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Question Paper Code : 33230

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fourth Semester

Automobile Engineering

CE 1262/CE 1258 A/070210003 — STRENGTH OF MATERIALS

(Common to Mechanical Engineering/Mechatronics Engineering/Metallurgical Engineering and Production Engineering)

(Regulation 2004/2007)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define the term : Elastic limit.

2. Give the relation between Young's modulus and Bulk modulus.

3. What do you mean by the point of contraflexure?

4. Sketch the shear stress distribution diagram across the depth of a T-section.

5. Give any two practical applications of helical springs.

6. What is polar modulus? Write the polar modulus value of a rectangle.

7. Write the equation giving maximum deflection in case of a simply supported beam subjected to udl over the entire span.

8. Give the equivalent length of a column for any two end conditions.

9. What is Mohr's circle method?

10. What is principal stress?

PART B — (5 × 16 = 80 marks)

11. (a) A 25 mm diameter bar, 200 mm long, extends 0.19 mm under a tensile load of 110 kN. On the same bar, an axial hole is drilled to produce a hollow cylinder of uniform thickness. What is the maximum diameter of the hole possible if the stress is limited to 240 MPa, the load being the same, What is its axial deformation?

Or

(b) A hollow steel cylinder surround a solid copper cylinder and the assembly is subjected to an axial load of 280 kN. The cross sectional areas of steel and copper cylinders are 2000 mm^2 and 6000 mm^2 respectively. Both the cylinders are 0.6 m long before the load is applied. Determine the rise in temperature required so that copper cylinder just supports the whole of the load. Ec = 100 GPa, Es = 205 GPa, $\alpha \equiv 12 \times 10^{-6} / ^{\circ} C$ for steel and $\alpha = 18.5 \times 10^{-6} / ^{\circ} C$ for copper.

12. (a) A simply supported beam of span 8m long is subjected to two concentrated loads of 24 kN and 48 kN at 2 m and 6 m from left support respectively. In addition it carries a UDL of 36 kN/m over the entire span. Draw shear force and bending moment diagrams. Mark the salient points.

Or

(b) A simply supported beam of span 6 m and of I section has the top flange 40 mm × 5 mm. Bottom flange of 60 mm × 5 mm total depth of 100 mm and web thickness 5 mm. It carries an UDL of 2 kN/m over the full span. Calculate the maximum tensile stress and maximum compressive stress produced.

13. (a) A closely coiled helical spring made of 10 mm diameter steel wire has 15 coils of 100 mm mean diameter. The spring is subjected to an axial load of 100 N. Calculate :

(i) the maximum shear stress (6)

(ii) the deflection and (5)

(iii) stiffness of the spring. (5)

Take modulus of rigidity, $C = 8.16 \times 10^4 \, N / mm^2$.

Or

(b) A solid circular shaft transmits 75 kW power at 200 rpm. Calculate the shaft diameter, if the twist in the shaft is not exceed 1^0 in 2 meter length of the shaft and the shear stress is limited to 50 N/mm^2. Take $C = 1 \times 10^5 \, N / mm^2$.

14. (a) An I section joint 400 mm × 200 mm × 20 mm and 6 m long is used as a strut with both ends fixed. What is Euler's crippling load for the column? Take E = 200 GPa.

Or

(b) A simply supported beam of span 8 m is subjected to concentrated leads of 24 kN, 48 kN and 72 kN at 2 m, 4 m and 6 m from left support respectively. Calculate the slope and deflection at the centre and also find maximum deflection.

15. (a) A cylindrical vessel 2 m long and 500 mm in diameter with 10 mm thick plates is subjected to an internal pressure of 2 MPa. Calculate the change in volume of the vessel. Take E = 200 GPa and Poisson's ratio = 0.3 for the vessel material.

Or

(b) A plane element in a boiler is subjected to tensile stresses of 400 MPa on one plane and 200 MPa on the other at right angles to the former. Each of the above stresses is accompanied by a shear stress of 100 MPa. Determine the principal stresses and their directions. Also, find maximum shear stress.
