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Question Paper Code : 23230

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 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 — ($10 \times 2 = 20$ marks)

1. Define Poisson's ratio.

2. What is thermal stress?

3. Sketch the bending moment diagram of a cantilever beam subjected to udl over the entire span.

4. The section modulus w.r.t. *xx* axis of a rectangle of width '*b*' and depth '*d*' is ———— and in case of circle, the section modulus is ————.

5. What is Polar Modulus? Give the expressions for Polar Modulus for a solid shaft and for a hollow shaft.

6. Define: Torsional rigidity of a shaft.

7. Write the relationship between intensity of load, shear force, bending moment, slope and deflection in a beam.

8. What is slenderness ratio?

9. Show that in thin cylinder shells subjected to internal fluid pressure, the circumferential stress is twice the longitudinal stress.

10. Define the terms: Principal planes and principal stresses.

PART B — (5 × 16 = 80 marks)

11. (a) In an experiment, a bar of 25 mm diameter is subjected to a pull of 70 kN. The measured extension on gauge length of 200 mm is 0.09 mm and the change in diameter is 0.0040 mm. Calculate the Poisson's ratio and the values of three moduli.

Or

(b) A reinforced concrete column 500 mm × 500 mm in section is reinforced with 4 steel bars of 20 mm diameter, one in each corner. The column is carrying a load of 750 kN. Determine the stresses in concrete and steel bars. Take $E_s = 210\,GPa$ and $E_c = 14\,GPa$. Also, calculate load carried by steel and concrete.

12. (a) A square beam 20 mm × 20 mm in section and 2m longis supported at the ends. The beam fails when a point load of 400 N is applied at the centre of beam. What uniformly distributed load per meter length will break a cantilever of same material 40 mm wide, 60 mm deep and 3 m long?

Or

(b) Draw the S.F. and B.M. diagrams for a simply supported beam carrying a uniformly varying load from zero at each end to w per unit length at the centre.

13. (a) A solid shaft is subjected to a torque of 45 kNm. If angle of twist is 0.5 degree per metre length of the shaft and shear stress is not to exceed 90 MN/m² find

(i) Suitable diameter of the shaft

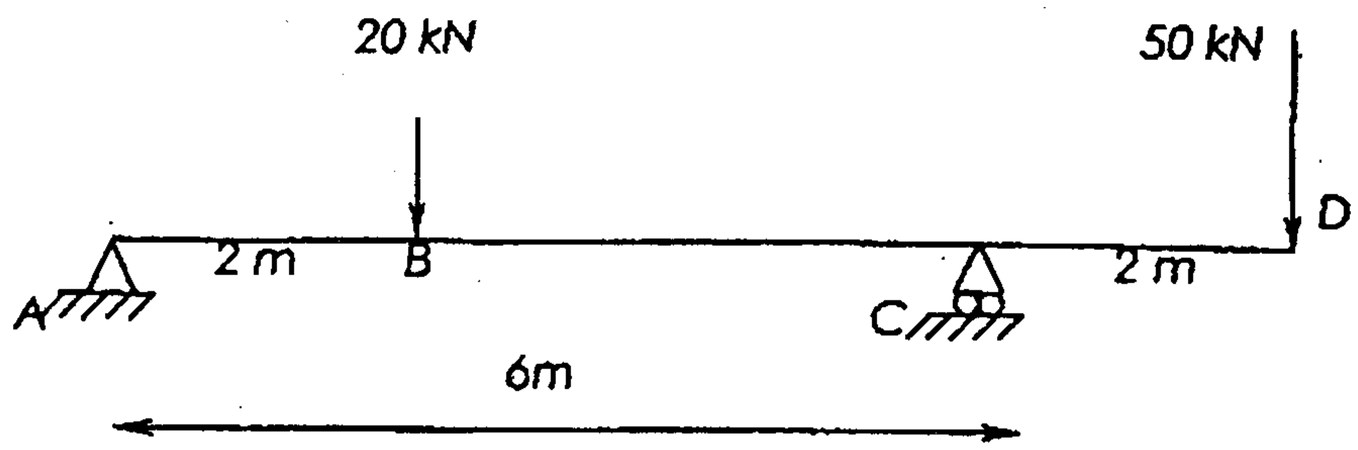
(ii) Final maximum shear stress and the angle of twist per metre length. Modulus of rigidity = 80 GN/m².

Or

(b) A closely coiled helical spring having 12 coils of wire diameter 16 mm and made with coil diameter 250 mm is subjected to an axial load of 300 N. Find axial deflection, strain energy stored and torsional shear stress.

Modulus of rigidity = 80 GN/m².

14. (a) Determine the deflection under B and D for the beam shown below. Also determine the slope at A and C. Take uniform flexural rigidity EI throughout the beam



Or

(b) A rectangular box of outer dimensions 500 mm × 300 mm of uniform thickness 10 mm is used as a column with both the ends fixed. If the unsupported length is 6 m, find the Euler's buckling load and Rankine's buckling load. Take $E = 200\,GPa$ and yie;d stress as 325 MPa.

15. (a) A simply supported beam of 6 m span carries a uniformly distributed load of 20 kN/m over the middle 2 m length and point loads of 10 kN and 20 kN at a distance of 1 m and 5 m from the left end. Draw the shear force and bending moment diagrams and determine the magnitude and position of the maximum bending moment.

Or

(b) An R.S. Joist 55 cm by 19 cm having flange and web thicknesses 1.5 cm and 0.99 cm respectively, is used as a beam. If at a section, it is subjected to shear force of 100 kN, find the greatest intensity of shear stress in the beam taking,

(i) Web vertical. (6)

(ii) Web horizontal. Show the variation of shear stress in both cases. (10)