Reg. No. : | | | | | | | | | | | |

Question Paper Code : 53201

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2010

Fourth Semester

Mechanical Engineering

ME 2254 — STRENGTH OF MATERIALS

(Common to Automobile Engineering and Production Engineering)

(Regulation 2008)

(Also common to PTME 2254 Strength of Materials for Third Semester Mechanical Engineering B.E. Part – Time Regulation 2009)

Time : Three hours Maximum : 100 Marks

(Assume 1 ton = 1000 kg and 1 kg = 10 N)

Answer ALL questions

PART A — (10 · 2 = 20 Marks)

1. State the principle of superposition.

2. Define “Shear Stress”.

3. Write down any four types of beams.

4. Write the expression for section modulus.

5. What is meant by stiffness of spring?

6. What is a laminated spring?

7. Mention any two methods of finding the slope and deflection of beams.

8. Write down the equations for maximum deflection of a simply Supported beam loaded with a central point load.

9. Define “Thin Shell”.

10. Mention the types of stresses produced in thin cylindrical shells.

PART B — (5 · 16 = 80 Marks)

11. (a) A Mild steel rod of 20 mm diameter and 300 mm long is enclosed centrally inside a hollow copper tube of external diameter 30 mm and internal diameter 25 mm. The ends of the rod and tube are brazed together, and the composite bar is subjected to an axial pull of 40 kN.

If E for steel and copper is 200 GN/m^2 and 100 GN/m^2 respectively, find the stresses developed in the rod and the tube also find the extension of the rod.

Or

(b) A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. calculate the Poisson's ratio and the values of the three moduli.

12. (a) A Cantilever 1.5 m long carries a load of 2 tons at its free end, and another load 1 ton at a distance of 0.5 m from the free end. Draw shear force and bending moment diagrams for the cantilever.

Or

(b) A beam of triangular cross section having base width of 100 mm and height of 150 mm is subjected to a shear force of 15 KN. Find the value of maximum shear stress, and sketch the shear stress distribution along the depth of beam.

13. (a) A bar of magnesium alloy 28 mm in diameter was tested on a gauge length of 25 cm in tension and in torsion. A tensile load of 5 tonnes produced an extension of 0.4 mm and a torque of 1250 kg-cm produced a twist of 1.51 degrees. Determine the (i) Young's modulus (ii) Modulus of rigidity (iii) Bulk modulus (iv) Poisson's ratio for the material under test.

Or

(b) An open coil helical spring made of 10 mm diameter wire and of mean diameter 10 cm has 12 coils, angle of helix being 15 degrees. Determine the axial deflection and the intensities of bending and shear stress under axial load of 50 kg. Take C as $0.8 \cdot 10^6$ kg/cm^2 and E as $0.2 \cdot 10^6$ kg/cm^2.

14. (a) A horizontal girder of steel having uniform section is 14 meters long and is simply supported at its ends. It caries concentrated loads of 12 tonnes and 8 tonnes at two points 3 metres and 4.5 metres from the two ends respectively. I for the section of the girder is $160 \cdot 10^3$ cm^4 and $E = 2.1 \cdot 10^6$ kg/cm^2 calculate the deflection of the girder at points under the two loads.

Or

(b) Find the Euler's crippling load for a hollow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3 m and hinged at its both ends. Take E = 205 kN/mm^2. Also determine the crippling load by Rankine's formula using f_c = 335N/mm^2 and a = 1/7500.

15. (a) A Cylindrical shell 3 meters long has 1 metre internal diameter and 15 mm metal thickness. Calculate the circumferential and longitudinal stresses induced and also changes in the dimensions of the shell, if it is subjected to an internal pressure of 15 kg/cm^2.

Take E = $2.0 \cdot 10^6$ kg/cm^2 and Poisson's ratio = 0.3.

Or

(b) At a point in a strained material the principal stresses are 100 N/mm^2 (tensile) and 60 N/mm^2 (compressive). Determine normal stress, shear stress, resultant stress on a plane inclined at 50 degrees to the axis of the major principal stress. Also determine the maximum shear stress at the point.

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