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BET-022

DIPLOMA IN CIVIL ENGINEERING (DCLE(G))/ DIPLOMA IN ELECTRICAL AND MECHANICAL ENGINEERING (DEME) / DCLEVI / DMEVI / DELVI / DECVI / DCSVI / ACCLEVI / ACMEVI / ACELVI / ACECVI / ACCSVI

02000 **Term-End Examination**

June, 2014

BET-022 : STRENGTH OF MATERIALS

Time : 2 hours *Maximum Marks : 70*

Note : *Question no. 1 is* ***compulsory****. Attempt any* ***four*** *questions from the remaining. Use of scientific calculator is permitted.*

1. Choose the correct alternative : *7×2=14*

(a) If the Young's modulus of elasticity of a material is twice its modulus of rigidity, the Poisson's ratio of the material is

(i) zero

(ii) 0·5

(iii) 1·0

(iv) 1·5

(b) Principal planes are the planes

(i) which have maximum shear stress

(ii) which have zero shear stress

(iii) which have maximum normal stress

(iv) which have minimum normal stress

(c) The point of contraflexure is a point where

(i) bending moment is maximum

(ii) shear force is maximum

(iii) bending moment changes sign

(iv) shear force changes sign

(d) The slope and deflection at the fixed end of the cantilever beam is

(i) maximum

(ii) minimum

(iii) cannot be calculated

(iv) zero

(e) Simple bending equation is

(i) $\frac{M}{I} = \frac{\sigma}{Y} = \frac{E}{R}$ (ii) $\frac{M}{I} = \frac{R}{E} = \frac{\sigma}{Y}$

(iii) $\frac{I}{M} = \frac{E}{R} = \frac{Y}{\sigma}$ (iv) $\frac{M}{I} = \frac{R}{E} = \frac{Y}{\sigma}$

(f) If a shaft of diameter d is subjected to torque T, the maximum shear stress is

(i) $\frac{32\,T}{\pi d^3}$ (ii) $\frac{16\,T}{\pi d^3}$

(iii) $\frac{16\,T}{\pi d^2}$ (iv) $\frac{64\,T}{\pi d^4}$

(g) Buckling load for a column depends upon

(i) length of column only

(ii) least lateral dimension

(iii) both length and least lateral dimension

(iv) None of the above

2. A rod is 3 m long at a temperature of 20°C. Find the expansion of rod when the temperature is raised to 90°. If this expansion is prevented, find the stress in the material of the rod.

Take $E = 10^{11}$ N/m^2

$\alpha = 12 \times 10^{-6}$/°C *14*

3. At a point in a material there is a horizontal tensile stress of 1000 N/mm^2, a vertical tensile stress of 400 N/mm^2 and shearing stress of 600 N/mm^2 as shown in Figure 1. Determine the maximum and principal stress and the plane on which they act. Determine also the magnitude of maximum shear stress. *14*

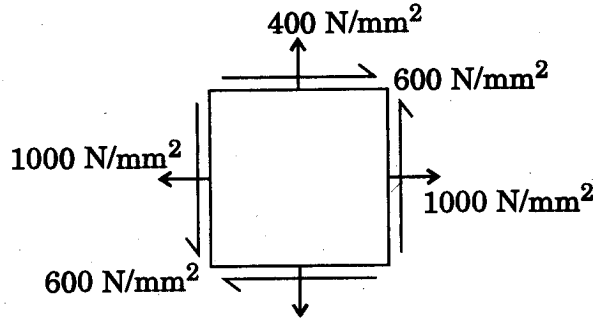

Figure 1

4. Draw the shear force and bending moment diagram for the simply supported beam as shown in Figure 2. *14*

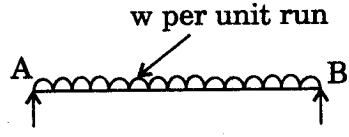

Figure 2

5. Determine the slope and deflection at the free end and fixed end of a cantilever beam of span L carrying a concentrated load W at the free end as shown in Figure 3. *14*

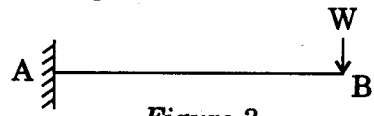

Figure 3

6. A rectangular beam of breadth 120 mm and depth 240 mm is simply supported over a span of 5 m. The beam is loaded with a uniformly distributed load of 4 kN/m over the entire span. Find the maximum bending stresses. *14*

7. A solid aluminium shaft 1000 mm long and of 50 mm diameter is to be replaced by a tubular steel shaft of the same length and the same outside diameter, so that either shaft could carry the same torque and have the same angle of twist over the total length. What must be the inner diameter of the tubular steel shaft ? Modulus of rigidity of steel may be taken as $0{\cdot}85 \times 10^6$ N/mm^2 and that of aluminium as $0{\cdot}28 \times 10^6$ N/mm^2. *14*

8. A steel round bar 6 cm in diameter and 2·5 m long is used as a strut. One end of the strut is fixed while its other end is hinged. Find the safe compressive load for this strut using Euler's formula.

   Assume $E = 2 \times 10^6$ N/mm^2 and factor of safety = 3. *14*