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BET-022

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

00643 **Term-End Examination**

December, 2018

BET-022 : STRENGTH OF MATERIALS

Time : 2 hours *Maximum Marks : 70*

Note : *Question no. 1 is **compulsory**. Attempt any **four** questions from the remaining ones. Use of scientific calculator is permitted. Assume suitable data wherever necessary and mention it clearly.*

1. Choose the correct answers from the alternatives given below : *7×2=14*

   (a) Bulk modulus is defined as the ratio of

   (i) Volumetric stress of volumetric strain

   (ii) Shear stress to shear strain

   (iii) Stress to strain

   (iv) Longitudinal stress to longitudinal strain

(b) The temperature of a bar of uniform cross-sectional area A, length 'L' and constrained at both ends is increased by ΔT. Then thermal stress in the bar is equal to

(i) $\alpha L \Delta T$

(ii) $E\alpha \Delta T$

(iii) $\alpha \Delta T$

(iv) $AE\alpha \Delta T$

(c) The rate of change of bending moment at a section is equal to

(i) Shear stress

(ii) Load

(iii) Shear force

(iv) Horizontal thrust

(d) The moment of resistance of a beam of circular section can be expressed as

(i) $\frac{\pi d^4 \sigma}{64}$

(ii) $\frac{\pi d^4 \sigma}{32}$

(iii) $\frac{\pi d^3 \sigma}{64}$

(iv) $\frac{\pi d^3 \sigma}{32}$

(e) A cantilever beam of length (L) is carrying concentrated load of intensity 'W' at its free end. The deflection at free end will be

(i) $WL^4 / 8\ EI$

(ii) $WL^3 / 3\ EI$

(iii) $WL^3 / 6\ EI$

(iv) $WL^2 / 2\ EI$

(f) The torsion equation can be expressed as

(i) $\frac{R}{fs} = \frac{T}{J} = \frac{C\theta}{l}$

(ii) $\frac{fs}{R} = \frac{T}{J} = \frac{C\theta}{l}$

(iii) $\frac{fs}{R} = \frac{J}{T} = \frac{C\theta}{l}$

(iv) $\frac{fs}{R} = \frac{T}{J} = \frac{l}{C\theta}$

(g) The slenderness ratio can be expressed as

(i) Length of column to radius

(ii) Least radius of gyration to effective length of column

(iii) Effective length of column to least radius of gyration

(iv) None of the above

2. A cylinder of height 300 mm and diameter 150 mm is tested for compression in a universal testing machine. Within the elastic limit, the cylinder was found to be shortened by 0·12 mm and its diameter was found to be increased by 0·01 mm under an axial load of 90 kN. Calculate the Young's Modulus (E) and Poisson's ratio (ν) for the specimen. *14*

3. At a point in a material, there is a horizontal tensile stress of 270 N/mm^2, a vertical tensile stress of 130 N/mm^2 and shearing stress of 40 N/mm^2 as shown in Figure 1.

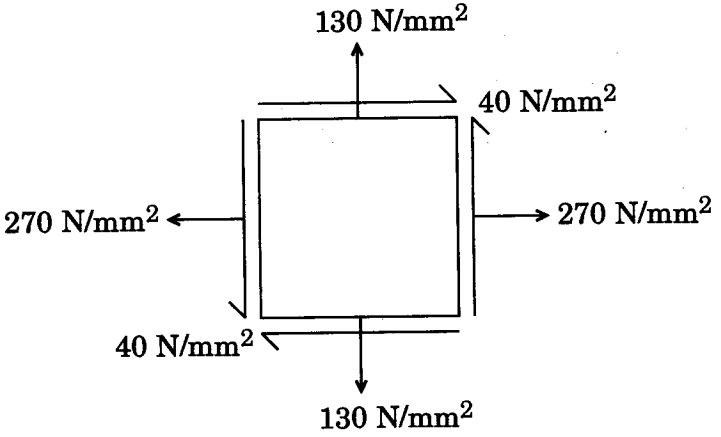

Figure 1

Determine the

(a) maximum and minimum principal stresses,

(b) planes on which maximum and minimum principal stresses act, and

(c) magnitude of maximum shearing stress. *14*

4. A simply supported beam AB of span L is carrying three point loads as shown in Figure 2.

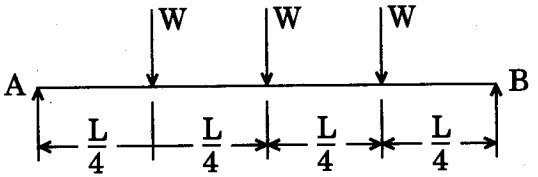

Figure 2

Draw the shear force and bending moment diagram. *14*

5. A rectangular beam 200 mm × 300 mm is 8 m long and is simply supported at the ends. It carries a point load of 45 kN at mid span. Find the maximum bending stress in the beam. *14*

6. A simply supported beam AB of span L carries a uniformly distributed load of w per unit run over the entire span as shown in Figure 3. Calculate the slope and deflection at the points A, B and C. *14*

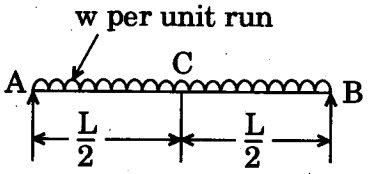

Figure 3

7. A solid shaft made of steel and of 2·50 m length is to transmit 40 kW at 125 rpm. If the shear stress in the shaft material is not to exceed 40 MPa and maximum allowable twist in the shaft is 1°, calculate the shaft diameter. Take modulus of rigidity as 80×10^3 N/mm^2. *14*

8. (a) Explain slenderness ratio and factor of safety in relation to Euler's buckling load. *7*

   (b) Explain the assumptions made in Euler's theory of long columns. *7*