2$

**55. A strip of steel 1 mm thick is bent into an arc of a circle of 1 m radius. The maximum bending stress will be($E = 200$ $GNm^{-2}$)**

**A)** 25 MPa **B)** 50 MPa
**C)** 64 MPa **D)** 100 MPa

**56. A steel wire of 20 mm diameter is bent into a circular shape of 10 m radius. If E, the modulus of elasticity is $2 \times 10^6$ $kg/cm^2$, then the maximum stress induced in the wire is**

**A)** $10^3$ $kg/cm^2$ **B)** $2 \times 10^3$ $kg/cm^2$
**C)** $4 \times 10^3$ $kg/cm^2$ **D)** $6 \times 10^3$ $kg/cm^2$

**57. A high strength steel band saw of 90 mm width and 0.5 mm thickness runs over a pulley of 500 mm diameter. Assuming E = 200 Gpa, the maximum flexural stress developed would be**

**A)** 100 MPa **B)** 200 MPa
**C)** 400 MPa **D)** 500 MPa

**58. A mild steel fleet of width 120 mm and thickness 10 mm is bent into an arc of a circle of radius 10 m by applying a pure moment M. If E is $2 \times 10^5$ $N/mm^2$, then the magnitude of the pure moment M will be**

**A)** $2 \times 10^6$ N-mm **B)** $2 \times 10^5$ N-mm
**C)** $0.2 \times 10^5$ N-mm **D)** $0.2 \times 10^4$ N-mm

**59. A steel cantilever beam 5 m in length is subjected to a concentrated load of 1 kN acting at the free end of the bar. The beam is of rectangular cross section, 50 mm wide by 75 mm deep. The stress induced in the beam will be**

**A)** 0 **B)** 107 MPa
**C)** 110 MPa **D)** 117 MPa

**60. A beam of circular cross section is 200 mm in diameter. It is simply supported at each end and loaded by two concentrated loads of 100 kN, applied 250 mm from the ends of the beam. The maximum stress in the beam will be**

**A)** 63.6 MPa **B)** 31.8 MPa
**C)** 17.6 MPa **D)** 0

**61. A beam is loaded by a couple of 1 kNm at each of its ends. The beam is steel and of rectangular cross section 25 mm wide by 50 mm deep. The maximum bending stress will be**

**A)** 24 MPa **B)** 48 MPa
**C)** 72 MPa **D)** 96 MPa

**50. (A) 51. (D) 52. (B) 53. (C) 54. (B) 55. (D) 56. (B) 57. (B) 58. (B) 59. (B) 60. (B) 61. (D)**

**62.** **A beam 3 m in length is simply supported at each end and bears a uniformly distributed load of 10 kN per metre of length. The cross section of the bar is rectangular, 75mm × 150mm. Maximum bending stress in the beam will be**

**A)** 20 MPa **B)** 40 MPa
**C)** 60 MPa **D)** 80 MPa

**63.** **A propeller shaft in a ship is 350 mm in diameter. The allowable working stress in shear is 50 MPa and the allowable angle of twist is 1 degree in 15 diameters of length. If G = 85 GNm$^{-2}$, then the shaft can transmit a maximum torque of**

**A)** 350 kNm **B)** 378 kNm
**C)** 416 kNm **D)** 545 kNm

**64.** **In the above problem if a 175 mm axial hole is bored through the length of shaft and if other conditions remain same then torsional load carrying capacity of the shaft will be reduced by**

**A)** 1% **B)** 3%
**C)** 6% **D)** 9%

**65.** **In the above problem, by what percentage is the weight of the shaft reduced?**

**A)** 25% **B)** 50%
**C)** 75% **D)** 53.6%

**66.** **If the driving torque is applied at one end and the resting torque at the other end then the shafts are said to be joined in**

**A)** series
**B)** parallel
**C)** a combination of series and parallel
**D)** none of these

**67.** **If two shafts are joined in series then**

**A)** resulting shaft is called compound (composite) shaft
**B)** both shafts carry the same torque(T)
**C)** total angle of twist at the fixed or resisting end($\theta$) is the sum of separate angles of twist of the two shafts
**D)** all of the above

**68.** **The shafts are said to be joined in parallel if**

**A)** torque (T) is applied at the junction of the two shafts
**B)** resisting torques $T_1$ and $T_2$ are applied at their ends
**C)** both A and B **D)** neither A nor B

**69.** **If two shafts are connected in parallel then**

**A)** resulting shaft is called composite (or compound) shaft
**B)** angle of twist in each shaft will be equal
**C)** both A and B **D)** neither A nor B

**70.** **A compound shaft is composed of a 500 mm length of solid copper 100 mm in diameter, joined to a 1 m length of solid steel 125 mm in diameter. A torque of 15 kNm is applied to each end of the shaft. The maximum shear stress in copper will be(G for copper = 40 GNm$^{-2}$ and G for steel is 85 GNm$^{-2}$)**

**A)** 76 MPa **B)** 39 MPa
**C)** 47 MPa **D)** 88MPa

**71.** **In the above problem, maximum shearing stress in steel will be**

**A)** 76 MPa **B)** 39 MPa
**C)** 47 MPa **D)** 88 MPa

**72.** **In the above problem, total angle of twist of the entire shaft will be**

**A)** 0.016 rad **B)** 0.026 rad
**C)** 0.046 rad **D)** 0.5 rad

**73.** **Two steel shafts "A" and "B" are used for transmitting power. The ratio of revolutions of shafts i.e. NA/NB = 2. The ratio of torques on shafts i.e. TA/TB = 1/2. The ratio of the horse power transmitted by the shafts i.e. PA/PB are**

**A)** 1/2 **B)** 1/4
**C)** 1 **D)** 2

**74.** **A twisting moment of 1 kNm is impressed upon a 50 mm diameter shaft, then maximum shear stress will be**

**A)** 25 MPa **B)** 32 MPa
**C)** 37 MPa **D)** 41 MPa

**75.** **In above problem, what is the angle of twist in a 1m length of the shaft if G=85 GNm$^{-2}$?**

**A)** 0.011 radian **B)** 0.019 radian
**C)** 0.1 radian **D)** 0.0001 radian

**62. (B) 63. (C) 64. (C) 65. (A) 66. (A) 67. (D) 68. (C) 69. (C) 70. (A) 71. (B) 72. (B) 73. (C) 74. (D) 75. (D)**

76. There are two shafts of equal length. One shaft is solid having diameter d and another shaft is hollow with inner diameter equal to 3/4 of outer diameter(D). If both shafts are required to transmit a given torsional load then weight of hollow shaft will be .....% of solid shaft.
**A)** 25.7% **B)** 50%
**C)** 56.3% **D)** 75%

77. A hollow steel shaft 3 m long must transmit a torque of 25 kNm. The total angle of twist in this length is not to exceed 2.50 and the allowable shearing stress is 90 MPa. The inside diameter of the shaft will be
**A)** 100 mm **B)** 125 mm
**C)** 145 mm **D)** 165 mm

78. In the above problem, the outside diameter of the shaft will be
**A)** 145 mm **B)** 165 mm
**C)** 175 mm **D)** 200 mm

79. An axial core of 100 mm is bored throughout the length of a 200 mm diameter solid circular shaft. For the same maximum shear stress, the percentage torque carrying capacity lost by this operation is
**A)** 6.25 **B)** 12.5
**C)** 25 **D)** 45

80. A composite shaft is fabricated from a 50mm diameter solid aluminium alloy, G = 30 $GNm^{-2}$, surrounded by a hollow steel circular shaft of outside diameter 65 mm and inside diameter 50 mm, G = 85 $GNm^{-2}$. This composite shaft is loaded by a twisting moment of 1.5 kNm, the shearing stress at the outer fibres of the steel will be
**A)** 18 MPa **B)** 24 MPa
**C)** 30 MPa **D)** 36 MPa

81. In the above problem, the shearing stress at the outer fibres of aluminium will be
**A)** 1 MPa **B)** 2.8 MPa
**C)** 5.6 MPa **D)** 9.8 MPa

82. A hollow shaft has outer diameter 125 mm and inner diameter 75 mm. Shearing stress at the inside fibres is 50 MPa. The shearing stress at the outer fibre will be
**A)** 74.7 MPa **B)** 55 MPa
**C)** 81.7 MPa **D)** 83.3 MPa

83. If Poisson's ratio for a material is 0. 5 then the elastic modulus for the material is
**A)** three times its shear modulus
**B)** two times its shear modulus
**C)** equal to shear modulus
**D)** indeterminate

84. In generalized three dimensional state of stress, the number of independent stress component is
**A)** 9 **B)** 6
**C)** 4 **D)** 3

85. The number of stress-strain relationships obtained from generalized statement of Hooke's law is
**A)** 3 **B)** 4
**C)** 6 **D)** 9

86. The number of strain readings (using strain gauges) needed on a plane surface to determine the principal strains and their directions is
**A)** 4 **B)** 3
**C)** 2 **D)** 1

## STRUCTURAL ANALYSIS

### Static and Kinematic Indeterminancy – Energy Principles – Deflection of pin jointed plane frames – rigid frames. Classical Method of Analysis of indeterminate structures (Slope deflection and Moment Distribution) – Matrix Method.

87. The number of independent equations to be satisfied for static equilibrium of a plane structure is
**A)** 1 **B)** 2
**C)** 3 **D)** 6

76. (C) 77. (B) 78. (A) 79. (A) 80. (D) 81. (D) 82. (D) 83. (A) 84. (B) 85. (C) 86. (B) 87. (C)

**88. If there are m unknown member forces, r unknown reaction components and j number of joints, then the degree of static indeterminacy of a pin-jointed plane frame is given by**

**A)** m + r + 2j **B)** m – r + 2j
**C)** m + r – 2j **D)** m + r – 3j

**89. Number of unknown internal forces in each member of a rigid jointed plane frame is**

**A)** 1 **B)** 2
**C)** 3 **D)** 6

**90. Degree of static indeterminacy of a rigid jointed plane frame having 15 members, 3 reaction components and 14 joints is**

**A)** 2 **B)** 3
**C)** 6 **D)** 8

**91. Degree of kinematic indeterminacy of a pin jointed plane frame is given by**

**A)** 2j – r **B)** j – 2r
**C)** 3j – r **D)** 2j + r

**92. Independent displacement components at each joint of a rigid-jointed plane frame are**

**A)** three linear movements
**B)** two linear movements and one rotation
**C)** one linear movement and two rotations
**D)** three rotations

**93. If in a pin-jointed plane frame (m + r) > 2j, then the frame is**

**A)** stable and statically determinate
**B)** stable and statically indeterminate
**C)** unstable **D)** none of the above

where m is number of members, r is reaction components and j is number of joints

**94. A pin-jointed plane frame is unstable if**

**A)** (m + r)<2j **B)** m + r = 2j
**C)** (m + r)>2j **D)** none of the above

where m is number of members, r is reaction components and j is number of joints

**95. A rigid-jointed plane frame is stable and statically determinate if**

**A)** (m + r) = 2j **B)** (m + r) = 3j
**C)** (3m + r) = 3j **D)** (m + 3r) = 3j

where m is number of members, r is reaction components and j is number of joints

**96. The number of independent equations to be satisfied for static equilibrium in a space structure is**

**A)** 2 **B)** 3
**C)** 4 **D)** 6

**97. The degree of static indeterminacy of a pin jointed space frame is given by**

**A)** m + r – 2j **B)** m + r – 3j
**C)** 3m + r – 3j **D)** m + r + 3j

where m is number of unknown member forces, r is unknown reaction components and j is number of joints

**98. The degree of static indeterminacy of a rigid jointed space frame is**

**A)** m + r – 2j **B)** m + r – 3j
**C)** 3m + r – 3j **D)** 6m + r – 6j

where m, r and j have their usual meanings

**99. The degree of kinematic indeterminacy of a pin-jointed space frame is**

**A)** 2j-r **B)** 3j-r
**C)** j-2r **D)** j-3r

where j is number of joints and r is reaction components

**100. The number of independent displacement components at each joint of a rigid jointed space frame is**

**A)** 1 **B)** 2
**C)** 3 **D)** 6

**101. If in a rigid-jointed space frame, (6m + r)<6j, then the frame is**

**A)** unstable
**B)** stable and statically determinate
**C)** stable and statically indeterminate
**D)** none of the above

**102. The principle of virtual work can be applied to elastic system by considering the virtual work of**

**A)** internal forces only
**B)** external forces only
**C)** internal as well as external forces
**D)** none of the above

**88. (C) 89. (C) 90. (C) 91. (A) 92. (B) 93. (B) 94. (A) 95. (C) 96. (D) 97. (B)**
**98. (D) 99. (B) 100. (D) 101. (A) 102. (C)**

**103. Castigliano's first theorem is applicable**
- **A)** for statically determinate structures only
- **B)** when the system behaves elastically
- **C)** only when principle of superposition is valid
- **D)** none of the above

**104. Principle of superposition is applicable when**
- **A)** deflections are linear functions of applied forces
- **B)** material obeys Hooke's law
- **C)** the action of applied forces will be affected by small deformations of the structure
- **D)** none of the above

**105. In moment distribution method, the sum of distribution factors of all the members meeting at any joint is always**
- **A)** zero **B)** less than 1
- **C)** 1 **D)** greater than 1

**106. The carryover factor in a prismatic member whose far end is fixed is**
- **A)** 0 **B)** 1/2
- **C)** 3/4 **D)** 1

**107. In column analogy method, the area of an analogous column for a fixed beam of span L and flexural rigidity El is taken as**
- **A)** L/EI **B)** L/2EI
- **C)** L/3EI **D)** L/4EI

**108. The degree of static indeterminacy up to which column analogy method can be used is**
- **A)** 2 **B)** 3
- **C)** 4 **D)** unrestricted

**109. The deflection at any point of a perfect frame can be obtained by applying a unit load at the joint in**
- **A)** vertical direction **B)** horizontal direction
- **C)** inclined direction
- **D)** the direction in which the deflection is required

**110. In the slope deflection equations, the deformations are considered to be caused by**
- **i)** bending moment
- **ii)** shear force
- **iii)** axial force

**The correct answer is**
- **A)** only (i) **B)** (i)and(ii)
- **C)** (ii) and (iii) **D)** (i), (ii) and (iii)

**111. The three moments equation is applicable only when**
- **A)** the beam is prismatic
- **B)** there is no settlement of supports
- **C)** there is no discontinuity such as hinges within the span
- **D)** the spans are equal

**112. While using three moments equation, a fixed end of a continuous beam is replaced by an additional span of**
- **A)** zero length **B)** infinite length
- **C)** zero moment of inertia
- **D)** none of the above

**113. The Castigliano's second theorem can be used to compute deflections**
- **A)** in statically determinate structures only
- **B)** for any type of structure
- **C)** at the point under the load only
- **D)** for beams and frames only

**114. Bending moment at any section in a conjugate beam gives in the actual beam**
- **A)** slope **B)** curvature
- **C)** deflection **D)** bending moment

**115. For a two-hinged arch, if one of the supports settles down vertically, then the horizontal thrust**
- **A)** is increased **B)** is decreased
- **C)** remains unchanged
- **D)** becomes zero

**116. For a symmetrical two hinged parabolic arch, if one of the supports settles horizontally, then the horizontal thrust**
- **A)** is increase-d **B)** is decreased
- **C)** remains unchanged
- **D)** becomes zero

**117. A single rolling load of 8 kN rolls along a girder of 15 m span. The absolute maximum bending moment will be**
- **A)** 8 kN.m **B)** 15 kN.m
- **C)** 30 kN.m **D)** 60 kN.m

**103. (C) 104. (A) 105. (C) 106. (B) 107. (A) 108. (B) 109. (D) 110. (A) 111. (C) 112. (A) 113. (B) 114. (C) 115. (C) 116. (B) 117. (C)**

**118. The maximum bending moment due to a train of wheel loads on a simply supported girder**

**A)** always occurs at centre of span
**B)** always occurs under a wheel load
**C)** never occurs under a wheel load
**D)** none of the above

**119. When a uniformly distributed load, longer than the span of the girder, moves from left to right, then the maximum bending moment at mid section of span occurs when the uniformly distributed load occupies?**

**A)** less than the left half span
**B)** whole of left half span
**C)** more than the left half span
**D)** whole span

**120. When a uniformly distributed load, shorter than the span of the girder, moves from left to right, then the conditions for maximum bending moment at a section is that**

**A)** the head of the load reaches the section
**B)** the tail of the load reaches the section
**C)** the load position should be such that the section divides it equally on both sides
**D)** the load position should be such that the section divides the load in the same ratio as it divides the span

**121. When a series of wheel loads crosses a simply supported girder, the maximum bending moment under any given wheel load occurs when**

**A)** the centre of gravity of the load system is midway between the centre of span and wheel load under consideration
**B)** the centre of span is midway between the centre of gravity of the load system and the wheel load under consideration
**C)** the wheel load under consideration is midway between the centre of span and the centre of gravity of the load system
**D)** none of the above

**122. Fluid is a substance that**

**A)** cannot be subjected to shear forces
**B)** always expands until it fills any container
**C)** has the same shear stress at a point regardless of its motion
**D)** cannot remain at rest under action of any shear force
**E)** flows

**123. In a static fluid**

**A)** resistance to shear stress is small
**B)** fluid pressure is zero
**C)** linear deformation is small
**D)** only normal stresses can exist
**E)** viscosity is nil

**124. For stable structures, one of the important properties of flexibility and stiffness matrices is that the elements on the main diagonal**

1) of a stiffness matrix must be positive
2) of a stiffness matrix must be negative
3) of a flexibility matrix must be positive
4) of a flexibility matrix must be negative The correct answer is

**A)** 1 and 3 **B)** 2 and 3
**C)** 1 and 4 **D)** 2 and 4

**125. Study the following statements.**

1) The displacement method is more useful when degree of kinematic indeterminacy is greater than the degree of static indeterminacy.
2) The displacement method is more useful when degree of kinematic indeterminacy is less than the degree of static indeterminacy.
3) The force method is more useful when degree of static indeterminacy is greater than the degree of kinematic indeterminacy.
4) The force method is more useful when degree of static indeterminacy is less than the degree of kinematic indeterminacy. The correct answer is

**A)** 1 and 3 **B)** 2 and 3
**C)** 1 and 4 **D)** 2 and 4

**118. (B) 119. (D) 120. (D) 121. (B) 122. (D) 123. (D) 124. (A) 125. (D)**