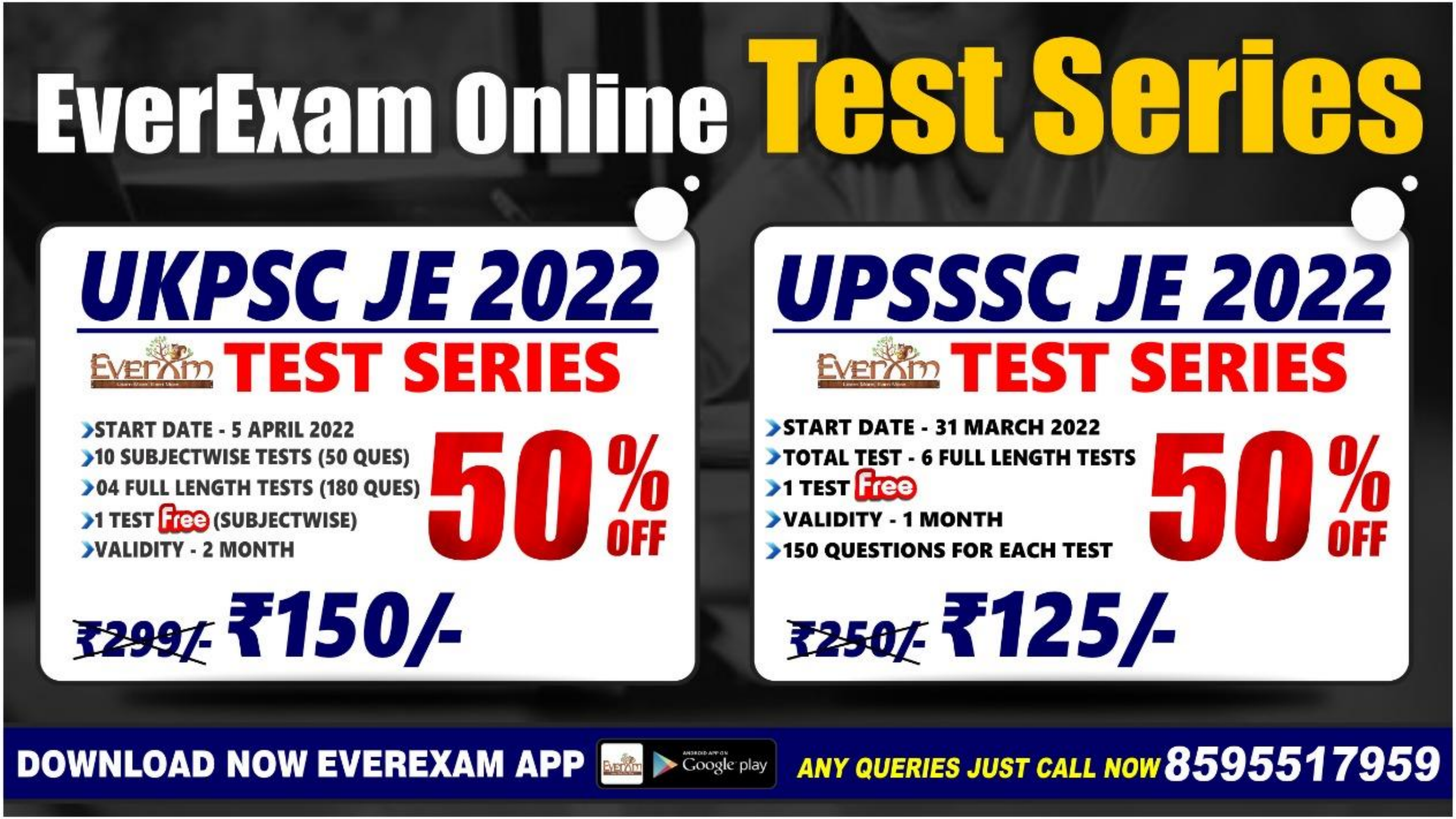
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Q : 1) The first moment of area about the axis of bending for a beam cross section is

A : Moment of inertia

B : Section modulus

C : Shape factor

D : Polar moment of inertia

Q : 2) Strain hardening of structural steel means.

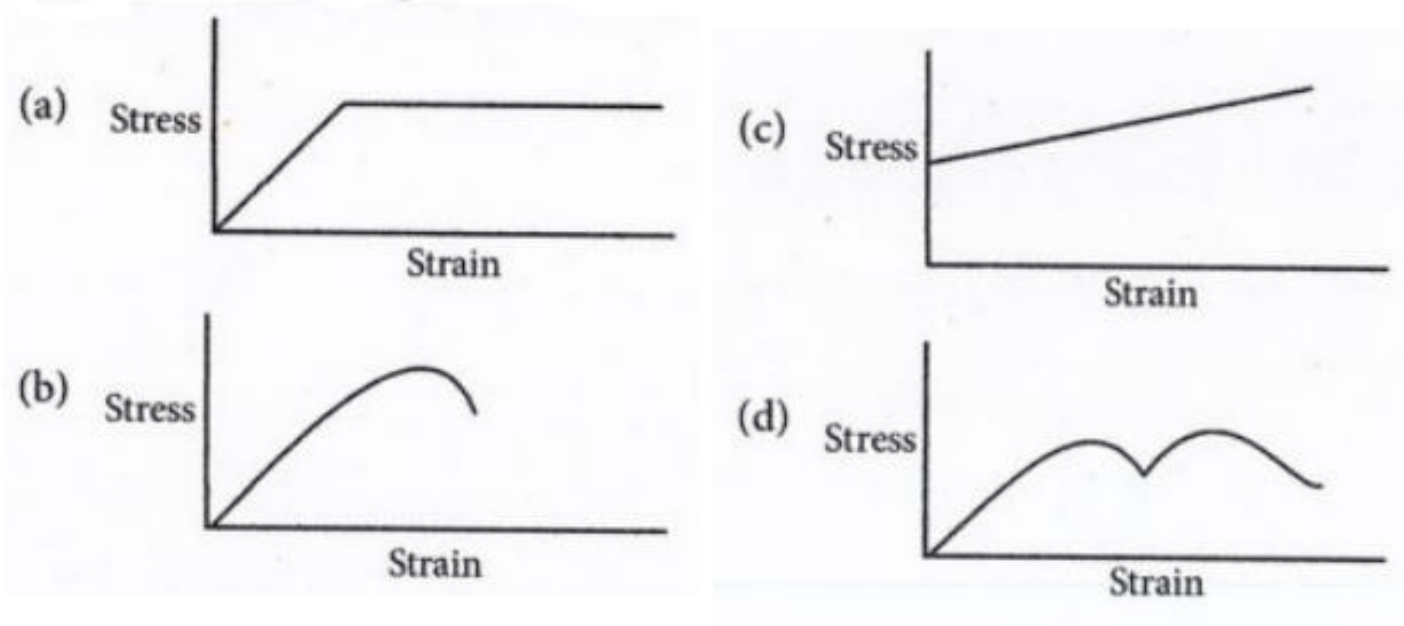
A : Decrease in the stress experienced with increasing strain

B : Experiencing higher stress than yield stress with increased deformation

C : Strain occurring before plastic flow of steel material

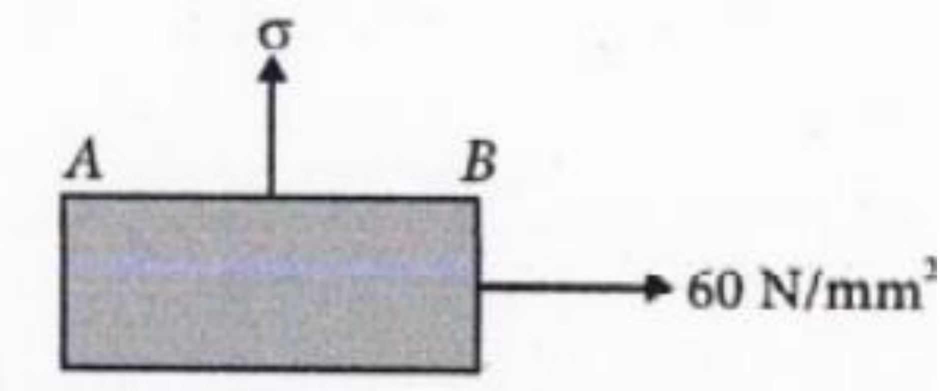
D : Strengthening steel member externally for reducing strain experienced.

Q : 3) The stress-strain curve for an ideally plastic material is



Q : 4) Two-dimension stress system on a block made of a material with Poisson's ratio of 0.3 is shown in the figure

The limiting magnitude of the stress so as to result in no change in length AB of the block is



A : 60 N/mm²

B : 120 N/mm²

C : 200 N/mm²

D : 240 N/mm²

Q : 5) A bar specimen of 36 mm diameter is subjected to a pull of 90 kN during a tension test. The extension on a gauge length of 200 mm is measured to be 0.089 mm and the change in diameter to be 0.0046 mm. The Poisson's ratio will be

A : 0.287

B : 0.265

C : 0.253

D : 0.241

Q : 6) When a round bar material with diameter of 37.5 mm, length of 2.4 m, Young's modulus of 110 GN/m^2 and shear modulus of 42 GN/m^2 is stretched for 2.5 mm its bulk modulus will be nearly

A : 104 GN/m^2

B : 96 GN/m^2

C : 84 GN/m^2

D : 76 GN/m^2

Q : 7) A steel bar 2 m long, 20 mm wide and 15 mm thick is subjected to a tensile load of 30 kN. If Poisson's ratio is 0.25 and Young's modulus is 200 Gpa, an increase in volume will be

A : 160 mm^3

B : 150 mm^3

C : 140 mm^3

D : 130 mm^3

Q : 8) A solid uniform metal bar of diameter D mm and length l mm hangs vertically from its upper end. The density of the material is ρ N/mm^3 and its modulus of elasticity is E N/mm^2. The total extension of the rod due to its own weight would be

A : $\frac{\rho l^2}{2E}$

B : $\frac{\rho l}{2E}$

C : $\frac{\rho l}{4E}$

D : $\frac{\rho l^2}{4E}$

Q : 9) A central steel rod 18 mm diameter passes through a copper sleeve with 24 mm inside and 39 mm outside diameter, it is provided with nuts and washers at each end and the nuts are tightened until a stress of 10 N/mm^2 is set up in the steel. Then, the stress developed in copper tube is.

A : 29.1 N/mm^2, compressive

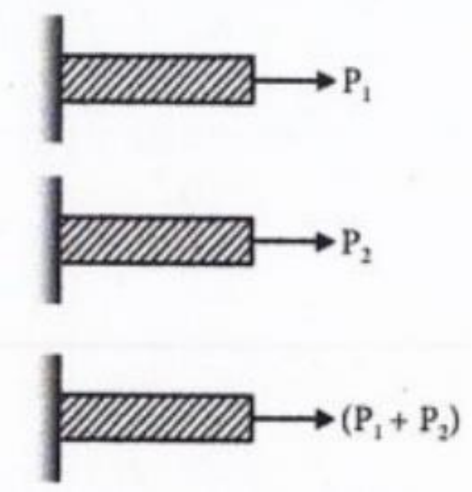
B : 3.4 N/mm^2, compressive

C : 3.4 N/mm^3, Tensile

D : 29.1 N/mm^2, Tensile

Q : 10) A prismatic linearly elastic bar of length L. Cross sectional area A, and made of a material with Young's modulus E, is subjected to axial tensile force as shown in the figures. When the bar is subjected to axial forces P_1 and P_2, the strain energies stored in the bar are U_1 and U_2 respectively.

If U is the strain energy stored in the same bar when subjected to an axial tensile force $(P_1 + P_2)$, the correct relationship is



A : $U = U_1 - U_2$

B : $U < U_1 + U_2$

C : $U > U_1 + U_2$

D : $U = U_1 + U_2$

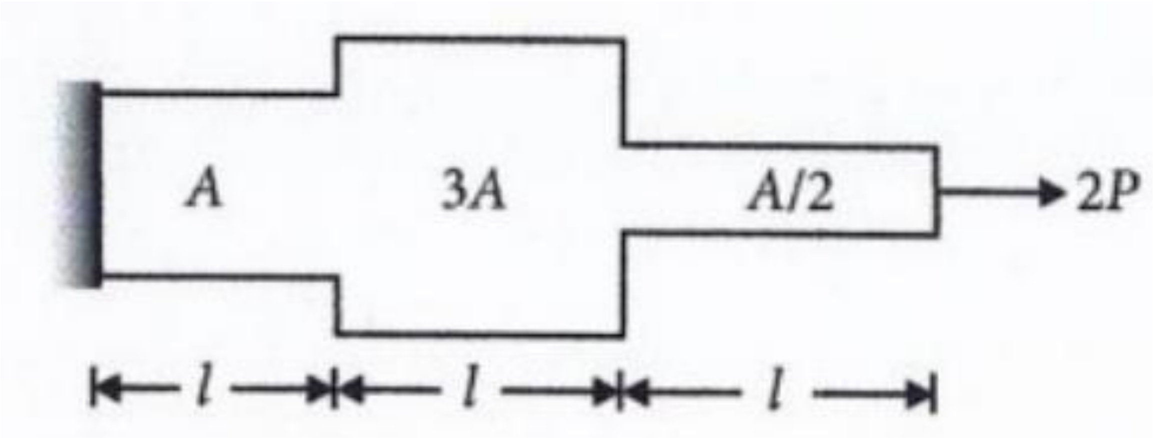
Q : 11) The total elongation of the structural element (Fixed at one end, free at the other end, and of varying cross-section) as shown in the figure, when subjected to load 2P at the free end is

A : $6.66 \frac{Pl}{AE}$

B : $5.55 \frac{Pl}{AE}$

C : $4.44 \frac{Pl}{AE}$

D : $3.33 \frac{Pl}{AE}$



Q : 12) A long rod of uniform rectangular section with thickness t, originally straight, is bend into the form of a circular arch with displacement d at the mid-point of span l. The displacement d may be regarded as small as compared to the length l. The longitudinal surface Strain is

A : $\frac{2td}{l^2}$

B : $\frac{4td}{l^2}$

C : $\frac{8td}{l^2}$

D : $\frac{16td}{l^2}$

Q : 13) A steel rod 15 m long is at a temperature of 15°C. The values of $\alpha = 12 \times 10^{-6}/^{o}C$ and E = 200 GN/m^2 are adopted. When the temperature is raised to 65°C, what is the free expansion of the length; and if this expansion of the rod is fully prevented, what is the temperature stress produced?

A : 5 mm and 120 MN/m^2

B : 9 mm and 120 Mn/m^2

C : 5 mm and 150 Mn/m^2

D : 9 mm and 150 MN/m^2

Q : 14) Consider the following statements regarding shearing force and bending moment:

1. **Point of contraflexure is the point where bending moment changes its sign.**
2. **Shear force is the rate of change of bending moment**
3. **For bending moment to be the maximum or minimum, shear force should change its sign.**
4. **Rate of change of loading is equal to shear force.**

Which of the above statements are correct?

A : 2 and 3 only

B : 1 and 4 only

C : 1, 2 and 4 only

D : 1, 2 and 3 only

Q : 15) A simply supported beam is subjected to a uniformly distributed load. Which one of the following statements is true?

1. **Maximum or minimum shear force occurs where the curvature is zero.**
2. **Maximum or minimum bending moment occurs where the shear force is zero**
3. **Maximum or minimum bending moment occurs where the curvature is zero**
4. **Maximum bending moment and maximum shear force occur at the same section**

A : 1 only

B : 1 and 2 only

C : 1, 2 and 3

D : 2 and 3 only

Q : 16) A steel cantilever beam is proposed to build into a concrete wall at one end and other end is free. It supports a dead load of 20 kN/m and a live load of 10 kN/m. The length of the beam is 5 m. What are the shear force and bending moment respectively?

(Take yield strength of steel as 250 N/mm^2)

A : 225 kN and 562.5 kNm

B : 22.5 kN and 56.25 kNm

C : 225 kN and 56.25 kNm

D : 22.5 kN and 562.5 kNm

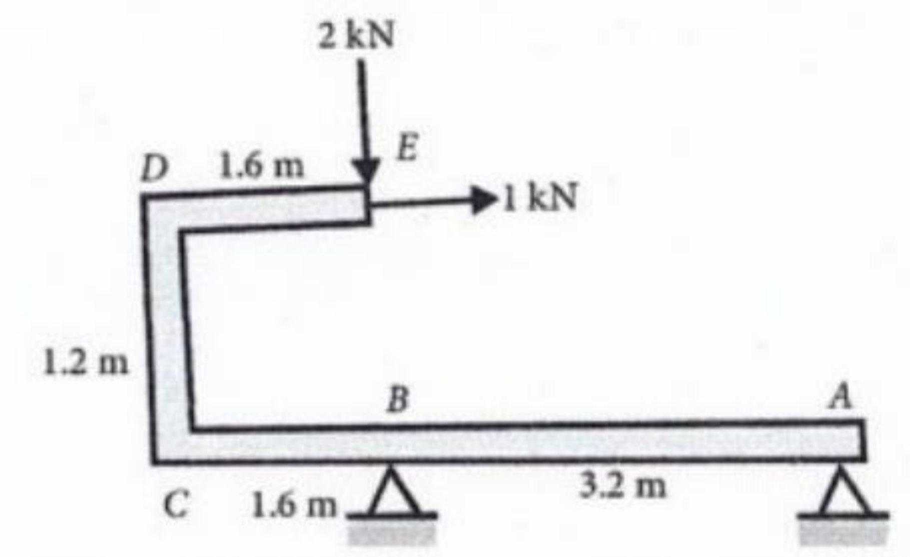
Q : 17) The bending moment at C for the beam shown in the figure

A : -3.2 kN-m

B : -4.4 kN-m

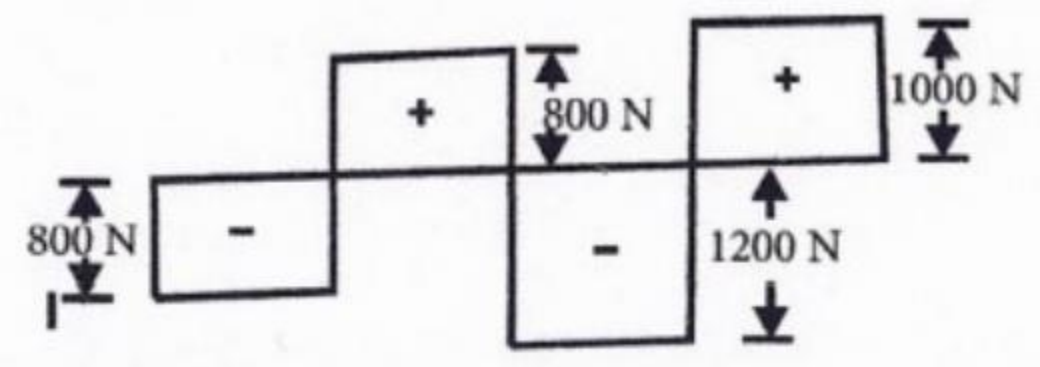
C : -6.2 kN-m

D : -7.2 kN-m



Q : 18) The shear-force diagram of beam is shown in the force

The total of the vertically downward loads on the beam is



A : 2600 N

B : 2000 N

C : 2400 N

D : 3800 N

Q : 19)The span of a cantilever beam is 2 m. The cross section of the beam is a hollow square with external sides 100mm; and its I = 4×10^5 mm^4. The safe bending stress for the beam material is 100 N/mm^2. The safe concentrated load at the free end would be

A : 100 N

B : 200 N

C : 300 N

D : 400 N

Q : 20) A beam simply supported over an effective span of 9 m, carries a uniformly distributed load of 60 kN/m, inclusive of its own weight. What is the section modulus of the beam, If f_y = 250 N/mm^2 and E = 2 × 10^5 N/mm^2?

(Assume width of support is 200 mm)

A : 2612 × 10^3 mm^3

B : 3682 × 10^3 mm^3

C : 4682 × 10^3 mm^3

D : 5124 × 10^3 mm^3

Q : 21) A wooden floor is required to carry a load of 12 kN/m^2 and is to be supported by wooden joints of 120 mm × 250 mm in section over a span of 4 m. If the bending stress in these wooden joints is not to exceed 8 MPa, what is the spacing of the joints?

A : 356 mm

B : 318 mm

C : 432 mm

D : 417 mm

Q : 22) A steel plate 120 mm wide and 20 mm thick is bend into a circular arc of radius 10 m. What is the maximum stress produced and the bending moment which can produce this stress respectively?

(Take E = 200 Gpa)

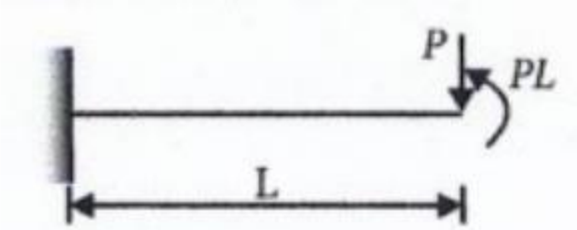
A : 100 MPa, 32 kN-m

B : 200 Mpa, 160 N-mm

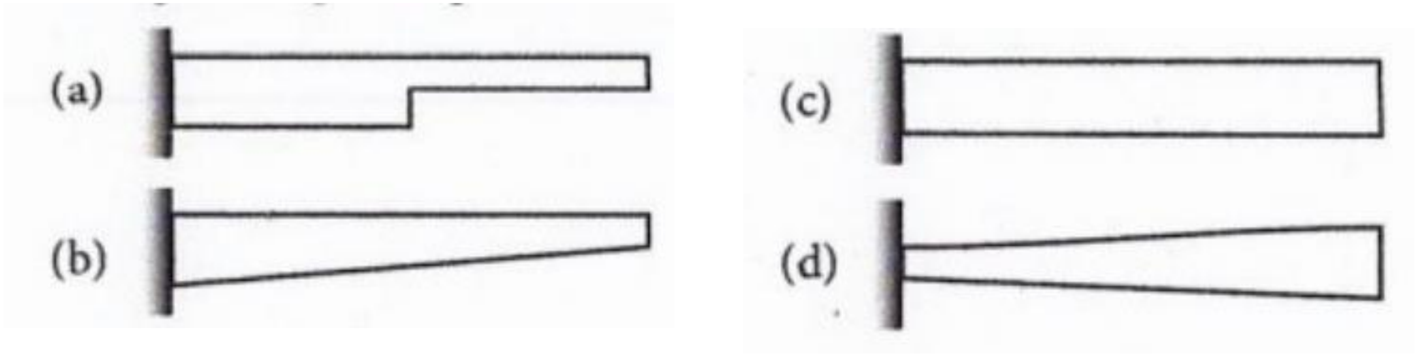
C : 200 MPa, 1600 N-m

D : 20 MPa, 160 kN-m

Q : 23) A weightless cantilever beam of span L is loaded as shown in the figure. For the entire span of the beam, the material properties are identical and the cross is rectangular with constant width



From the flexure-critical perspective, the most economical longitudinal profile of the beam to carry the given loads amongst the options given below, is



Q : 24) For a given loading on a rectangular plain concrete beam with an overall depth of 500 mm, the compressive strain and tensile strain developed at the extreme fibers are of the same magnitude of 2.5×10^{-4}. The curvature in the beam cross section (in m^{-1}, round off to 3 decimal places), is ___________

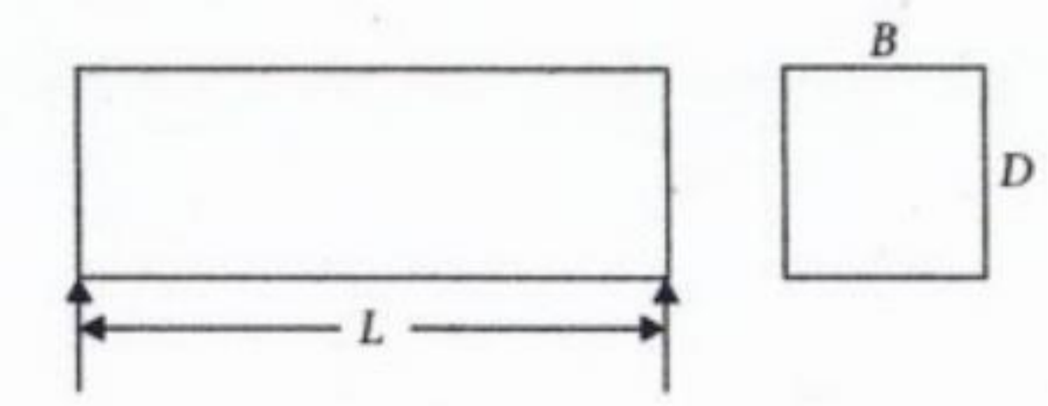
Q : 25) A homogeneous prismatic simply supported beam is subjected to a point load F. The load can be placed anywhere along the span of the beam the very maximum flexural stress developed in the beam is

A : $\frac{3FL}{2BD^2}$

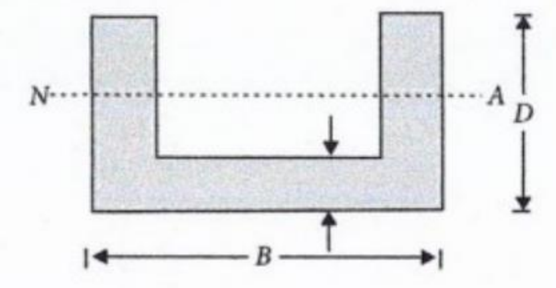
B : $\frac{3FL}{4BD^2}$

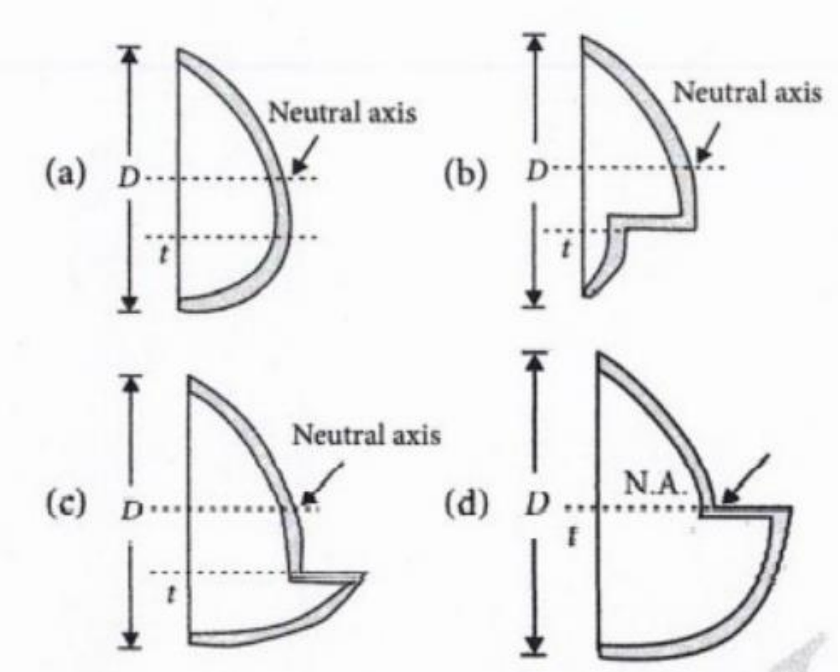
C : $\frac{2FL}{3BD^2}$

D : $\frac{4FL}{3BD^2}$



Q : 26) A horizontal beam shown in the figure given below is subjected to transverse loading. Which one of the following diagrams represent the distribution of shear force along the cross-section?





Q : 27) Which one of the following statements specifies shear flow?

A : Flow of shear force along the beam

B : It is the product of the shear stress at any level and the corresponding width b (of the section)

C : Unbalanced force on any side of given section divided by area of section

D : The deformation at any level due to sudden variation in shear stress

Q : 28) A beam of triangular cross-section is subjected to a shear force of 50 kN. The base width of the section is 250 mm and the height is 200 mm. The beam is placed with its base horizontal. The shear stress at neutral axis will be nearly

A : 2.2 N/mm^2

B : 2.7 N/mm^2

C : 3.2 N/mm^2

D : 3.7 N/mm^2

Q : 29) Consider the following statements :

Moment area method proves advantageous in analyzing

1. Cantilever beams
2. Symmetrically loaded simply supported beams.
3. Fixed beams.
4. Continuous beams.

Which of the above statements are correct?

A : 1, 2 and 4 only

B : 3 and 4 only

C : 1, 2 and 3 only

D : 1 and 2 only

Q : 30) The planer structure RST shown in the figure is roller-supported at S and Pin-supported at R. Members RS and ST has uniform flexural rigidity (EI) band S is a rigid joint. Consider only bending deformation and neglect effects of self-weight and axial stiffening.

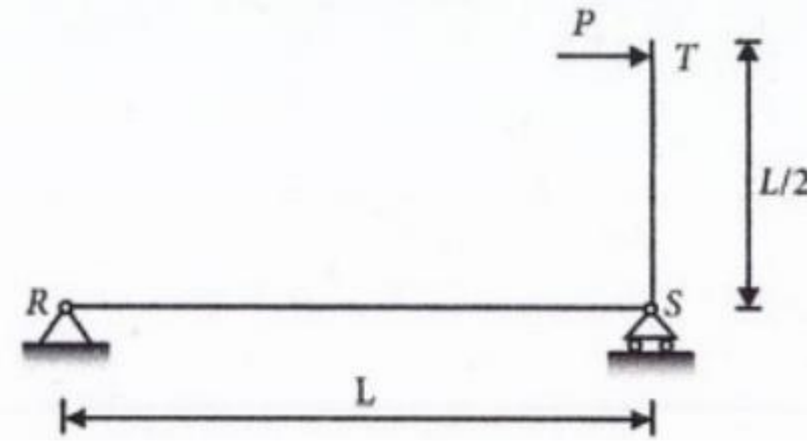
When the structure is subjected to a concentrated horizontal load P at the end T, te magnitude of rotation at the support R, is

A : $\frac{PL^3}{12\ EI}$

B : $\frac{PL^2}{12\ EI}$

C : $\frac{PL^2}{6\ EI}$

D : $\frac{PL}{6\ EI}$



Q : 31) The deflection δ of the closed coil helical spring

A : $\frac{WR^2n}{8Cd^3}$

B : $\frac{64WR^3n}{Cd^4}$

C : $\frac{128WR^3n}{Cd^2}$

D : $\frac{64WR^2n}{Cd^2}$

Where

W is the axial load

R is the radius of the coil

n is the number of turns of coil

C is the modulus of rigidity

d is the diameter of the wire of the coil

Q : 32) A beam of uniform cross-section simply supported at ends carries a concreted load W at midspan. If the ends of the beam are fixed and only load P is applied at the midspan such that deflection at the centre remains the same, the value of the load P will be

A : 6W

B : 4W

C : 2W

D : W

Q : 33) Consider the following statements

1. The shear stress distribution across the section of a circular shaft subjected to twisting varies parabolically.
2. The shear stress at the centre of a circular shaft under twisting moment is zero.
3. The shear stress at the extreme fibres of a circular shaft under twisting statement is/are correct?

Which of the above statements is/are correct?

A : 1, 2 and 3

B : 1 only

C : 2 only

D : 3 only

Q : 34) A motor driving a solid circular shaft transmits 30 kW at 500 r.p.m. what is the torque activity on the shaft, if allowable shear stress is 42 MPa?

A : 427 Nm

B : 573 Nm

C : 180 Nm

D : 219 Nm

Q : 35) A closed thin walled tube has thickness, t, mean enclosed area within the boundary of the centre line of tube's thickness, Am, an shear stress τ. Torsional moment of resistance, T of the section would be

A : $2\tau A_m t$

B : $\tau A_m t$

C : $0.5\tau A_m t$

D : $4\tau A_m t$

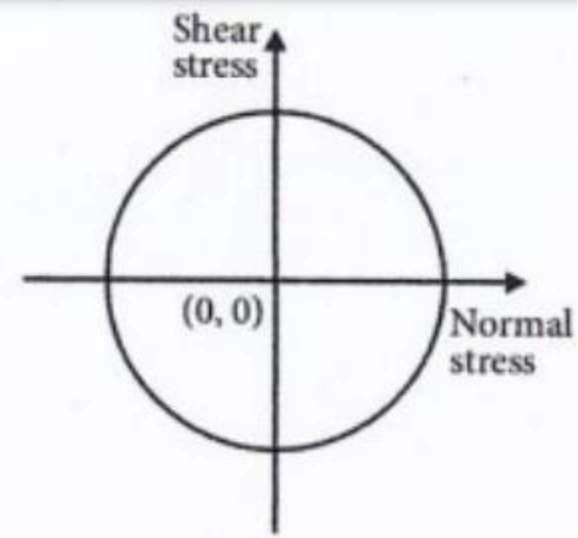
Q : 36) The sate of stress represented by Mohr's circle shown in the figure is

A : Uniaxial tension

B : Biaxial tension of equal magnitude

C : Hydrostatic stress

D : Pure shear



Q : 37) In a two-dimensional stress analysis, the state of stress at a point P is

$$[\sigma] = \begin{bmatrix} \sigma_{xx} & \tau_{xy} \\ \tau_{xy} & \sigma_{yy} \end{bmatrix}$$

The necessary and sufficient condition for existence of the state of pure shear at the point P, is

A : $\sigma_{xx} + \sigma_{yy} = 0$

B : $\tau_{xy} = 0$

C : $\sigma_{xx}, \sigma_{yy} - \tau_{xy}^2 = 0$

D : $(\sigma_{xx} - \sigma_{yy})^2 + 4\tau_{xy}^2 = 0$

Q : 38) The stresses at a point of a machine component are 150 MPa and 50 MPa, both tensile. What is the intensity of normal stress on a plane inclined at an angle of 30^{o} with the axis of major tensile stress?

A : 125 MPa

B : 50 MPa

C : 75 MPa

D : 100 MPa

Q : 39) If strains on a piece of metal are $\varepsilon_x = -120\ \mu m/m$, $\varepsilon_y = -30\ \mu m/m$ and γ = 120 μm/m, what is the maximum principal strain?

A : 0

B : 50 $\mu m/m$

C : 75 $\mu m/m$

D : 150 $\mu m/m$

Q : 40) The normal stresses on two mutually perpendicular planes are 140 N/mm^2 (Tensile) and 70 N/mm^2 (Tensile). If the maximum shear stress is 45 Nmm^2, the shear stress on these planes will be nearly

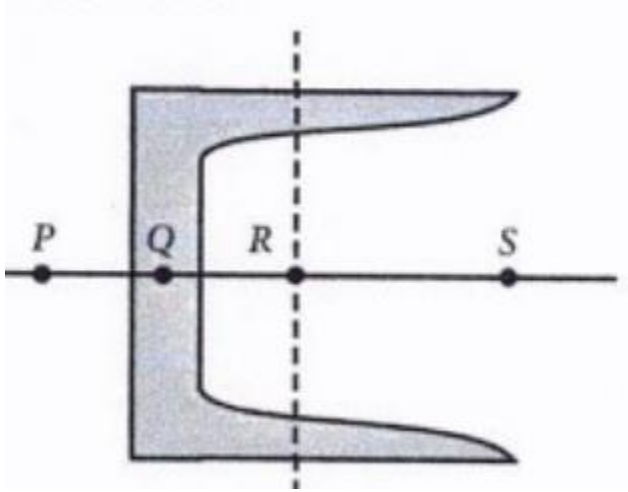
A : 20.9 N/mm^2

B : 24.6 N/mm^2

C : 28.3 N/mm^2

D : 32.0 N/mm^2

Q : 41) The possible location of shear centre of the channel section shown below is



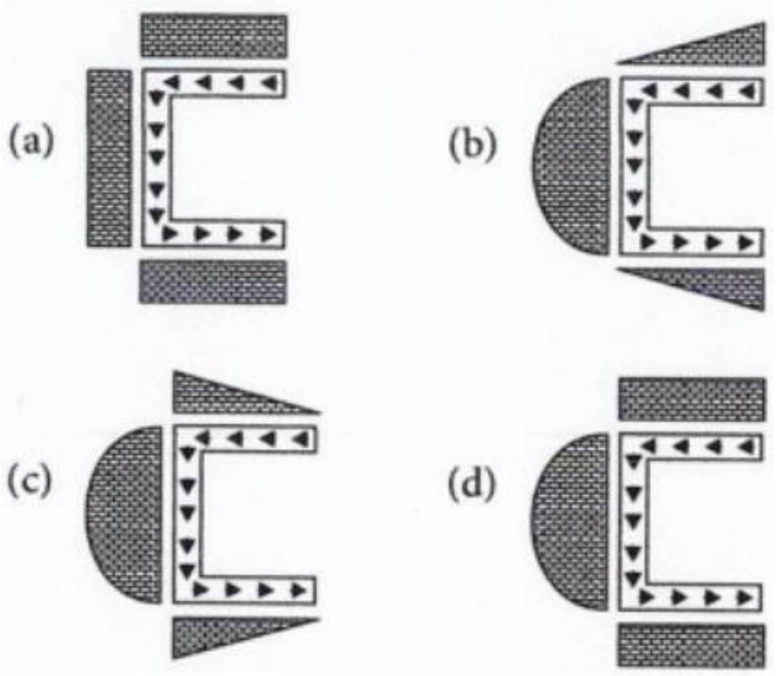
A : P

B : Q

C : R

D : S

Q : 42) For a channel section subjected to a downward vertical shear force at its centroid, which one of the following represents the correct distribution of shear stress in flange and web?



Q : 43) Consider the following statements for Euler's equation to find critical load of a column :

1. **Critical load of a column is proportional to the flexural rigidity.**
2. **Critical load of a column depends upon yield stress**
3. **Critical load of a column is inversely proportional to the length of column.**
4. **Critical load of a column is inversely proportional to the square of the length of column.**

Which of the above statements are correct?

A : 1 and 2 only

B : 1 and 4 only

C : 2 and 3 only

D : 2 and 4 only

Q : 44) A column of height h with a rectangular cross section of a $\times 2a$ has a buckling load of P. If the cross-section is changed to 0.5 a × 3a and its height changed to 1.5 h, the buckling load of the redesigned column will be

A : P/12

B : P/4

C : P/2

D : 3P/4

Q : 45) Which of the following assumptions are made with respect to Euler's theory applied columns?

1. The section of the column is uniform
2. The length of the column is very large compared to the lateral dimensions
3. The direct stress is large when compared with the bending stress.

A : 1, 2 and 3

B : 1 and 3 only

C : 2 and 3 only

D : 1 and 2 only

Q : 46) A 1.5 m long column has a circular cross-section of 50 mm diameter. Consider Rankine's formula with values of $f_c = 560\ N/mm^2, \alpha = \frac{1}{1600}$ for pinned ends and factor of safety of 3. If one end of the column is fixed and the other end is free, the safe load will be

A : 9948 N

B : 9906 N

C : 9864 N

D : 9822 N

Q : 47) According to maximum shear stress failure theory, yielding occurs in the material when

A : Max. shear stress = yield stress

B : Max. shear stress = 2 times yield stress

C : Max. shear stress = ½ of yield stress

D : Max. shear stress = $\sqrt{2}$ times yield stress

Q : 48) For the design of a cast iron. Member, the most appropriate theory of failure is

A : Mohr’s theory

B : Rankine’s theory

C : Maximum stress theory

D : Maximum shear energy theory