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— DURATION —
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Q :) The deflection at the free end of a cantilever beam subjected to a couple 'M' at the free end and having an uniform flexural rigidity 'EI' throughout its length 'L' is equal to

A : $\frac{ML^2}{2EI}$

B : $\frac{ML^2}{3EI}$

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

D : $\frac{ML^2}{8EI}$

Q :) The first moment of area of a rectangular section of width 'b' and depth 'h' about centre of gravity is

A : $\frac{b.h^2}{2}$

B : $\frac{b.h^2}{4}$

C : Zero

D : $b.h^2$

Q :) A ductile structure is defined as one for which the plastic deformation before fracture

A : Is smaller than the elastic deformation

B : Vanishes

C : Is equal to the elastic deformation

D : Is much larger than elastic deformation

Q :) When body is subjected to a direct tensile stress (p) in one plane accompanied by a simple shear stress (q), the maximum normal stress is

A : $\frac{p}{2} + \frac{1}{2}\sqrt{p^2 + 4q^2}$

B : $\frac{p}{2} - \frac{1}{2}\sqrt{p^2 + 4q^2}$

C : $\frac{p}{2} + \frac{1}{2}\sqrt{p^2 - 4q^2}$

D : $\frac{p}{2} - \frac{1}{2}\sqrt{p^2 - 4q^2}$

Q :) A simply supported beam of length 6 m carries a point load at the centre of the beam such that the maximum bending moment there is 12 kN-m, if 'EI' is the flexural rigidity of the beam, the deflection at the centre is

A : $\frac{9}{EI}$

B : $\frac{18}{EI}$

C : $\frac{36}{EI}$

D : $\frac{45}{EI}$

Q :) A cast iron column of external diameter of 300 mm is 20 mm thick. Find safe compressive of 5, if the crushing strength of material is 550 N/mm^2

A: 1925.21 kN

B : 1935.21 kN

C : 1945.21 kN

D : 1955.21 kN

Q :) A prismatic bar in compression has a cross sectional area $A = 1200 \text{ mm}^2$ and carries a load $P = 90 \text{ kN}$. Normal and shear stresses acting on a plane cut through the bar at $\theta = 25^\circ$, are respectively

A : 61.6 MPa and 28.7 MPa

B : 49.5 MPa and 23.8 MPa

C : 78.2 MPa and 20.7 MPa

D : 73.4 MPa and 29.2 MPa

Q :) Two shafts of same length and material are joined in series. If the ratio of their diameters is 2, then the ratio of their angles of twist will be

A : 2

B : 4

C : 8

D : 16

Q :) A cylindrical boiler 1.5 m diameter and made up on 10 mm thick plate is subjected to steam pressure of 2 N/mm^2 . The hoop tension and longitudinal stresses will be

- A : 150 N/mm^2 and 75 N/mm^2**
- B : 150 N/mm^2 and 150 N/mm^2**
- C : 75 N/mm^2 and 75 N/mm^2**
- D : 75 N/mm^2 and 150 N/mm^2**

Q :) In terms of bulk modulus (K) and modulus of rigidity (C), the Poisson's ratio can be expressed as

A : $\frac{3K - 4C}{6K + 4C}$

B : $\frac{3K + 4C}{6K - 4C}$

C : $\frac{3K - 2C}{6K + 2C}$

D : $\frac{3K + 2C}{6K - 2C}$

Q :) Lamé's equations are applicable for

A : Thick cylinder

B : Thin cylinder

C : Thin spherical vessel

D : Beams

Q :) The D'Alembert principle

A : Is a hypothetical principle

B : Provides no special advantage over Newton's law

C : Is based upon the existence of inertia force

D : Allows a dynamical problem to be considered as a static problem

Q :) he coefficient of friction is the ratio of

A : Limiting friction force to the normal reaction

B : Limiting friction force to the weight of body to be moved

C : Sliding friction force to the normal reaction

D : None of the above

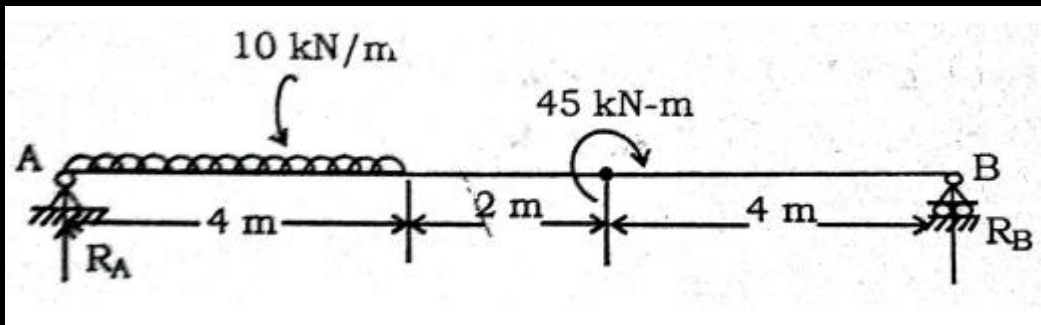
Q :) The vertical support reactions R_A and R_B for the given beam is

A : $R_A = 25 \text{ kN}$, $R_B = 15 \text{ kN}$

B : $R_A = 15 \text{ kN}$, $R_B = 25 \text{ kN}$

C : $R_A = 12.5 \text{ kN}$, $R_B = 27.5 \text{ kN}$

D : $R_A = 27.5 \text{ kN}$, $R_B = 12.5 \text{ kN}$



Q :) A simply supported beam of span 'l' carries a uniformly variable load of intensity w_0x over its entire span. Maximum bending moment in the beam is

A : $\frac{w_0 l^3}{27}$

B : $\frac{w_0 l^3 (\sqrt{3})}{27}$

C : $\frac{w_0 l^3 (\sqrt{2})}{9}$

D : $\frac{w_0 l^3}{9}$

Q :) The principal design criteria for foundations for reciprocating machinery are as follows:

- 1. The natural frequency should be at least 40% away from the operating speed of the machine.**
- 2. The amplitude of motion of the foundation should not exceed 0.2 mm.**
- 3. The pressure on soil should be within the respective permissible values.**
- 4. For preliminary design, the maximum pressure on soil due to static load, alone may be taken as 0.4 times the corresponding safe bearing capacity.**

A : 1, 2, 3 and 4 are correct B : 1, 3 and 4 are correct

C : 3 and 4 are correct D : 2, 3 and 4 are correct

Q :) What will be the natural frequency of a machine foundation which has a base area of $2.20 \text{ m} \times 2.20 \text{ m}$ and a weight of 155 kN including the weight of the machine? Take the value of the coefficient of elastic uniform compression as $4.4 \times 10^4 \text{ kN/m}^3$.

A : $29/\pi$

B : $58/\pi$

C : $116/\pi$

D : None of these

Q :) A propped cantilever beam of span 'L' is carrying a vertical concentrated load acting at mid span. The plastic moment of the section is M_p . The magnitude of collapse load will be

A : $8 M_p/L$

B : $6 M_p/L$

C : $4 M_p/L$

D : $2 M_p/L$

Q :) Which one of the following represents 'constitutive relationship'?

A : Vertical displacements in a structure

B : Rotational displacements in a structure

C : System of forces in equilibrium

D : Stress-strain behaviour of a material

Q :) In mild steel specimens subjected to tensile test cycle, the elastic limit in tension is raised and the elastic limit in compression is lowered. This is called

A : Annealing effect

B : Bauschinger effect

C : Strain rate effect

D : Fatigue effect

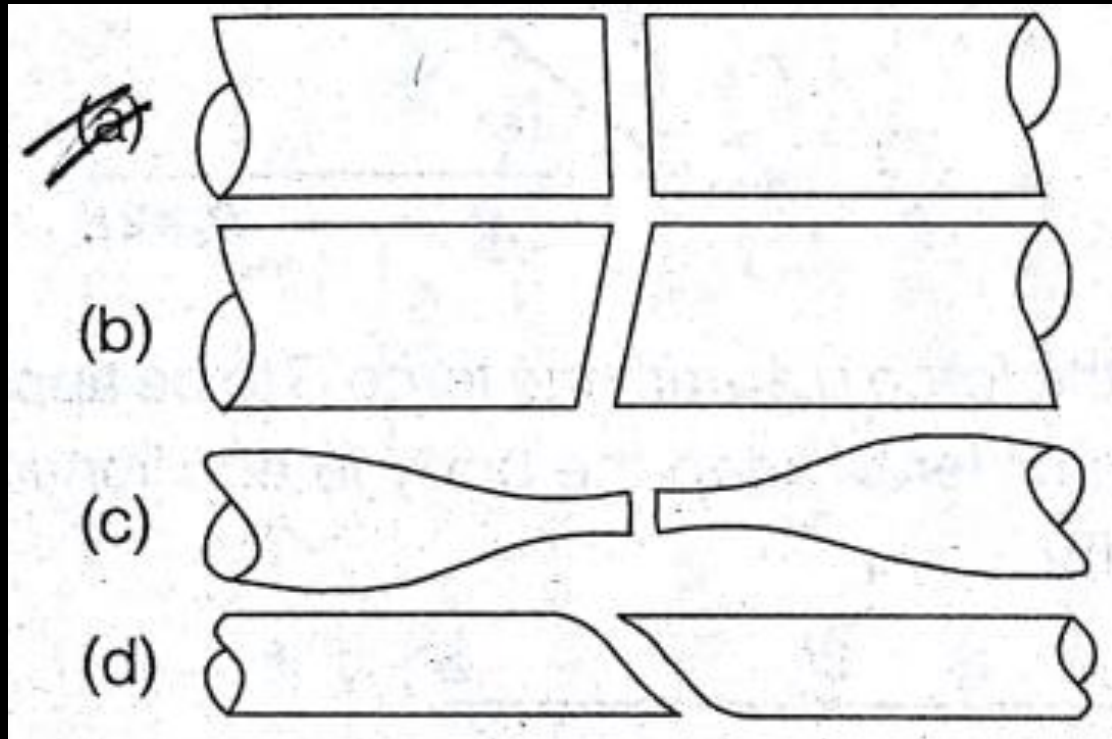
Q :) Consider the following salient points in a stress strain curve of a mild steel bar:

- 1. Yield point**
- 2. Braking point**
- 3. Yield plateau**
- 4. Proportionality limit**
- 5. Ultimate point**

The correct sequence in which they occur while testing the mild steel bar in tension from initial zero strain to failure is

- A : 4, 1, 2, 3, and 5 B : 1, 4, 3, 5 and 2**
C : 4, 1, 3, 5 and 2 D : 1, 4, 2, 3 and 5

Q :) When a mild steel specimen fails in a torsion test fracture looks like



Q :) The length, coefficient of thermal expansion and Young's modulus of bar A are twice that of bar B. If the temperature of both bars is increased by the same amount while preventing any expansion, then the ratio of stress developed in bar A to the in bar B will be

A : 2

B : 4

C : 8

D : 16

Q :) If all the dimensions of a prismatic bar of square cross-section suspended freely from the ceiling of a roof are doubled then the total elongation produced by its own weight will increase

A : Eight times

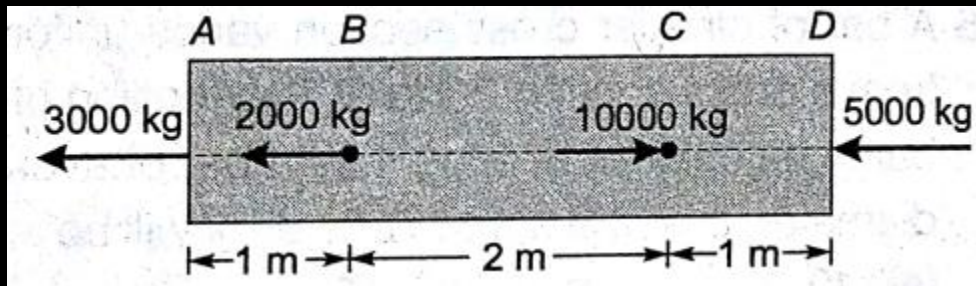
B : Four times

C : Three times

D : Two times

Q :) A prismatic bar of uniform cross-sectional area of 5 cm^2 is subjected to axial loads as shown in the given figure.

Portion BC is subjected to an axial stress of



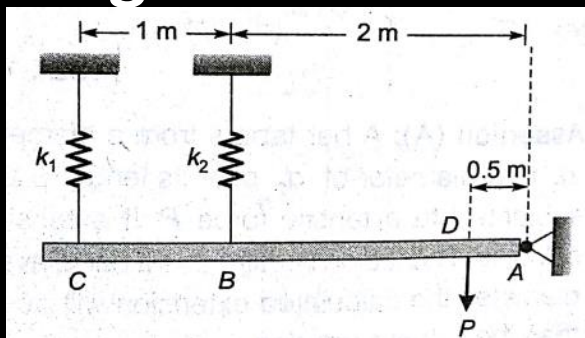
A : 400 kg/cm^2 tension

B : 2000 kg/cm^2 compression

C : 1000 kg/cm^2 tension

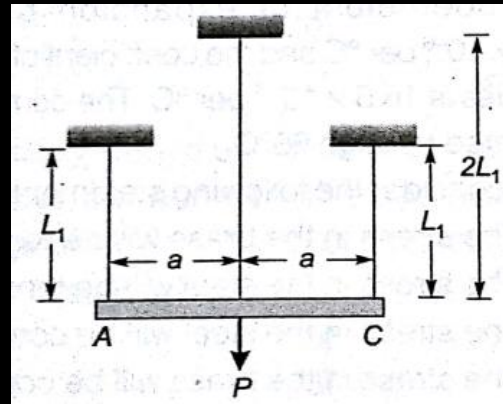
D : 600 kg/cm^2 tension

Q :) A rigid beam CBDA is hinged at A and supported by two springs at C and B with a vertical load 'P' at point D as shown in the given figure. The ratio of stiffness (k_2/k_1) of springs at B and C is 2. The ratio of forces in spring at C to that at B is



- | | |
|-------------------------------------|--------------|
| A : $\frac{3}{4}$ | B : 1 |
| C : $\frac{4}{3}$ | D : 2 |

Q :) A rigid bar AC is supported by three rods of same material and of equal diameter. The bar AC is initially horizontal. A force P is applied such that the bar AC continues to remain horizontal. Forces in each of the shorted bars and in the longer bar are, respectively



A : $0.4P$, $0.2P$

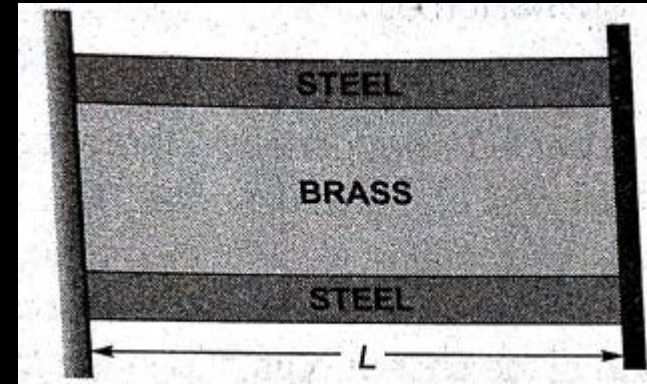
B : $0.3P$, $0.4P$

C : $0.2P$, $0.6P$

D : $0.5P$, Zero

Q :) A brass bar of solid section is encased in a steel tube as shown in the diagram below

The coefficient of expansion of steel is 11.2×10^{-6} per $^{\circ}\text{C}$ and the coefficient of expansion of brass is 16.5×10^{-6} per $^{\circ}\text{C}$. The composite bar is heated through 60°C .



Now consider the following statements:

- 1. The stress in the brass will be tensile**
- 2. The stress in the steel will be tensile**
- 3. The stress in the steel will be compressive**
- 4. The stress in the brass will be compressive**

Which of these statements are correct?

A : 1 and 2

B : 1 and 3

C : 2 and 4

D : 2 and 3

Q :) A round steel bar of overall length 40 cm consists of two equal portions of 20 cm each having diameters of 10 cm and 8 cm respectively. Take E as $2 \times 10^6 \text{ kg/cm}^2$. If the rod is subjected to a tensile load of 10 tonnes, the elongation in cm will be given by

A : $\frac{1}{10\pi} \left(\frac{1}{25} + \frac{1}{16} \right)$

B : $\frac{2}{10\pi} \left(\frac{1}{25} + \frac{1}{16} \right)$

C : $\frac{3}{10\pi} \left(\frac{1}{25} + \frac{1}{16} \right)$

D : $\frac{4}{10\pi} \left(\frac{1}{25} + \frac{1}{16} \right)$

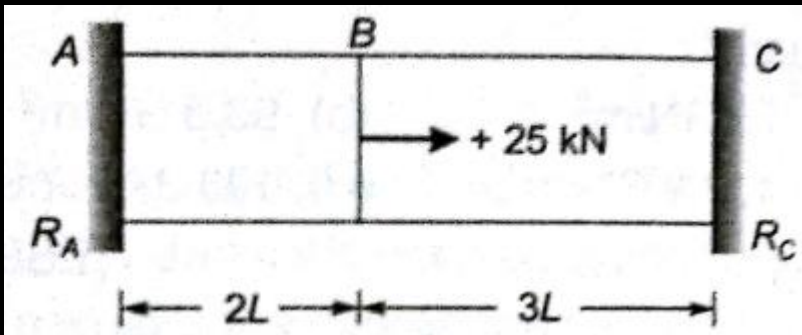
Q :) A prismatic bar ABC is subjected to an axial load of 25 kN; the reactions R_A and R_C will be

A : $R_A = -10$ kN and $R_C = -15$ kN

B : $R_A = 10$ kN and $R_C = -35$ kN

C : $R_A = -15$ kN and $R_C = -10$ kN

D : $R_A = 15$ kN and $R_C = -40$ kN



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