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Question Paper Code : 60353

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

Third/Fourth Semester

Aeronautical Engineering

CE8395 — STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS

(Common to Aerospace Engineering/Automobile Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/ Marine Engineering/Material Science and Engineering/Mechanical Engineering/ Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering/ Mechatronics Engineering/Production Engineering/Robotics and Automation/Safety and Fire Engineering)

(Regulations 2017)

Time : Three hours

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Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define factor of safety.
2. Mention the radius of Mohr's circle.
3. Define shear stress distribution.
4. List the types of stresses are caused in a beam subjected to a constant shear force.
5. Write down the equation for shear strain energy of a closed coil helical spring.
6. Define helix angle.
7. State second Mohr's theorem
8. Give the units of slope and deflection
9. Give the condition for a thin cylinder.
10. Differentiate between thin and thick cylinders.

PART B — ($5 \times 13 = 65$ marks)

11. (a) Determine the change in length, breadth and thickness of a steel bar 4 m long, 30 mm wide and 20 mm thick when subjected to an axial pull of 120 kN in the direction of its length. Take $E = 200$ GPa and $\mu = 0.3$.

Or

- (b) The composite bar shown in figure.1 is rigidly fixed at the ends. An axial pull of $P = 15$ kN is applied at B which is at a fixed temperature of 20°C . Find the stresses in each material at 80°C .

Take $\alpha_s = 11 \times 10^{-6}/^\circ\text{C}$; $\alpha_a = 24 \times 10^{-6}/^\circ\text{C}$

$E_s = 210$ kN/mm²; $E_a = 70$ kN/mm²

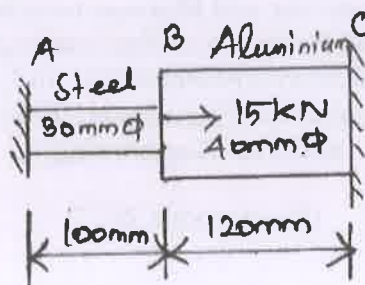


Figure 1

12. (a) Draw the shear force and bending moment diagrams for a simply supported beam of span 9 m. The beam carries a UDL of 10 kN/m for a distance of 6 m from the left support. Find the maximum value and their position. Mention the values at salient points in the diagram.

Or

- (b) Draw the shear force and bending moment diagram for the beam as shown in Fig. 2

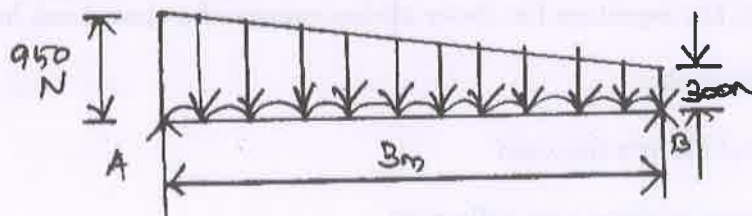


Fig. 2

13. (a) Design a suitable diameter for a circular shaft required to transmit 120 KW at 180 rpm. The shear stress in the shaft is not to exceed 70 N/mm² and the max torque exceeds the mean by 40% . Calculate the angle of twist in a length of 2m. Take $C = 0.8 \times 10^5$ N/mm².

Or

- (b) A closed coil helical spring of 8mm dia wire with 12 coils of mean diameter 100 mm carries an axial load of 400N. Find the shear stress induced and deflection caused. What is the strain energy stored? Take $C = 8 \times 10^6$ N/cm².
14. (a) A cantilever beam of 8 m long carries a UDL of 5 KN/m run and a load of W at the free end. If the deflection at the free end is 30 mm, calculate the magnitude of load W and shape at free end.

Or

- (b) A cantilever beam of 2 m long is loaded as shown in figure. 3. Calculate the deflection at the free end if the section is rectangular 100 mm $\times$ 200 mm. $E = 110$ GPa.

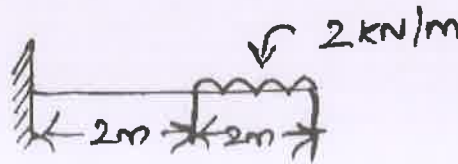


Fig. 3

15. (a) A cylindrical shell 1m diameter and 3m length is subjected to an internal pressure of 2MPa. Calculate the minimum thickness if the stress should not exceed 50 MPa. Find the change in diameter and volume of the shell. $\mu = 0.3$ and $E = 200$ kN/mm².

Or

- (b) A rectangular block of material is subjected to a tensile stress of 90 N/mm² along x-x axis and a compressive stress of 45 N/mm² on a plane at right angles to it together with a shear stress of 80N/mm² on the same plane.

Calculate :

- (i) The direction of principal planes. (5)
- (ii) The magnitude of principal stresses. (4)
- (iii) The magnitude of the greatest shear stress. (4)

PART C — ($1 \times 15 = 15$ marks)

16. (a) A steel tube 30 mm external diameter and 25mm internal diameter encloses a gun metal rod of 20 mm diameter to which it is rigidly joined at each end. The temperature of whole assembly is raised to 150°C . Find the intensity of stress in the rod when the common temperature has fallen to 20°C . Take $E_{\text{steel}} = 2.1 \times 10^5 \text{ N/mm}^2$ and $E_{\text{gunmetal}} = 1 \times 10^5 \text{ N/mm}^2$ respectively. Take $\alpha_{\text{steel}} = 12 \times 10^{-6}/^{\circ}\text{C}$ and $\alpha_{\text{gunmetal}} = 20 \times 10^{-6}/^{\circ}\text{C}$.

Or

- (b) A 10 m simply supported beam carries a central point of 10 kN. It is also subjected to a UDL of 2 kN/m over its entire span. Find the maximum deflection of beam by

- (i) Macaulay's method
- (ii) Moment area method

Take $E = 200 \text{ kN/mm}^2 = 200 \times 10^6 \text{ mm}^4$.