MULTIPLE CHOICE OBJECTIVE TYPE QUESTIONS

1. The moment area theorems in the structural analysis fall in the category of
(*a*) Force method (*b*) Displacement method
(*c*) Stiffness method (*d*) Iterative method

2. The analysis of statically indeterminate structures by the unit load method is based on
(*a*) Force method concept (*b*) Stiffness method
(*c*) Both of the above (*d*) None of the above

3. The analysis of statically indeterminate structures by the unit load method is based on
(*a*) Consistent deformation
(*b*) Stiffness method
(*c*) Consistent force (*d*) None of the above

4. The force method in structural analysis always ensures
(*a*) Equilibrium
(*b*) Kinematically admissible forces
(*c*) Equilibrium of forces (*d*) None of the above

5. Unequal settlements in the supports of a statically indeterminate structure develop
(*a*) Member forces (*b*) Reactions from supports
(*c*) No reactions
(*d*) Strains in some members only

6. The method of virtual work in the analysis of structures results in
(*a*) Compitable deformations
(*b*) Equilibrium of forces
(*c*) Stress strain relations
(*d*) None of the above

7. Maxwell's reciprocal theorem in structural analysis can be applied in
(*a*) All elastic structures (*b*) Plastic structures
(*c*) Symmetrical structures only
(*d*) Prismatic element structures only

8. Castigliano's first theorem is applicable
(*a*) for elastic structures
(*b*) for all statically determinate structures
(*c*) only when priciple of superposition is valid
(*d*) None of the above.

9. The Muller-Breslau principle in structural analysis is used for
(*a*) Drawing influence line diagram for any force function
(*b*) Superimposition of load effects
(*c*) Writing virtual work equation
(*d*) None of the above **(IES 2012)**

10. When a load is applied to a structure with rigid joints
(*a*) there is no rotation or displacement of joint
(*b*) there is no rotation of joint
(*c*) there is no displacement of joint
(*d*) there can be rotation and displacement of joint but the angle between the members connected to the joint remains same even after application of the load **(IES 2008)**

11. A determinate structure
(*a*) cannot be analyzed without the correct knowledge of modulus of elasticity
(*b*) must necessarily have roller support at one of its ends
(*c*) requires only statical equilibrium equations for its analysis
(*d*) will have zero deflection at its ends.

12. By which one of the following methods is an approximate quick solution possible for frames subjected to transverse loads?
(*a*) By cantilever or portal method
(*b*) By strain energy method
(*c*) By moment distribution method
(*d*) By matrix method

13. A statically indeterminate structure is the one which
(*a*) cannot be analyzed at all
(*b*) can be analyzed using equations of statics only
(*c*) can be analyzed using equations of statics and compatibility equations
(*d*) can be analyzed using equations of compatibility only

14. The three moment equation in structural analysis is basically a
(*a*) Stiffness method (*b*) Displacement method
(*c*) Energy method (*d*) Flexibility method

15. In moment distribution method the sum of distribution factors of all the members meeting at any joint is always
(*a*) zero (*b*) <1 (*c*) >1 (*d*) =1

16. For prismatic members, stiffness factor is
(*a*) $\frac{I}{l}$ (*b*) $\frac{l}{E}$ (*c*) EI (*d*) $\frac{AEl}{I}$
where I = moment of inertia
l = length of member
E = Young's modulus
A = Area of cross-sections

17. The carry over factor for prismatic member with far end fixed is
(*a*) $-\frac{1}{2}$ (*b*) $\frac{1}{2}$ (*c*) $\frac{1}{4}$ (*d*) $-\frac{1}{4}$

18. The absolute stiffness of a prismatic member with one end fixed is
(*a*) $\frac{2EI}{L}$ (*b*) $\frac{4EI}{L}$
(*c*) $\frac{3EI}{L}$ (*d*) none of the above

19. The absolute stiffness of a prismatic member with one end hinged is
(*a*) $\frac{2EI}{L}$ (*b*) $\frac{4EI}{L}$ (*c*) $\frac{3EI}{L}$ (*d*) none

20. In the Fig. shown the degree of external indeterminacy is

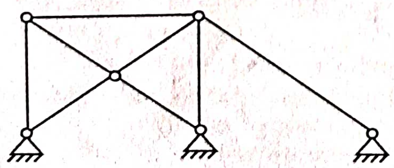


Fig. 10.93.

(*a*) 1 (*b*) 2 (*c*) 3 (*d*) 4

21. In the Fig. 10.93, the degree of internal indeterminacy is
(*a*) 1 (*b*) 2
(*c*) 3 (*d*) stable and determinate

22. What is the degree of kinetic indeterminacy of the frame shown below if axial deformation is neglected

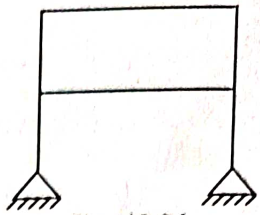


Fig. 10.94.

(*a*) 6 (*b*) 8 (*c*) 10 (*d*) 12

23. What is the degree of kinetic indeterminacy of the beam shown below

Fig. 10.95.

(*a*) 2 (*b*) 3 (*c*) 4 (*d*) 5

24. What is the degree of kinematic indeterminacy of the beam shown in above problem, if the axial deformation is ignored?
(*a*) 2 (*b*) 3 (*c*) 4 (*d*) 5

25. The kinematic indeterminacy of the beam is

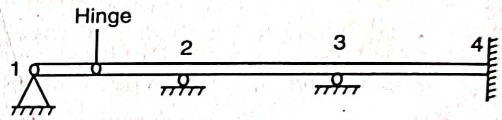


Fig. 10.96.

(*a*) 5 (*b*) 9
(*c*) 14 (*d*) 15

26. The kinematic indeterminacy of the frame is:

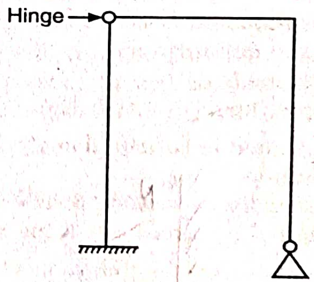


Fig. 10.97.

(*a*) 4 (*b*) 6 (*c*) 8 (*d*) 10

27. What is the degree of kinematic indeterminacy of the frame shown below if the axial deformation is ignored?

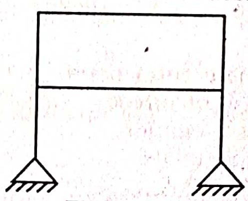


Fig. 10.98.

(*a*) 8 (*b*) 10 (*c*) 12 (*d*) 14

28. What is the degree of static indeterminacy of the beam shown below?

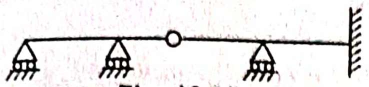


Fig. 10.99.

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

29. What is the total degree of indeterminacy in the continuous prismatic beam shown in the figure below?

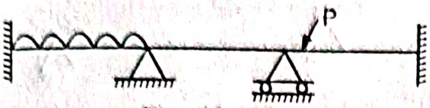


Fig. 10.100.

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

30. A suspension bridge with a two-hinged stiffening girder is
(a) staticaly determinate
(b) indeterminate of one degree
(c) indeterminate of two degrees
(d) a mechanism

31. What is the kinematic indeterminacy for the frame shown below? (member inextensible)

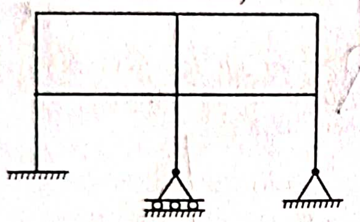


Fig. 10.101.

(a) 6 (b) 11 (c) 12 (d) 21

32. A suspension bridge with a two-hinged stiffening girder is
(a) statically determinate
(b) indeterminate of one degree
(c) indeterminate of two degrees
(d) a mechanism

33. What is the statical indeterminacy for the frame shown below?

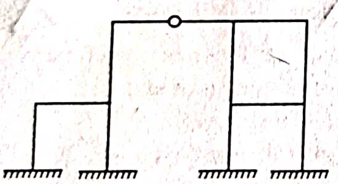


Fig. 10.102.

(a) 12 (b) 15 (c) 11 (d) 14

34. The portal frame shown below will

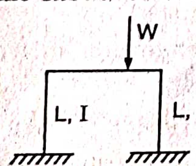


Fig. 10.103.

(a) not sway (b) sway towards left
(c) sway towards right
(d) sway either to left or right

35. The influence line for force in member DC of the truss shown below will be

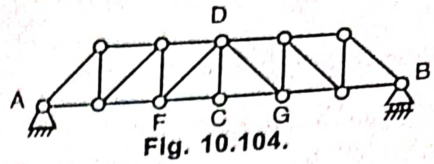
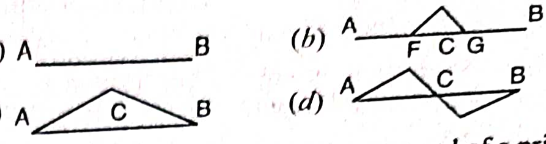


Fig. 10.104.



36. The moment required to rotate the near end of a prismatic beam through unit angle without translation, when the far end is fixed.

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

(IES 2012)

37. A suspension bridge with a two-hinged stiffening girder is statically
(a) Determinate
(b) Indeterminate to 1 degree
(c) Indeterminate to 2 degrees
(d) Indeterminate to 3 degrees **(IES 2012)**

38. The expression given by Castiglianos first theorem to determine the deflection component of any point on structure is

(a) $\int \frac{M}{EI} \frac{\rho M}{\rho P}$ (b) $\int \frac{\rho M}{\rho P} \frac{dx}{EI}$

(c) $\int M\left(\frac{\rho M}{\rho P}\right)\frac{dx}{EI}$ (d) None of the above

39. In the moment area method, the difference in slope between any two sections of a loaded flexural member is equal to the

(a) Area of the $\frac{M}{EI}$ diagram between these two sections

(b) Moment of the $\frac{M}{EI}$ diagram between these two sections

(c) $\frac{1}{2}$ × area of the $\frac{M}{EI}$ diagram between these two sections

(d) $\frac{1}{2}$ × moment of the $\frac{M}{EI}$ diagram between these two sections

40. In the moment area method, the deflection of a point A from a tangent at B is equal to the

(a) Area of $\frac{M}{EI}$ diagram between A and B (*b*) Moment of $\frac{M}{EI}$ diagram between A and B about A

(*c*) Moment of $\frac{M}{EI}$ diagram between A and B about B

(*d*) $\frac{1}{2}$ × area of $\frac{M}{EI}$ diagram between A and B

41. The conjugate beam method falls in the category of
(*a*) Force method (*b*) Stiffness method
(*c*) Displacement method (*d*) None of the above

42. Bending moment at any section in a conjugate beam gives in the actual beam
(*a*) Slope (*b*) Curvature
(*c*) Deflection (*d*) None of the above

43. The fixed support in real beam becomes in the conjugate beam is a
(*a*) Fixed support (*b*) Hinged support
(*c*) Roller support (*d*) Free support

44. The three moments equation is applicable only when
(*a*) The beam is prismatic
(*b*) There is no discontinuity such as hinges within the span
(*c*) The span are equal
(*d*) Threre are atleast 2 spans.

45. Which are of the following is true example of statically determinate beam?
(*a*) One end is fixed and the other end is simply supported
(*b*) Both the ends are fixed
(*c*) The beam over hangs over two supports
(*d*) The beam is supported on three support

(IES 2011)

46. If M is the external moment which rotates the near end of a prismatic beam without translation, the far end being fixed, then the moment induced at the far end is
(*a*) zero
(*b*) $\frac{M}{2}$ in the same direction as M
(*c*) $\frac{M}{2}$ in the opposite direction as M
(*d*) None of the above

47. The method of moment distribution in structural analysis is
(*a*) An iterative method (*b*) An exact method
(*c*) An approximate method
(*d*) None of the above

48. The moment distribution method in structural analysis can be treated as
(*a*) Force method (*b*) Displacement method
(*c*) Flexibility method (*d*) None of the above

(IES 2011)

49. A propped cantilever beam AB of span L is subjected to a moment M at the prop end B. The moment at fixed end A is
(*a*) 2 M (*b*) $\frac{M}{2}$ (*c*) M (*d*) $\frac{3M}{4}$

(IES 2010)

50. A fixed beam AB, of constant EI, shown in the figure below, supports a concentrated load of 10 kN. What is the fixed end-moment M_{FAB} at support A?

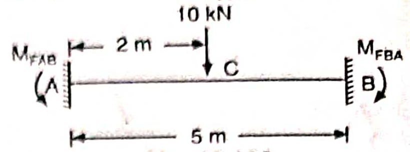


Fig. 10.105.

(*a*) 4.8 kN-m (*b*) 6.0 kN-m
(*c*) 7.2 kN-m (*d*) 9.5 kN-m

(GATE 2007)

51. If the free end of a cantilever of span L and flexure rigidity EI undergoes a unit displacement (without rotation), what is the bending moment induced at the fixed end?
(*a*) $\frac{3EI}{L^2}$ (*b*) $\frac{4EI}{L^2}$ (*c*) $\frac{5EI}{L^2}$ (*d*) $\frac{6EI}{L^2}$

(GATE 2008)

52. The fixed beam AB has a hinge C at mid span. A concentrated load P is applied at C? What is the fixed end moment M_A?

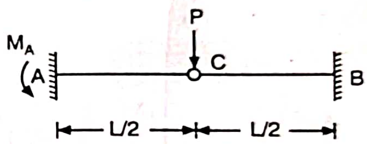


Fig. 10.106.

(*a*) PL (*b*) PL/2 (*c*) PL/4 (*d*) PL/B

(IES 2012)

53. The units of flexural stiffness are
(*a*) Radians per unit rotation
(*b*) Moment per unit rotation
(*c*) Force per unit deflection and rotation
(*d*) Extension per unit force

54. The torsional stiffness of a member can be defined as
(*a*) Torque for unit moment
(*b*) Torque for unit twist
(*c*) Moment for unit twist
(*d*) Torsion for unit twist

55. The stiffness method in structural analysis is also known as
(*a*) Unit load method
(*b*) Consistant deformation method
(*c*) Force method
(*d*) Displacement method

(GATE 2006)

56. The flexibility of an element can be defined as
(*a*) Flexural moment per unit rotation
(*b*) Rotation for unit moment

(c) Flexibility for unit translation
(d) None of the above

57. The elements of flexibility matrix of a structure
(a) are independent of the choice of coordinates
(b) are dependent on the choice of coordinates
(c) are always dimensionally homogeneous
(d) both (a) and (c)

58. An increase in temperature on the top fibre of a simply supported beam will cause
(a) Downward deflection (b) Upward deflection
(c) No deflection
(d) Angular rotation about neutral axis **(IES 2011)**

59. A fixed beam with central point load undergoes a slight settlement at one end. Select suitable answer from the following:
(a) Moment induced at both ends will be same
(b) Moment induced at the end that has undergoes settlement will be maximum
(c) Moment induced will be maximum at the end having no settlement
(d) Zero moment at the end that has settled

(IES 2011)

60. A uniformly distributed load (w) of length shorter than the span crosses a grider. The bending moment at a section in grider will be maximum when
(a) Head of the load is at the section
(b) Tail of the load is at the section
(c) Section divides the load in the same ratio as it divides the span
(d) Section divides the load in two equal lengths

(IES 2011)

61. Consider the following statements relating to structural analysis:
1. Flexibility matrix and its transpose are equal
2. Elements of main diagonal of stiffness matrix are always positive
3. For unstable structures, coefficients in leading diagonal matrix can be negative

Which of these statements is/are correct?
(a) 1, 2 and 3 (b) 1 and 2 only
(c) 2 and 3 only(d) (d) 3 only **(IES 2011)**

62. Flexibility matrix for a beam element is $[F] = \frac{1}{EI}\begin{bmatrix} 36 & 9 \\ 9 & 4 \end{bmatrix}$

What is the corresponding stiffness matrix [S]?

(a) $[S] = \frac{EI}{63}\begin{bmatrix} 36 & -9 \\ -9 & 4 \end{bmatrix}$ (b) $[S] = \frac{EI}{63}\begin{bmatrix} 36 & 9 \\ 9 & 4 \end{bmatrix}$

(c) $[S] = \frac{EI}{63}\begin{bmatrix} 4 & -9 \\ -9 & 36 \end{bmatrix}$ (d) $[S] = \frac{EI}{63}\begin{bmatrix} 4 & 9 \\ 9 & 36 \end{bmatrix}$

(IES 2010)

63. Flexibility matrix of the beam shown below is:

$$\delta = \frac{1}{3EI}\begin{bmatrix} 1 & 2 \\ 2 & 8 \end{bmatrix}$$

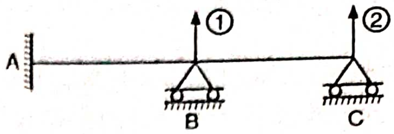


Fig. 10.107.

If support B settles by $\frac{\Delta}{EI}$ units, what is the reaction at B
(a) 0.75 Δ (b) 3.0 Δ (c) 6.0 Δ (d) 24.0 Δ
(IES 2010)

64. What is the value of flexibility coefficient f_{12} for the continuous beam shown in figure below?

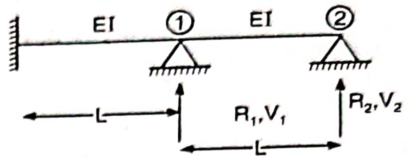


Fig. 10.108.

(a) $\frac{L^3}{3EI}$ (b) $\frac{L^3}{2EI}$ (c) $\frac{L^3}{8EI}$ (d) $\frac{L^3}{1.2EI}$
(IES 2010)

65. Euler critical load of a column restrained against rotation and translation at both end is

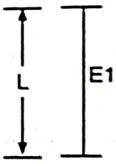


Fig. 10.109.

(a) $\frac{EI}{L^2}$ (b) $-\frac{EI}{L^2}$ (c) $\frac{1.33\,\pi^2 EI}{L^2}$ (d) $\frac{2.02\,\pi^2 EI}{L^2}$

66. The pin jointed plane truss *abcd* supported by means of links as shown in Fig. 10.110.

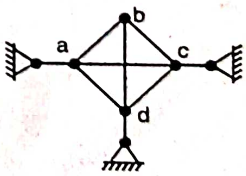


Fig. 10.110.

(a) Stable and determinate
(b) Stable and indeterminate
(c) Geometrical unstable and has the internal indeterminacy
(d) A mechanism

67. Which one of the following statements is correct?
(a) In slope-deflection method, the force are taken as unknowns

(*b*) In slope-deflection method, the joint rotations are taken as unknowns

(*c*) Slope-deflection method is not applicable for beams and frames having settlement at the supports

(*d*) Slope deflection method is also known as force method

68. The deflection at the free end *F* of cantilever beam HF having uniform flexural rigidity *EI* is

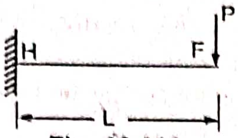


Fig. 10.111.

(*a*) $\frac{PL^2}{3EI}$ (*b*) $\frac{PL^2}{2EI}$ (*c*) $\frac{5PL^2}{38EI}$ (*d*) $\frac{PL^2}{48EI}$

(GATE 2008)

69. The Euler's critical bucking load for a column restrained against rotation and translation at one end and against translation at the other end is

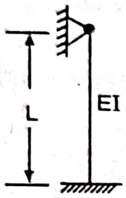


Fig. 10.112.

(*a*) $\pi^2 EL/L^2$ (*b*) $4\pi^2 EL/L^2$

(*c*) $\pi^2 EL/4L^2$ (*d*) $2\pi^2 EL/L^2$

70. For maximum negative bending moment at support *B* of continuous beam *ABCDE* the live load should be placed in the spans

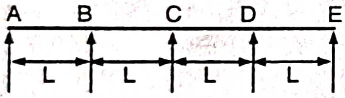


Fig. 10.113.

(*a*) *AB* and *CD* (*b*) *AD*, *BC* and *DE*

(*c*) *BC* and *DE* (*d*) *AB*, *BC*, *CD* and *DE*

71. What is the value of vertical reaction at A for the frame shown in figure below?

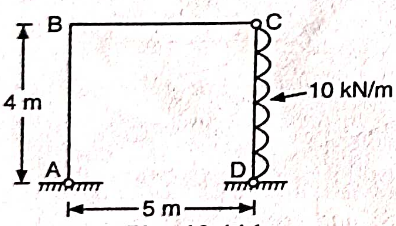


Fig. 10.114.

(*a*) 0 (*b*) 10 kN (*c*) 16 kN (*d*) 20 kN

(IES 2009)

72. The reactions R_1 and R_2 of the beam simply supported on springs having stiffness *K* and 3 *K* are

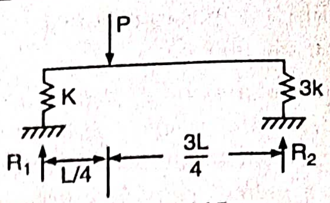


Fig. 10.115.

	R_1	R_2
(*a*)	$P/2$	$P/2$
(*b*)	$P/4$	$3P/4$
(*c*)	$3P/4$	$P/4$
(*d*)	$3P/8$	$P/8$

73. The bending moment at *b* of column *ab* by the portal method of analysis

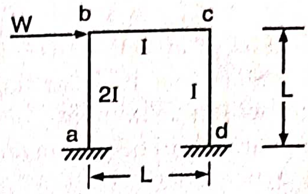


Fig. 10.116.

(*a*) $\frac{WL}{4}$ (*b*) $\frac{WL}{2}$ (*c*) WL (*d*) $\frac{WL}{3}$

74. The bar force *bd* in the truss beam bracket *abcd* is

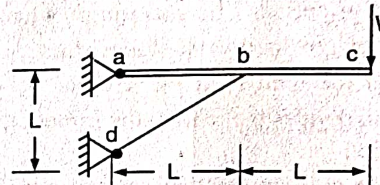


Fig. 10.117.

(*a*) $\frac{W}{\sqrt{2}}$ (comp.) (*b*) $W\sqrt{2}$ (comp.)

(*c*) *W* (tensile) (*d*) $W\sqrt{2}$ (comp.)

75. What is the force in member *AB* of the pin jointed frame as shown below?

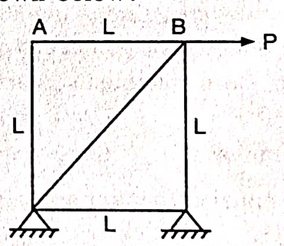


Fig. 10.118.

(*a*) *P* (tension) (*b*) *P* (compression)

(*c*) $\frac{P}{\sqrt{2}}$ (compression) (*d*) zero **(IES 2006)**

76. If members are axially rigid the number of independent degrees of freedom of joints of the rigid frame *abc* has is

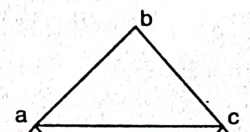


Fig. 10.119.

(*a*) 3 rotations
(*b*) 3 rotations and a horizontal translation at *c*
(*c*) 3 rotations and a translation each at *b* and *c*
(*d*) None

77. What is the magnitude of the force the member *BD* in the figure given below?

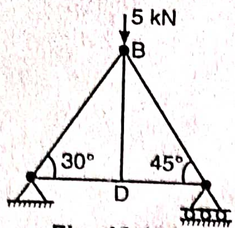


Fig. 10.120.

(*a*) 5 kN (*b*) 7 kN (Approx)
(c) $4\sqrt{2}$ kN (*d*) Zero **(GATE 2007)**

78. What is the force in the vertical member CD of the pin-jointed frame shown below?

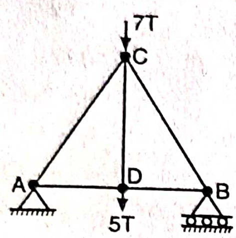


Fig. 10.121.

(*a*) 12T (tension) (*b*) 2T (compression)
(c) 7T (compression) (*d*) 5T (tension)
(IES 2008)

79. What is the force in the member BC of the plane frame shown below?

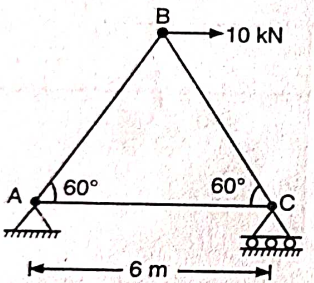


Fig. 10.122.

(*a*) 10 kN tensile (*b*) 10 kN compressive
(*c*) 5.76 kN compressive (*d*) zero

80. The force in member *ab* of the space truss *abcd* is

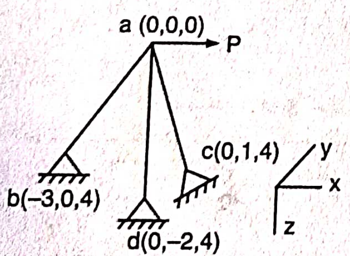


Fig. 10.123.

(*a*) *P* (tension) (*b*) $\frac{4}{3}P$ (comp.)
(*c*) $\frac{5}{3}P$ (tension) (*d*) $\sqrt{2}\,P$ (comp.)
(GATE 2011)

81. Two bars *AO* and *BO* are of uniform area A and are hinged at *O* as shown in figure below:

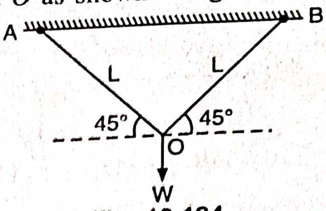


Fig. 10.124.

What is the vertical deflection at *O* when elastic modulus is uniformly *E*?

(*a*) $\frac{WL}{2AE}$ (*b*) $\frac{WL^2}{AE}$ (*c*) $\frac{WL}{AE}$ (*d*) $\frac{W^2L}{AE}$
(GATE 2011)

82. What is the area of influence line diagram for the reaction at the hinged end of a uniform propped cantilever beam of span L?

(a) $\frac{L}{8}$ (*b*) $\frac{L}{2}$ (*c*) $\frac{L}{4}$ (*d*) $\frac{3L}{8}$
(GATE 2012)

83. The displacement method is also referred to as which one of the following?
(*a*) Minimum strain energy method
(*b*) Maxwell-Mohr method
(*c*) Consistent deformation method
(*d*) Slope-deflection method

84. The horizontal displacement at *b* of the elastically propped cantilever is

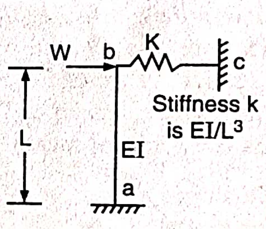


Fig. 10.125.

(*a*) $\frac{WL^3}{4EI}$ (*b*) $\frac{WL^3}{12EI}$ (*c*) $\frac{WL^3}{EI}$ (*d*) $\frac{WL^3}{13EI}$

85. Number of independent mechanisms the gable frame will have, when loaded as shown, is

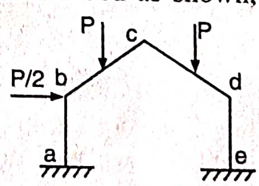


Fig. 10.126.

(*a*) 2 (*b*) 4 (*c*) 3 (*d*) 5
(GATE 2011)

86. The force in member *PQ* of the truss *PQR* is

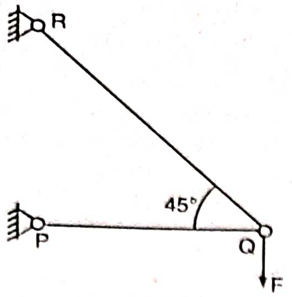


Fig. 10.127.

(*a*) *F* (compression) (*b*) $F\sqrt{2}$ (compression)

(*c*) *F* (tension) (*d*) $F/\sqrt{2}$ (tension)

87. The truss is shown in figure. The cross sectional area of each member is '*A*', and the modulus of elasticity of the material is uniformly *E*. The strain energy in the member *XY* is given by

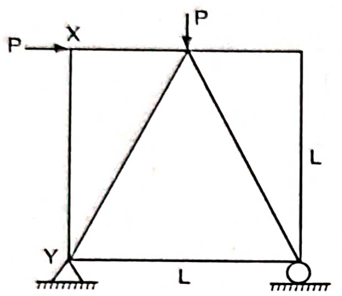


Fig. 10.128.

(*a*) $\dfrac{P^2L}{6\,AE}$ (*b*) $\dfrac{P^2L}{3\,AE}$ (*c*) Zero (*d*) $\dfrac{P^2L}{2\,AE}$

(GATE 2008)

88. A statically determinate truss *PQR* is subjected to a uniform temperature rise ΔT. All members have same area of cross-section '*A*', modulus of elasticity, *E* and coefficient of thermal expansion α. The force in member $\underline{QR}$ due to this temperature increase is

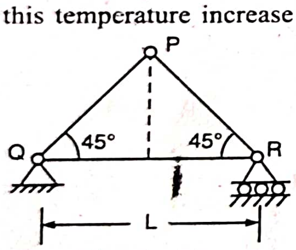


Fig. 10.129.

(*a*) $EA\,\alpha\,\Delta T$ (*b*) $\sqrt{2}\,EA\,\alpha\,\Delta T$

(*c*) $EA\,\Delta\,T/L$ (*d*) 0

89. The fixed beam *AB* has a span of 3000 mm and is of uniform cross-section. The plastic moment capacity (M_p) of the beams cross-section is 1.5×10^8 N-mm. The beam will behave like a simply supported beam when the magnintude of the distributed load *p* attains a value equal to

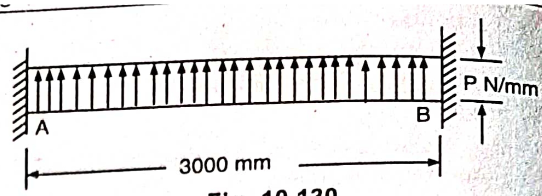


Fig. 10.130.

(*a*) 100 N/mm (*b*) 20 N/mm

(*c*) 200 N/mm (*d*) 500 N/mm

90. For the rigid frame shown below. What is the moment reaction at *A*?

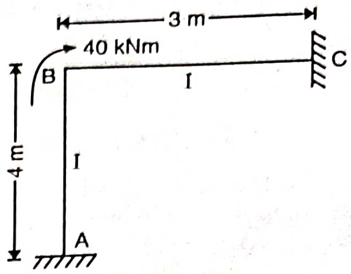


Fig. 10.131.

(*a*) 5 kN-m (*b*) 10 kN-m

(*c*) 12.33 kN-m (*d*) 15 kN-m **(IES 2008)**

91. A simple plane truss acted upon by a load 2P at the apex A is shown below. The axial force in the member AB is

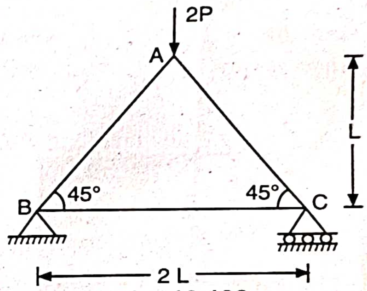


Fig. 10.132.

(*a*) *P* (*b*) $\sqrt{2}\,P$ (*c*) $\dfrac{\sqrt{3}}{2}P$ (*d*) $\sqrt{3}\,P$

(IES 2009)

92. A three-hinged symmetrical arch is loaded as shown in figure below. Which one of the following is the magnitude of the correct horizontal thrust?

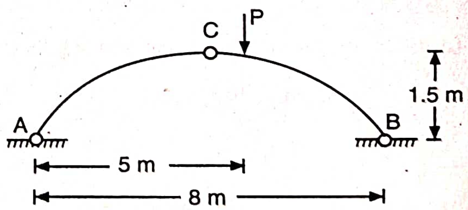


Fig. 10.133.

(*a*) $\dfrac{4}{3}P$ (*b*) *P* (*c*) $\dfrac{3}{4}P$ (*d*) $\dfrac{3}{8}P$

(IES 2010)

93. The distribution factors for members AE and AC of the box section are

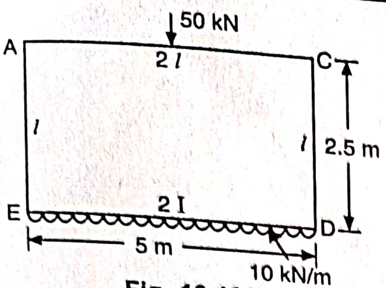


Fig. 10.134.

(*a*) 0.5 and 0.5
(*b*) 0.6 and 0.4
(*c*) 0.25 and 0.75
(*d*) 1 and zero

94. For the elastic system under the action of loads the elastic strain and complementary strain energies are represented by U and U^* respectively. Select the correct expression for displacement in the direction of load P

(*a*) $\frac{\partial U}{\partial P}$
(*b*) $\frac{\partial U^*}{\partial P}$
(*c*) $\frac{\partial}{\partial P}(U + U^*)$
(*d*) $\frac{1}{2}\frac{\partial}{\partial P}(U + U^*)$

95. The force in the member CD of the truss shown in figure is

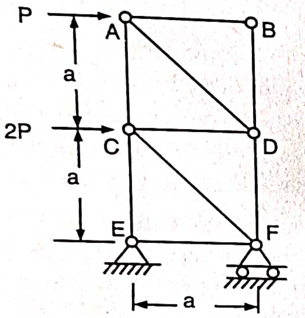


Fig. 10.135.

(*a*) Zero
(*b*) 2 P (compressive)
(*c*) p (compressive)
(*d*) p (tensile)

96. In the continuous beam ABC subjected to udl of w/unit length, the value of central support reaction becomes zero if the central support sink by

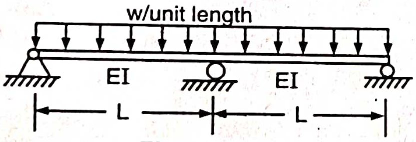


Fig. 10.136.

(*a*) 5 $wL^4/24\ EI$
(*b*) 5 $wL^4/384\ EI$
(*c*) 10 $wL^4/384\ EI$
(*d*) $wL^4/48\ EI$

97. What is the value of θ_B for the beam shown in figure below?

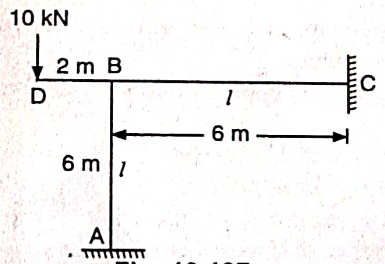


Fig. 10.137.

(*a*) Zero
(*b*) $\frac{15}{EI}$ anticlockwise
(*c*) $\frac{30}{EI}$ anticlockwise
(*d*) $\frac{30}{EI}$ clockwise

(IES 2009)

98. A fixed beam AB of span L carries a uniformly distributed load w per unit length. During loading, the support B sinks downnwards by an amount δ. If $\delta = \frac{wL^4}{72EI}$, what is the fixing moment at B?

(*a*) $\frac{wL^2}{12}$
(*b*) $\frac{wL^2}{6}$
(*c*) $\frac{6EI\,\delta}{L^2}$
(*d*) Zero

(IES 2007)

99. What is the rotation of the member at C for a frame as shown in figure below?

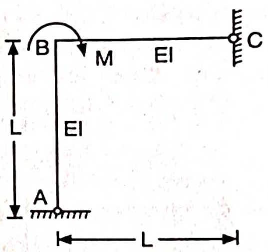


Fig. 10.138.

(*a*) $\frac{ML}{3\,EI}$
(*b*) $\frac{ML}{4\,EI}$
(*c*) $\frac{ML}{6\,EI}$
(*d*) $\frac{ML}{12\,EI}$

(IES 2009)

100. The principle of superposition is made use of in stuctural computations when:

(*a*) The geometry of the structure changes by finite amount during the application of the loads
(*b*) The changes in the geometry of the structure during the application of the loads is too small and the strains in the structure are directly proportional to the corresponding stress
(*c*) The strains in the structure are not directly proportional to the corresponding stresses, even through the effect of changes in geometry can be neglected
(*d*) None of the above conditions are met

101. Two elastic rods AB and BC are hinged at B. The joint A is a hinged one, joint C is over a roller and the joint B is supported on a spring having the stiffness as k. A load P acts at mid-point of the rod BC. The downward deflection of joint B is

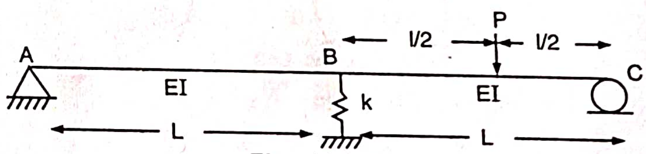


Fig. 10.139.

(*a*) P/K
(*b*) 2 P/K
(*c*) $P/2\ K$
(*d*) 0

102. A rigid rod AB of length L is hinged at A and is maintained in its vertical position by two springs with spring constants K attached at end B. The system is

under stable equilibrium under the action of load P when $P < P_{CT}$. Then system will be in unstable equilibrium when P attains a value greater than

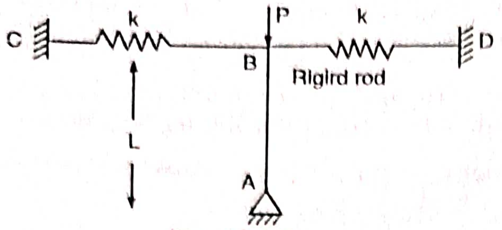


Fig. 10.140.

(*a*) KL
(*b*) K/L
(*c*) 2 KL
(*d*) 4 KL

103. The stability and determinacy of rigid frame are investigated by establishing a criterion based on the number of unknowns and the number of independent equations of static equilibrium available. Based on this criterion, the frame shown is classified as

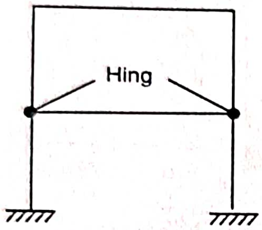


Fig. 10.141.

(*a*) Unstable
(*b*) Stable, Determinate
(*c*) Stable; 5th degree indeterminacy
(*d*) Stable; 3rd degree indeterminate

104. In a real beam, at an end, the boundary condition of zero slope and zero vertical displacement exists. In the corresponding conjugate beam, the boundary condition at this end will be

(*a*) Shear force = 0 and bending moment = 0
(*b*) Slope = 0 and vertical displacement = 0
(*c*) Slope = 0 and bending moment = 0
(*d*) Shear force = 0 and vertical displacement = 0

105. The beam supported by 3 links and loaded as shown in the figure is

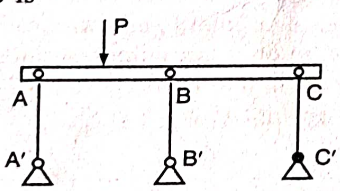


Fig. 10.142.

(*a*) Stable and determinate
(*b*) Unstable
(*c*) Stable and indeterminate
(*d*) Unstable and determinate

106. What is the most appropriate method for analysis of a skeletal plane frame shown in the figure below?

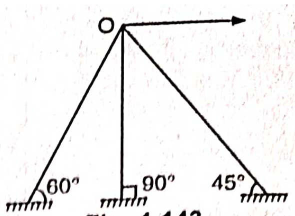


Fig. 1.143.

(*a*) Slope-deflection method
(*b*) Strain energy method
(*c*) Moment distribution method
(*d*) None of the above **(IES 2007)**

107. Number of independent displacement modes

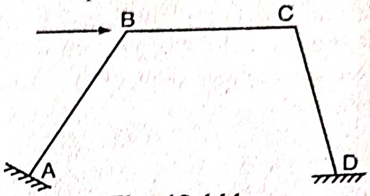


Fig. 10.144.

(sway mechanisms) for the given frame with load shown therein are

(*a*) 4 (*b*) 1 (*c*) 3 (*d*) 2

108. In a linear elastic 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

109. The moments at the end '*a*' and '*b*' of a beam '*ab*' where end '*a*' is fixed and '*b*' is hinged, when the end (*b*) sinks by an amount Δ, are given as

	at the end '*a*'	at the end '*b*'
(*a*)	$\frac{6\,EI\,\Delta}{L^2}$	$\frac{6\,EI\,\Delta}{L^2}$
(*b*)	$\frac{6\,EI\,\Delta}{L^2}$	0
(*c*)	$\frac{3\,EI\,\Delta}{L^2}$	$\frac{3\,EI\,\Delta}{L^2}$
(*d*)	$\frac{3\,EI\,\Delta}{L^2}$	0

110. A parabolic two hinged arch carrying a load 'W' at center. Find the height from supports at which reactions at two ends intersect with load W. The central rise of arch is h

(*a*) $\frac{8\,h}{5}$ (*b*) $\frac{32\,h}{25}$ (*c*) h (*d*) $2\,h$

111. (I) In a two-hinged semi-circular, the reaction locus is a straight line

(II) The distance of reaction locus from abutment is $\pi R/2$

(*a*) Both I and II are true
(*b*) I is true II is false
(*c*) I is false and II is true
(*d*) Both I and II are false

112. For a linear elastic material. Where U = strain energy, C = complementary energy
(a) $U > C$ (b) $U = C$
(c) $U < C$ (d) None of the above

113. A plane structure shown in figure is

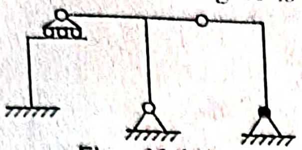


Fig. 10.145.

(a) Stable and determinate
(b) Stable and indeterminate
(c) Unstable and determinate
(d) Unstable and indeterminate

114. A plane frame $ABCDEFGH$ shown in figure has a clamp support at A, hinge supports at G and H, axial force release (horizontal sleeve) at C and moment release (hinge) at E. The static (α_s) and kinematic (α_k) indeterminacies are

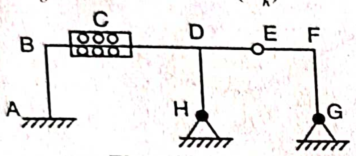


Fig. 10.146.

	α_s	α_k
(a)	4	9
(b)	3	11
(c)	2	13
(d)	1	14

115. The maximum bending stress induced in a steel wire of modulus of elasticity 200 kN/mm^2 and diameter 1 m is approximately equal to
(a) 50 N/mm^2 (b) 100 N/mm^2
(c) 200 N/mm^2 (d) 400 N/mm^2

116. A cantilever beam of span L, is subjected to a downward load of 800 kN uniformly distributed over its length and a concentrated upward load, P at its free end. For vertical displacement to be zero at the free end, the value of P is
(a) 300 kN (b) 500 kN (c) 800 kN (d) 1000 kN

117. A cantilever beam of span L, is subjected to a load W, at a distance 'a' from support. It is desired to obtain the vertical displacement at the free end by unit load method. The expression for deflection is

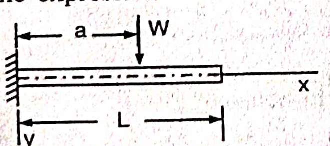


Fig. 10.147.

(a) $y = \int_0^a \frac{W(a-x)(a-x)}{EI} dx$

(b) $y = \int_0^a \frac{W(a-x)(L-x)}{EI} dx$

(c) $y = \int_0^a \frac{W(x-a)(L-x)}{EI} dx$

(d) $y = \int_0^a \frac{W(L-x)(L-x)}{EI} dx$

118. In a simply supported carrying a point load at a distance of 'X' from one of the support. Deflection at middle will be a close approximation of
(a) Max. deflection of beam
(b) Deflection at load point
(c) Both (a) and (b)
(d) None of above

119. Moment at A and B in following Fig. will satify which of the following condition

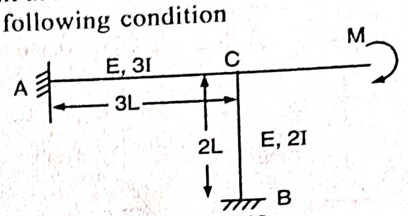


Fig. 10.148.

(a) $M_A = M_B$ (b) $M_A > M_B$
(c) $|M_A| = 0.25$ M (d) Both (a) and (c)

120. Which of the following condition will be satisfied in the given portal frame?

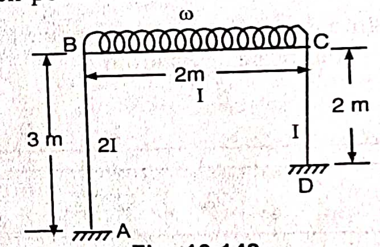


Fig. 10.149.

(a) Portal frame will sway towards left
(b) Portal frame will sway towards left
(c) There is no sway
(d) None of the above

121. Which of the following is true in the following figure

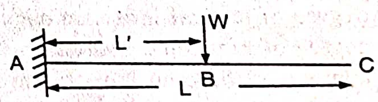


Fig. 10.150.

(a) deflection at C = deflection at B + $\theta_B(L - L')$

(b) deflection at $C = \frac{L}{L'}$ × deflection at B

(c) deflection at C = deflection at $B + \theta_c (L - L')$

(d) Both (a) and (c)

122. A simply supported beam of span length L and flexural stiffness EI has another spring support at the centre span of stiffness K as shown in figure. The central deflection of the beam due to central concentrated load of P would be

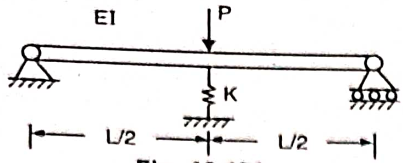


Fig. 10.151.

(*a*) $(PL^3/48\ EI) + (P/K)$ (*b*) $P/(48\ EI/L^3) - K$
(*c*) $(PL^3/48\ EI) - (P/K)$ (*d*) $P/(48\ EI/L^3) + K$

123. The plane frame shown in figure is
(*a*) stable and statically determinate
(*b*) unstable and statically determinate
(*c*) stable and statically indeterminate
(*d*) unstable and statically indeterminate

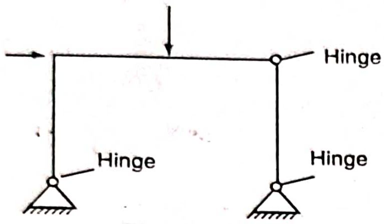


Fig. 10.152.

124. The kinematic indeterminacy of the plane frame shown in above figure is (disregrading the axial deformation of the members)
(*a*) 7 (*b*) 5 (*c*) 6 (*d*) 4

125. The magnitude of the bending moment at the fixed support of the beam is equal to

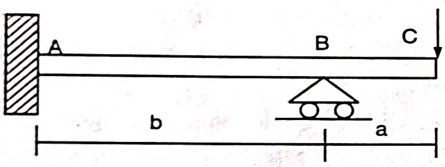


Fig. 10.153.

(*a*) *P.a* (*b*) *P.a*/2
(*c*) *P.b* (*d*) *P*.(*a* + *b*)

126. The number of simultaneous equations to be solved in the slope deflection method is equal to
(*a*) The degree of statical indeterminacy
(*b*) The degree of kinematic indeterminacy
(*c*) The number of joints in the structure
(*d*) None of the above

127. The influence line for vertical reaction at A of the beam is

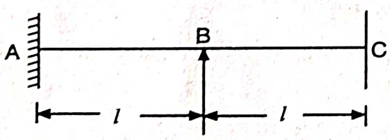
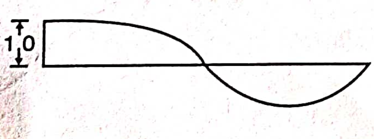
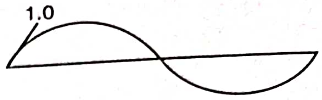


Fig. 10.154.

(*a*)


(*b*)


(*c*)


(*d*)


(IES 2011)

128. The influence line diagram for the support moment at A of the fixed beam AB of constant EI is

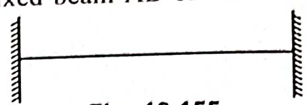
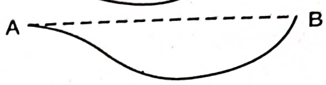
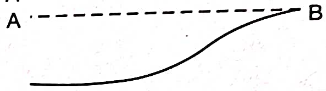


Fig. 10.155.

(*a*)


(*b*)


(*c*)


(*d*)


(IES 2010)

129. The influence line for force in member *BC* is

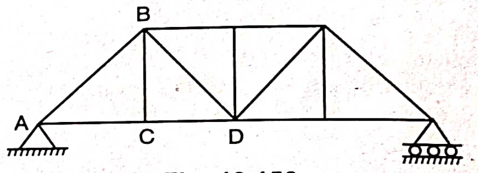
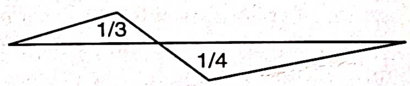
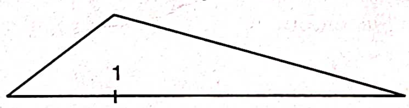
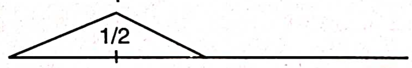
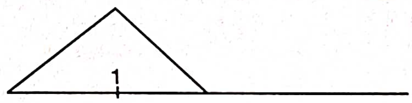


Fig. 10.156.

(*a*)


(*b*)


(*c*)


(*d*)


(IES 2010)

130. What is the ordinate of influence line at B for reaction R_D in figure below?

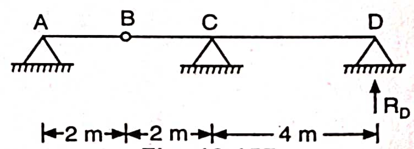


Fig. 10.157.

(*a*) 0.5 (*b*) 0.4 (*c*) 0.2 (*d*) Zero

(IES 2009)

131. What is the area of influence line diagram for the reaction at the hinged end of a uniform propped cantilever beam of span L?

(a) $\frac{L}{B}$ (b) $\frac{L}{2}$ (c) $\frac{L}{4}$ (d) $\frac{3L}{8}$

(IES 2009)

132. What is the variation of influence line for stress function in a statically determinate structure?

(a) Parabolic (b) Bilinear
(c) Linear (d) Uniformly rectangular

(IES 2007)

133. The influence line diagram for the force in member a of the truss shown below is given by

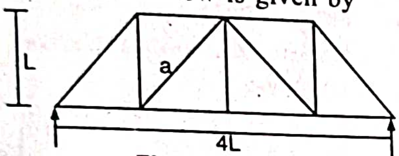
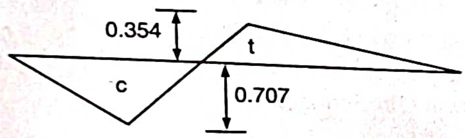
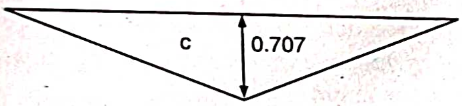


Fig. 10.158.

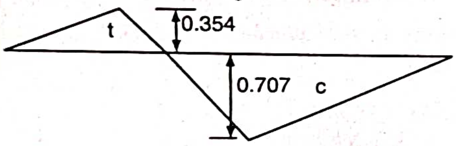
(a)



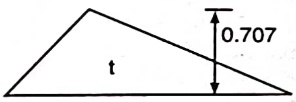
(b)



(c)



(d)



134. The forces in members 'a, b, c' in the truss shown are, respectively

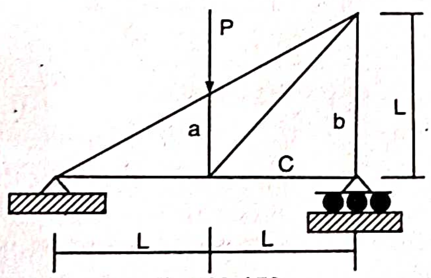


Fig. 10.159.

(a) $P, \frac{P}{2}, 0$ (b) $\frac{P}{2}, P, 0$

(c) P, P, P (d) $\frac{P}{2}, \frac{P}{2}, 0$

135. Which one of the following statements is true with regard to the flexibility method of analysis?

(a) The method is used to analyse determinate structures

(b) The method is used only for manual analysis of indeterminate structures

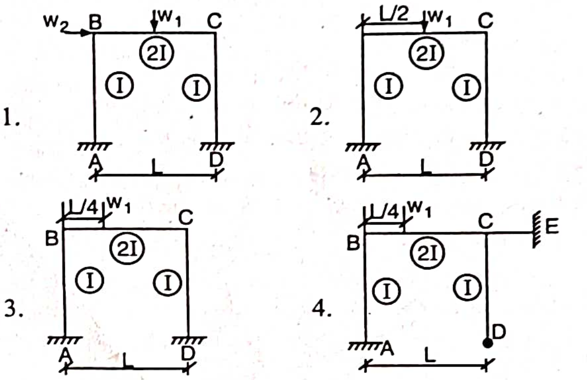
(c) The method is used for analysis of flexible structures

(d) The method is used for analysis of indeterminate structures with lesser degree of static indeterminacy

136. A single bay storey portal frame has a hinged left support and a fixed right support. It is loaded with uniformly distributed load on the beam. Which one of the following statements is true regard to the deformation of the frame?

(a) It would sway to the left side
(b) It would sway to the right side
(c) It would not sway at all
(d) None of the above

137. Which of the following structures will experience sway?



Select the correct answer using the codes given below:

Codes:

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

138. The given figure shows a simply supported beam overhanging to the left. The beam carries a uniformly distributed load of w/m throughout. The correct bending moment diagram for the beam is

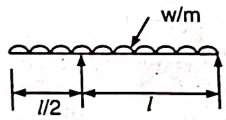
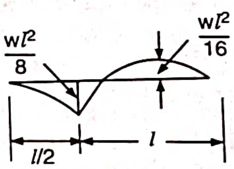
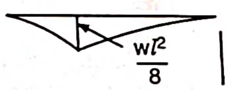


Fig. 10.160.

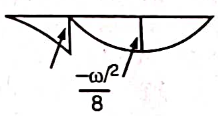
(a)



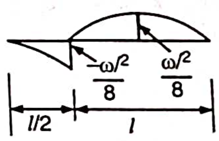
(b)



(c)



(d)



139. A symmetrical two-hinged parabolic arch when subjected to uniformly distributed load on the entire horizonotal span, is subjected to

(a) radial shear alone (b) normal thrust alone
(c) normal thrust and bending moment
(d) normal thrust, radial shear and bending moment

140. A three-hinged symmetric parabolic arch is hinged at the springing and at the crown. The span and rise are 40 m and 10 m respectively. The left half of the arch is loaded with U.D.L. of 3t/m. The horizontal thrust at the springings will be

(a) 15 t (b) 20 t (c) 30 t (d) 40 t

141. A one-storey rigid portal frame, $ABCD$, carries loads P and Q as shown in the given figure. It is hinged at the two supports A and D. The structure is statically

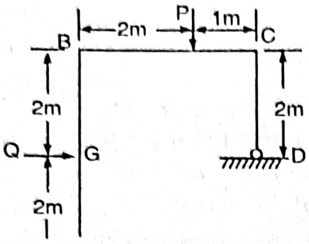


Fig. 10.161.

(a) determinate
(b) indeterminate to the first degree
(c) indeterminate to the second degree
(d) indeterminate to the third degree

142. In the truss shown in the given figure, the forces in the members AB and BC will be respectively (plus denotes tension)

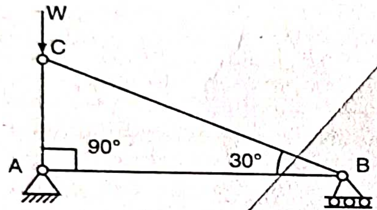


Fig. 10.162.

(a) zero and zero
(b) $-W/\cos 60°$ and $+W \tan 60°$
(c) $-W/\cos 60°$ and zero
(d) zero and $+W/\tan 60°$

143. The deflection at the free end of a cantilever of rectangular cross-section due to certain loading is 0.8 cm. If the depth of the section is doubled keeping the width the same, then the deflection at the free end due to the same loading will be

(a) 0.1 cm (b) 0.4 cm (c) 0.8 cm (d) 1.6 cm

144. The influence line for shear at section X (F_x) at a distance of 4 m from the left support of a simply supported girder AB is shown in figure. The shear force at section X due to a uniformly distributed dead load of intensity 2t/m covering the entire span will be

(a) 8 t (b) 4 t (c) 2 t (d) 1 t

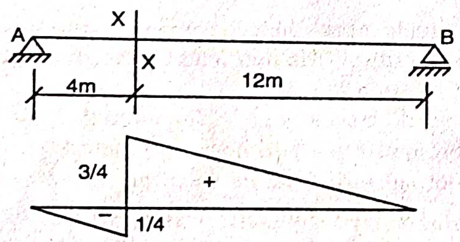


Fig. 10.163.

145. Consider the propped cantilever shown in figure and the fixed beam shown in figure.

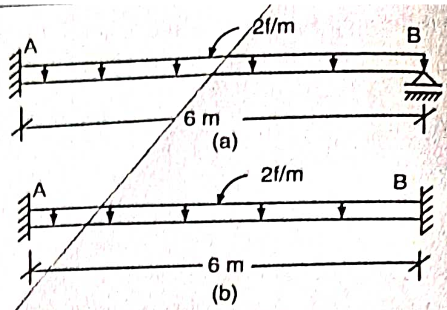


Fig. 10.164.

Consider the following statements regarding the two figures.

Statement I: The fixed end moment (FEM) at A of the propped cantilever is 12 tm

Statement II: The FEM at A of the fixed beam is 6 tm

Of these statements:

(a) both I and II are false (b) I is correct but II is false
(c) both I and II are correct
(d) I is false but II is correct

146. In an indeterminate structure, when there is no lack of fit, the partial derivative of strain energy with respect to any of the redundants

(a) is zero
(b) will give deflection in the direction of redundant
(c) will give slope in the direction of redundant
(d) is a maximum

147. The force in the member CD is

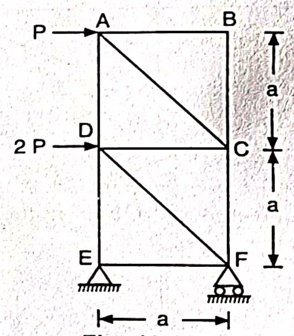


Fig. 10.165.

(a) P tensile (b) P Compressive
(c) 2P Tensile (d) 2P Compressive

(IES 2011)

148. A pin-jointed truss is loaded as shown in figure the force in member CE is

(a) 10 tonnes tensile (b) 10 tonnes compressive
(c) 5 tonnes tensile (d) 5 tonnes compressive

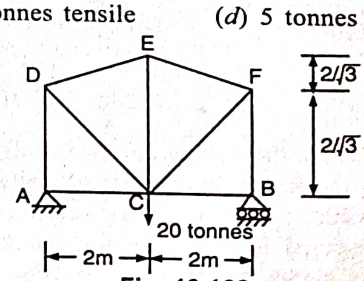


Fig. 10.166.

149. A rigid cantilever frame ABC is fixed at C, as shown in given figure. It carries a point load P at A. Neglecting the axial deformation, the horizontal deflection ΔH_x of the point A will be be

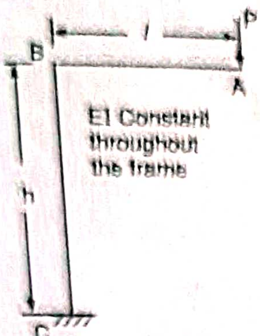


Fig. 10.167.

(a) $\frac{plh^2}{2\,EI}$ (b) $\frac{pl^2h}{3\,EI}$

(c) $\frac{pl^2}{EI}\left(h+\frac{l}{3}\right)$ (d) $\frac{pl^2}{EI}\left(h+\frac{l}{2}\right)$

150. Consider the following assumption in the analysis of a plane truss
1. The individual members are straight
2. The individual members are connected by frictionless hinges
3. The loads and reactions act only at the joints

Of these assumptions
(a) 1 and 2 are valid (b) 1 and 3 are valid
(c) 2 and 3 are valid (d) 1, 2 and 3 are valid

151. Two bars AO and BO are of uniform area 'A' each and are hinged at O as shown in fig. A load W is applied at O. The vertical deflection of O will be

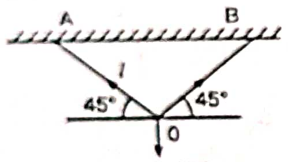


Fig. 10.168.

(a) $\frac{Wl}{AE}$ (b) $\frac{Wl}{2AE}$ (c) $\frac{W^2l}{AE}$ (d) $\frac{W^2l}{2\,AE}$

152. The influence line for bending moment at sectionn $X(M_x)$ at a distance of 4 m from the left support of simply-supported girder AB is shown in figure. A uniformly distributed load of intensity 2 t/m longer than the span crosses the grider from left to right. The maximum bending moment at section X is equal to

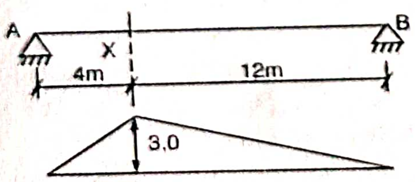


Fig. 10.169.

(a) 12 tm (b) 24 tm (c) 48 tm (d) 96 tm

153. The slope at the support A of the overhanging beam shown in figure.

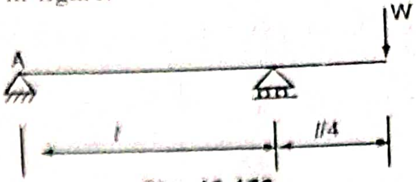


Fig. 10.170.

(a) $\frac{Wl^2}{12\,EI}$ (b) $\frac{Wl^2}{24\,EI}$ (c) $\frac{Wl}{3\,EI}$ (d) $\frac{Wl}{6\,EI}$

154. A simply supported beam is made of two wooden planks of same width resting one upon the other without friction and without connection. The upper plank is of half the thickness as compared to lower plank. The assembly is loaded by a uniformly distributed load on the entire span. The ratio of the maximum stresses developed between top and bottom planks will be
(a) 1 : 16 (b) 1 : 8 (c) 1 : 4 (d) 1 : 2

155. The cantilever beam shown in figure has load P acting at points A and B. The deflection at B is Δ when the load at B is removed. When the load at A is removed, the deflection at A will be

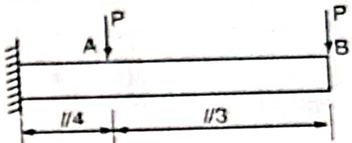


Fig. 10.171.

(a) $\frac{\Delta}{4}$ (b) $\frac{\Delta}{2}$ (c) Δ (d) $\frac{2\Delta}{3}$

156. System A is simply supported beam with a load P at midspan. System B is the same beam but the load is replaced by a udl of intensity P/L wherein L is the span. The midspan deflection of system B will
(a) be the same as that of system A at midspan
(b) be less than that of system A at midspan
(c) be more than that of system A at midspan
(d) bear no relation to that of system

157. Given that P_E = the crippling load given by Euler
P_C = the load at failure due to direction compression
P_R = the load in accordance with the Rankine's criterion of failure
P_R is given by

(a) $\frac{P_E + P_C}{2}$ (b) $\sqrt{P_E \times P_C}$

(c) $\frac{P_C - P_E}{P_C + P_E}$ (d) None of the above

158. Consider the following statements regarding a simply supported beam subjected to a uniformly distributed load over the entire span:
1. The bending moment is maximum at the central portion
2. The shear force is zero at central position
3. The slope is maximum at the middle position 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

159. The pin jointed frame shown in figure is

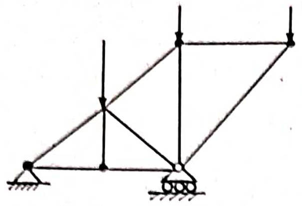


Fig. 10.172.

(a) a perfect frame (b) a redundant frame
(c) a deficient frame (d) None of the above

160. A composite section made of two materials has moduli of elasticity in the ratio 1 : 2 and lengths in the ratio 2 : 1. The ratio of corresponding stresses under a direct load is

(a) 2 : 1 (b) 1 : 2 (c) 4 : 1 (d) 1 : 4

161. In a two-hinged arch an increase in temperature induces
(a) no bending moment in the arch rib
(b) uniform bending moment in the arch rib
(c) maximum bending moment at the crown
(d) minimum bending moment at the crown

162. A simply supported truss shown in figure carries load as shown. The force in member BE is

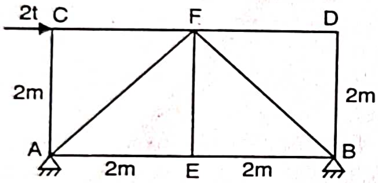


Fig. 10.173.

(a) $\sqrt{2}t$ (tensile) (b) $\sqrt{2}t$ (compressive)
(c) 1 t (tensile) (d) 1 t (compressive)

163. Assuming that the bar BC (see figure given below) is infinitely rigid and is of weight W and bars AB and CD have flexural rigidity EI and are of negligible weight, what would be the downward deflection of the bar BC (Joints B and C are rigid)?

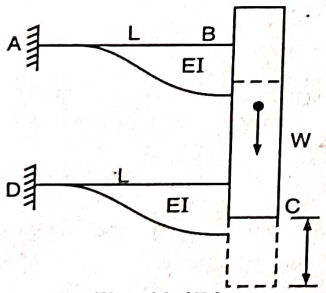


Fig. 10.174.

(a) $\dfrac{WL^3}{12\,EI}$ (b) $\dfrac{WL^3}{24\,EI}$ (c) $\dfrac{WL^3}{3\,EI}$ (d) $\dfrac{WL^3}{6\,EI}$

164. A beam with a cantilevered arm BC supporting a freely supported end span CD is shown in figure. Which one of the following figures represents the influence line diagram for shear force at A?

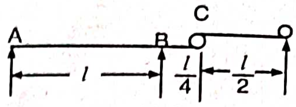
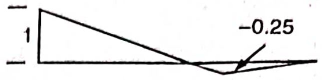
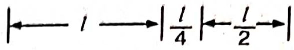
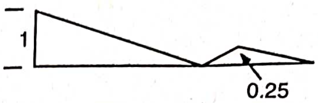


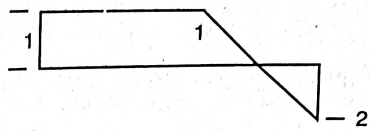
Fig. 10.175.

(a)




(b)


(c)


(d)


165. The strain energy stored in a simply supported beam of span 'l' and flexural rigity EI due to a central concentrated load W is
(a) $W^2\ l^3/48\ EI$ (b) $W^2\ l^2/48\ EI$
(c) $W^2\ l^2/96\ EI$ (d) $W^2\ l^3/96\ EI$

166. A two-span continuous beam ABC is simply supported at A and C is continuous over support B. Span AB = 6 m and span BC = 6 m. The beam carries a udl of 2 t/m over both the spans. EI is constant for the entire beam. The fixed end moment at B in span BA or BC would be

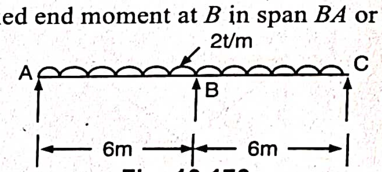


Fig. 10.176.

(a) 12 tm (b) 9 tm (c) 8 tm (d) 6 tm

167. Three wheel load 10 t, 26 t and 24 t spaced 2 m apart roll on a girder from left to right with the 10 t load leading. The girder has a span of 20 metre. For the condition of maximum bending moment at a section 8 metre from the left end.
(a) The 10 t load should be placed at the section
(b) The 26 t load should be placed at the section
(c) The 24 t load should be placed at the section
(d) Either the 26 t load or the 24 t load should be placed at the section

168. The strain energy stored in simply supported beam of span 'l' and flexural rigidity EI due to a central concentrated load W is

(a) $\dfrac{W^2 l^3}{48\ EI}$ (b) $\dfrac{W^2 l^2}{48\ EI}$ (c) $\dfrac{W^2 l^2}{96\ EI}$ (d) $\dfrac{W^2 l^3}{96\ EI}$

169. In a system of coplanar forces, when the force polygon closes but funicular polygen does not close, the forces are

(*a*) equivalent to a couple

(*b*) equivalent to a resultant whose magnitude direction and line of action can be determined

(*c*) in equilibrium

(*d*) equivalent to a couple and a resultant force

170. In the statement 'the buckling load for a slender column rigidly fixed at both ends is about X times that of a geometrically identical column but with hinged ends'. X stands for

(*a*) two (*b*) three (*c*) four (*d*) six

171. The ratio of Young's modulus to modulus of rigidity for a material having Poisson's ratio 0.2 is.

(*a*) $\frac{12}{5}$ (*b*) $\frac{5}{12}$ (*c*) $\frac{5}{14}$ (*d*) $\frac{14}{5}$

172. The ratio of reactions R_A and R_B of the simply supported beam shown in figure.

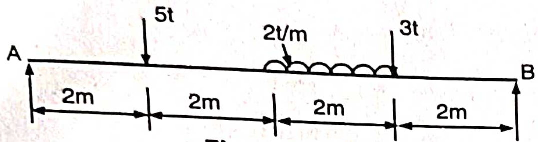


Fig. 10.177.

(*a*) $\frac{1}{2}$ (*b*) $\frac{2}{3}$ (*c*) $\frac{3}{2}$ (*d*) 1

173. Consider the following statements regarding a simply supported beam subjected to a uniformly distributed load over the entire span:

I. The bending moment is maximum at the central position

II. The shear force is zero at the central position.

III. The slope is maximum at the middle position.

Of these statements

(*a*) I, II and III are correct

(*b*) I and II are correct

(*c*) II and III are correct (*d*) I and III are correct

174. In a beam AB, support A is hinged and support B is on rollers, as shown in figure.

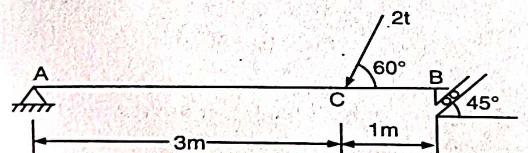
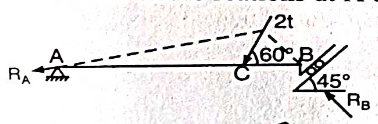
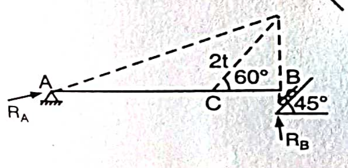
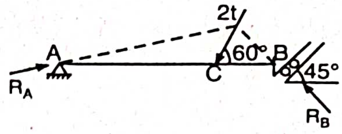


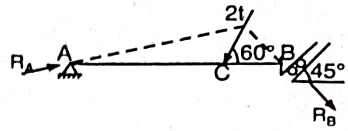
Fig. 10.178.

The directions of the reations at A and B are given by

(*a*)


(*b*)


(*c*)


(*d*)


175. A simply supported beams of uniform cross-section is subject to a maximum bending moment of 2.25 *m*. If it has rectangular cross-section with width 15 cm and depth 30 cm, then the maximum bending stress induced in the beam will be

(*a*) 50 kg/cm^2 (*b*) 100 kg/cm^2

(*c*) 150 kg/cm^2 (*d*) 225 kg/cm^2

176. A beam has a solid circular cross-section having diameter *d*. If a section of the beam is subjected to shear force *F*, the maximum shear stress in the cross-section is given by

(*a*) $\frac{4}{3}\frac{F}{\pi d^2}$ (*b*) $\frac{16F}{3\pi d^2}$ (*c*) $\frac{8}{3}\frac{F}{\pi d^2}$ (*d*) $\frac{3}{16}\frac{F}{\pi d^2}$

177. A cantilever beam '*A*' with rectangular cross-section is subjected to a concentrated load at its free end. If width and depth of another cantilever beam '*B*' are twice those of beam *A*, then the deflection at free end of the beam '*B*' to that of '*A*' will be.

(*a*) 6.25% (*b*) 14% (*c*) 23.6% (*d*) 28%

178. Consider the following statements:

For the N-girder shown in the figure ILD for force in the member $L_0\ U_t$ is obtained by

I. multiplying the ordinate of ILD for shear in the panel $L_0\ L_1$ by sec θ.

II. dividing the ordinate of ILD for moment at L_1 by cos θ × $L_0\ L_1$.

III. dividing the ordinate of ILD for moment at L_1 by $L_1\ U_1$.

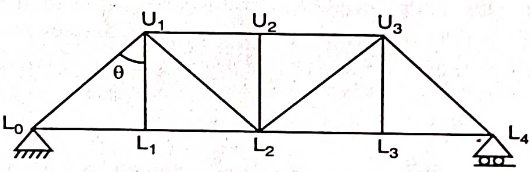


Fig. 10.179.

Of these statements:

(*a*) only III is correct (*b*) I and III are correct

(*c*) I and II are correct (*d*) I, II and III are correct

179. A timber beam of rectangular section 100 mm × 50 mm is simply supported at the ends, has a 30 mm × 10 mm steel strip securely fixed to the top surface as shown in Fig. 10.180.

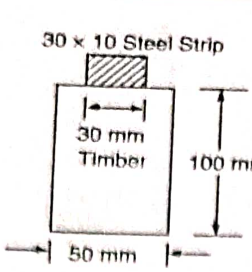


Fig. 10.180.

The centroid of the 'Equivalent timber beam' in this case from the top surface

(*a*) is 5 mm (*b*) is 30 mm
(*c*) is 15 mm (*d*) cannot be predicted

180. The 'Euler' load for a column is 1000 kN and crushing load is 1500 kN. The 'Rankine' load is equal to

(*a*) 600 kN (*b*) 1000 kN
(*c*) 1500 kN (*d*) 2500 kN

181. Figure shows a retaining wall of base width B_1 and height H_1. The sp. gravity of the material of construction is S. Further

$$AB = BC = CD = \frac{B_1}{3}$$

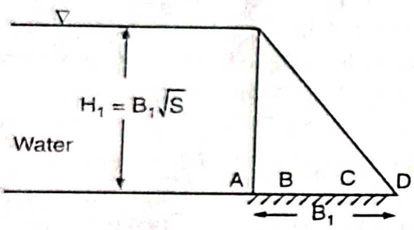


Fig. 10.181.

When the depth of storage increases from 0 to H_1, the resultant force will move from

(*a*) A to B (*b*) B to C
(*c*) C to D (*d*) B to D

182. A cantilever pin-jointed truss carries one load P at the point Z as shown in the given figure. The hinges in the vertical wall are at A and D. The truss has only three horizontal members AC, CG and GZ.

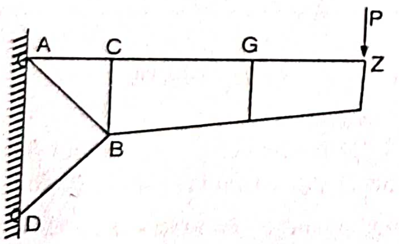


Fig. 10.182.

The nature of force in member AB

(*a*) is tensile (*b*) is zero
(*c*) is compressive (*d*) cannot be predicted

183. A shaft PQRS is subjected to torques at P, Q, R, S as shown in figure.

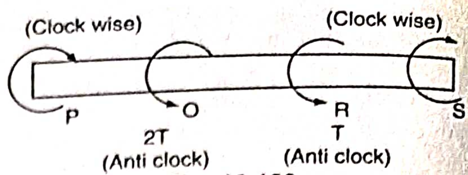


Fig. 10.183.

The maximum torque for the shaft section occurs between

(*a*) P and Q (*b*) P and R
(*c*) Q and R (*d*) R and S

184. A column section as indicated in figure is loaded with a concentrated load at a point 'P' so as to produce maximum bending stress due to eccentricities about *xx* axis and *yy* axis as 5 t/m^2 and 8 t/m^2 respectively. If the direct stress due to loading is 15 t/m^2 (compressive), then the intensity of resultant stress at the corner 'B' of the column section is

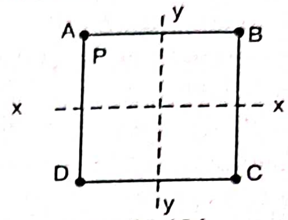


Fig. 10.184.

(*a*) 2 t/m^2 (compressive) (*b*) 12 t/m^2 (compressive)
(*c*) 18 t/m^2 (tensile) (*d*) 28 t/m^2 (compressive)

185. Two similar round bars A and B are each 30 cm long as shown in figure. The ratio of the energies stored by the bars A and B, $\frac{U_B}{U_A}$ is

(*a*) $\frac{3}{2}$ (*b*) 1.0 (*c*) $\frac{5}{8}$ (*d*) $\frac{2}{3}$

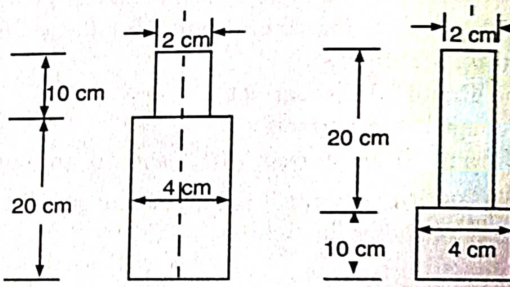


Fig. 10.185.

186. The ratio between the stress produced in a bar by a sudden application of load (impact loading) as compared to the stress produced by the gradual application of same load is

(*a*) 1.5 (*b*) 2.0 (*c*) 2.5 (*d*) 3.0

187. Consider a close-coiled helical spring of radius R subject to a load P. The spring consists of n turns of wire with wire radius r. The stiffness of the spring is

(*a*) $\frac{PR^3}{GI_z}$ (*b*) $\frac{Gr^4}{4nR^3}$

(*c*) $\frac{GI_z nr^4}{2\pi R^3}$ (*d*) $\frac{PR^4 2\pi n}{GI_z}$

88. The following methods are used for structural analysis:
I. Macaulay method
II. Column analogy method
III. Kani's method
IV. Method of selections
Those used for indeterminate structural analysis would include
(a) I and II (b) I and III
(c) II and III (d) II, III and IV

89. The reaction at B due to the load as shown in figure.

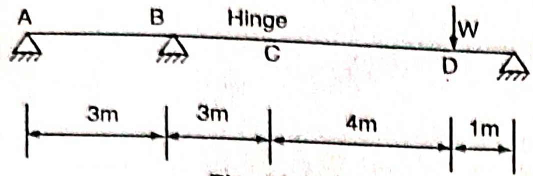


Fig. 10.186.

(a) $\frac{W}{3}$ (b) $\frac{W}{2}$ (c) 2 W (d) 3 W

90. In figure the maximum bending moment at the fixed end of the cantilever caused by the UDL is M. The bending moment at a section $l/5$ from the free end is

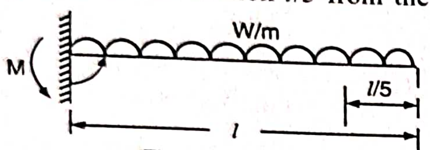


Fig. 10.187.

(a) 4% of M (b) 5% of M
(c) 10% of M (d) 20% of M

91. The force in member FD in figure is

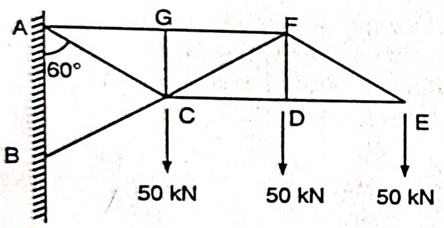


Fig. 10.188.

(a) 50 kN compression (b) 50 kN tension
(c) 150 kN tension (d) 100 kN compression

92. A gradually applied load W is suspended by wire ropes AB and CD as shown, in figure. The wires AB and CD, made of the same material and of the same cross-section are connected to a rigid block from which the load W is suspended in such a way that both the ropes

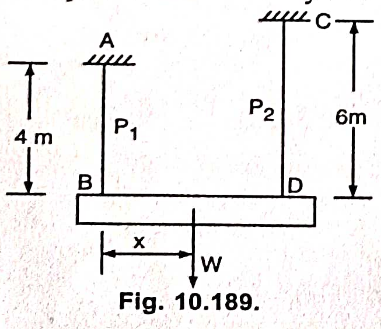
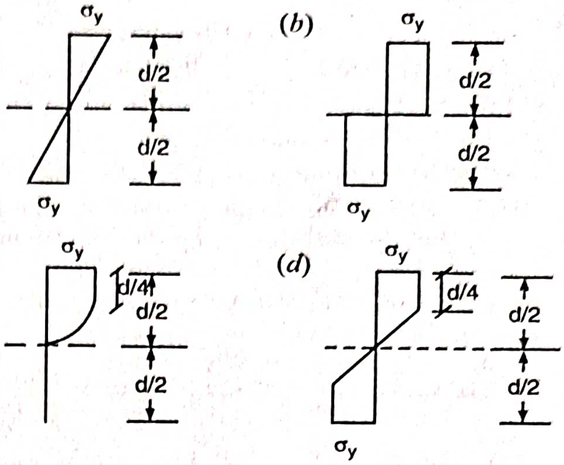


Fig. 10.189.

stretch by the same amount. If the stress in AB and CD are p_1 and p_2 respectively, then the ratio p_1/p_2 will be

(a) $\frac{3}{2}$ (b) $\frac{2}{3}$ (c) $\frac{9}{4}$ (d) $\frac{4}{9}$

193. Which one of the following stress diagrams corresponds to a plastic hinge formed at a section of a beam of a rectangular cross-section, of depth 'd'? (σ_y is the yield strength of the material).



194. In the cantilever truss shown in figure the reaction at A is

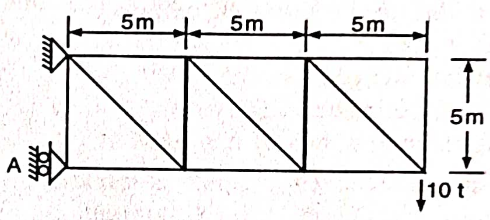


Fig. 10.190.

(a) 10 t (b) 20 t (c) 30 t (d) 40 t

195. When the strain in a material increases with time under sustained constant stress, the phenomenon is known as
(a) Strain hardening (b) Hysteresis
(c) Creep (d) Visco-elasticity

196. Maximum shear stress developed in a beam of rectangular section beara a constant ratio to the average shear stress and this ratio is equal to

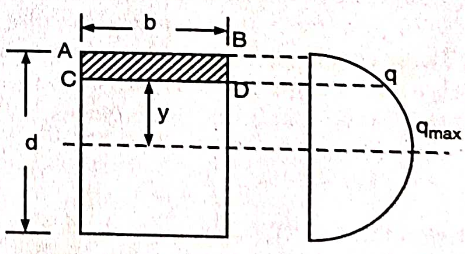


Fig. 10.191.

(a) 1.33 (b) 1.5 (c) 2.0 (d) 2.5

197. A truss ABC, carries two horizontal and two vertical loads, as shown in figure. The horizontal and vertical components of the reacion at A will be

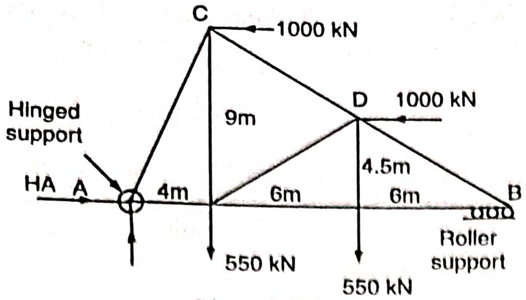


Fig. 10.192.

(*a*) H_A = 1000 kN; V_A = 1706.25 kN
(*b*) H_A = 2000 kN; V_A = 2550 kN
(*c*) H_A = 1000 kN; V_A = 2550 kN
(*d*) H_A = 2000 kN; V_A = 1706.25 kN

198. ABCD is a beam of length 5 l which is supported at B and C (having supported length BC = 'l') and having two equal overhangs AB and CD of length 2 l each. It carries a uniformly distributed load of intensity p per unit length throughout the beam as shown in figure.

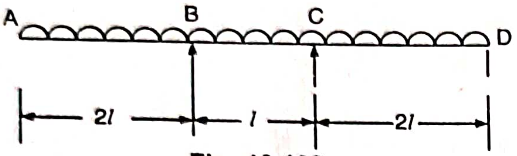


Fig. 10.193.

The points of contraflexure will occur
(*a*) at *B* and *C*
(*b*) at the mid-point of *BC*
(*c*) nowhere in the beam
(*d*) at the mid-points of AB and CD

199. The structure shown in figure is stable if

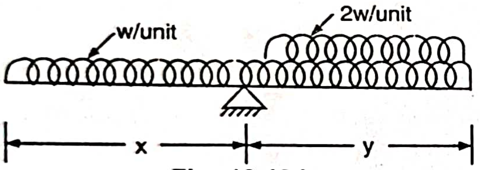


Fig. 10.194.

(*a*) $2x = y$ (*b*) $x = 2y$
(*c*) $\sqrt{2}\,x = y$ (*d*) $x = \sqrt{2}\,y$

200. Two simply supported beams B_1 and B_2 have spans l and 2 l respectively. Beam B_1 has a cross-section of 1 × 1 units and beam B_2 has a cross-section of 2 × 2 units. These beams are subjected to concentrated loads. W each at the centre of their spans. The ratio of the maximum flexural stress in these beams is

(*a*) 4 (*b*) 2 (*c*) $\frac{1}{2}$ (*d*) $\frac{1}{4}$

201. A propped cantilever of span 'l' carries a uniformly distributed load of 'W' per unit run over its entire span. The value of prop reaction to keep the beam horizontal is

(*a*) $\frac{wl}{3}$ (*b*) $\frac{3}{8}wl$ (*c*) $\frac{wl}{2}$ (*d*) $\frac{5}{8}wl$

202. The shear force diagram for a simple supported beam of span 'l' is given in figure. The maximum bending moment is

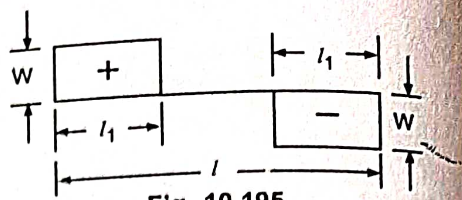


Fig. 10.195.

(*a*) $\frac{Wl}{2}$ (*b*) $W\left(\frac{l}{2}-l_1\right)$
(*c*) Wl_1 (*d*) $W(l - 2\,l_1)$

203. Figure shows a frame to be analyzed by moment distibution method. The distribution factors for members GF, GH and GD will be respectively.

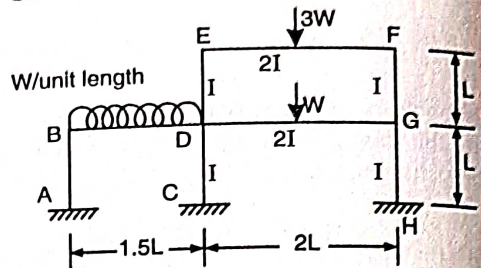


Fig. 10.196.

(*a*) $\frac{1}{4}$, $\frac{1}{4}$ and $\frac{1}{2}$ (*b*) $\frac{1}{3}$, $\frac{1}{3}$ and $\frac{1}{3}$
(*c*) $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{4}$ (*d*) $\frac{2}{3}$, 0 and $\frac{1}{3}$

204. The deflection of the free end of a cantilever subjected to a couple M at its free end and having a uniform flexural rigidity EI through out its length 'L' is equal to

(*a*) $\frac{ML^2}{2EI}$ (*b*) $\frac{ML^2}{3EI}$ (*c*) $\frac{ML^2}{6EI}$ (*d*) $\frac{ML^2}{8EI}$

205. A truss is shown in figure. The cross sectional area of each member is 'A' and the modulus of elasticity of the material is E. The strain energy in the member XY is given by

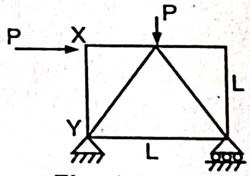


Fig. 10.197.

(*a*) $\frac{P^2L}{2AE}$ (*b*) $\frac{P^2L}{6AE}$ (*c*) $\frac{P^2L}{3AE}$ (*d*) zero

206. A rigid cantilever frame ABC is fixed at C. It carries a load P at A as shown in figure. Neglecting axial deformation the vertical deflection of the point A is given by

ANSWERS

1. (*a*)	**2.** (*a*)	**3.** (*a*)	**4.** (*c*)	**5.** (*b*)	**6.** (*b*)	**7.** (*a*)	**8.** (*c*)	**9.** (*a*)	**10.** (*d*)
11. (*c*)	**12.** (*a*)	**13.** (*c*)	**14.** (*d*)	**15.** (*c*)	**16.** (*a*)	**17.** (*b*)	**18.** (*b*)	**19.** (*c*)	**20.** (*b*)
21. (*d*)	**22.** (*d*)	**23.** (*b*)	**24.** (*b*)	**25.** (*c*)	**26.** (*c*)	**27.** (*a*)	**28.** (*b*)	**29.** (*d*)	**30.** (*b*)
31. (*b*)	**32.** (*b*)	**33.** (*c*)	**34.** (*c*)	**35.** (*b*)	**36.** (*d*)	**37.** (*c*)	**38.** (*c*)	**39.** (*a*)	**40.** (*b*)
41. (*a*)	**42.** (*c*)	**43.** (*d*)	**44.** (*b*)	**45.** (*c*)	**46.** (*b*)	**47.** (*a*)	**48.** (*b*)	**49.** (*b*)	**50.** (*c*)
51. (*d*)	**52.** (*c*)	**53.** (*b*)	**54.** (*b*)	**55.** (*d*)	**56.** (*b*)	**57.** (*b*)	**58.** (*b*)	**59.** (*c*)	**60.** (*c*)
61. (*b*)	**62.** (*c*)	**63.** (*c*)	**64.** (*d*)	**65.** (*b*)	**66.** (*c*)	**67.** (*b*)	**68.** (*b*)	**69.** (*d*)	**70.** (*b*)
71. (*c*)	**72.** (*c*)	**73.** (*a*)	**74.** (*c*)	**75.** (*d*)	**76.** (*d*)	**77.** (*d*)	**78.** (*d*)	**79.** (*b*)	**80.** (*c*)
81. (*c*)	**82.** (*c*)	**83.** (*d*)	**84.** (*a*)	**85.** (*b*)	**86.** (*a*)	**87.** (*c*)	**88.** (*d*)	**89.** (*c*)	**90.** (*b*)
91. (*c*)	**92.** (*b*)	**93.** (*a*)	**94.** (*b*)	**95.** (*d*)	**96.** (*d*)	**97.** (*b*)	**98.** (*d*)	**99.** (*d*)	**100.** (*b*)
101. (*c*)	**102.** (*c*)	**103.** (*b*)	**104.** (*a*)	**105.** (*a*)	**106.** (*b*)	**107.** (*b*)	**108.** (*b*)	**109.** (*d*)	**110.** (*b*)
111. (*a*)	**112.** (*b*)	**113.** (*a*)	**114.** (*c*)	**115.** (*c*)	**116.** (*a*)	**117.** (*b*)	**118.** (*a*)	**119.** (*d*)	**120.** (*a*)
121. (*d*)	**122.** (*c*)	**123.** (*a*)	**124.** (*d*)	**125.** (*a*)	**126.** (*c*)	**127.** (*a*)	**128.** (*a*)	**129.** (*d*)	**130.** (*b*)
131. (*c*)	**132.** (*c*)	**133.** (*a*)	**134.** (*a*)	**135.** (*d*)	**136.** (*b*)	**137.** (*b*)	**138.** (*a*)	**139.** (*b*)	**140.** (*c*)
141. (*b*)	**142.** (*a*)	**143.** (*a*)	**144.** (*a*)	**145.** (*d*)	**146.** (*a*)	**147.** (*a*)	**148.** (*a*)	**149.** (*a*)	**150.** (*d*)
151. (*a*)	**152.** (*c*)	**153.** (*b*)	**154.** (*b*)	**155.** (*c*)	**156.** (*b*)	**157.** (*c*)	**158.** (*b*)	**159.** (*a*)	**160.** (*d*)
161. (*c*)	**162.** (*d*)	**163.** (*d*)	**164.** (*a*)	**165.** (*d*)	**166.** (*b*)	**167.** (*d*)	**168.** (*d*)	**169.** (*c*)	**170.** (*c*)
171. (*a*)	**172.** (*d*)	**173.** (*b*)	**174.** (*c*)	**175.** (*b*)	**176.** (*b*)	**177.** (*a*)	**178.** (*a*)	**179.** (*b*)	**180.** (*a*)
181. (*b*)	**182.** (*a*)	**183.** (*d*)	**184.** (*b*)	**185.** (*d*)	**186.** (*b*)	**187.** (*b*)	**188.** (*c*)	**189.** (*a*)	**190.** (*a*)
191. (*b*)	**192.** (*a*)	**193.** (*b*)	**194.** (*c*)	**195.** (*c*)	**196.** (*b*)	**197.** (*b*)	**198.** (*c*)	**199.** (*d*)	**200.** (*a*)
201. (*b*)	**202.** (*c*)	**203.** (*b*)	**204.** (*a*)	**205.** (*d*)	**206.** (*c*)	**207.** (*a*)	**208.** (*c*)	**209.** (*a*)	**210.** (*b*)
211. (*c*)	**212.** (*a*)	**213.** (*a*)	**214.** (*d*)	**215.** (*c*)	**216.** (*b*)	[illegible]	[illegible]	[illegible]	[illegible]