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R 3166

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Fourth Semester

(Regulation 2004)

Automobile Engineering

CE 1262 — STRENGTH OF MATERIALS

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

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define the terms Poisson's ratio and Bulk modulus.
2. Explain the effect of change of temperature in a composite bar.
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. Express the strength of a solid shaft.
6. Give the expression for finding deflection of a closely coiled helical spring.
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. A boiler of 800 mm diameter is made up of 10 mm thick plates. If the boiler is subjected to an internal pressure of 2.5 MPa, determine circumferential and longitudinal stress.
10. Define 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) Draw shear force and bending moment diagram for the simply supported beam shown in Fig. 1. Also, find the maximum bending moment and its position.

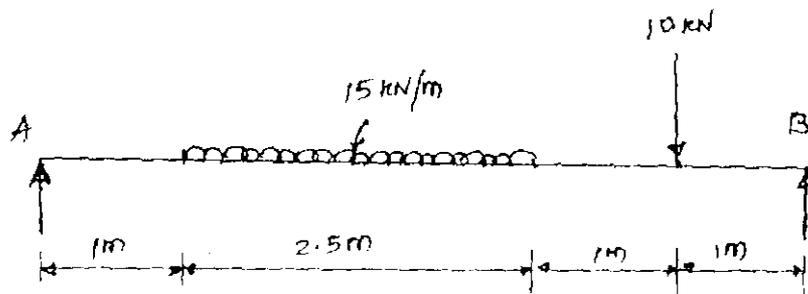


Fig. Qn. 12(a)

Or

- (b) Two beams are simply supported over the same span and have the same flexural strength. Compare the weights of these two beams, if one of them is solid and the other is hollow circular with internal diameter half of the external diameter.
13. (a) A solid shaft is subjected to a torque of 1.6 kN-m. Find the necessary diameter of the shaft, if the allowable shear stress is 50 MPa. The allowable twist is 1° for every 20 diameters length of the shaft. Take $C = 80$ GPa.

Or

- (b) A closely coiled helical spring of round steel wire 5 mm in diameter having 12 complete coils of 50 mm mean diameter is subjected to an axial load of 150 N. Find the deflection of the spring and the maximum shearing stress in the material. Modulus of rigidity (C) = 80 GPa. Also, find stiffness of the spring.

14. (a) A beam is loaded as shown in Fig. 2. Determine the deflection under the load points. Take $E = 200 \text{ GPa}$ and $I = 160 \times 10^6 \text{ mm}^4$.

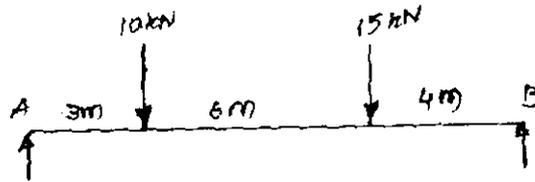


Fig. Qn. 14(a)

Or

- (b) An I section joist $400 \text{ mm} \times 200 \text{ mm} \times 20 \text{ mm}$ and 6 m long is used as a strut with both ends fixed. What is Euler's crippling load for the column? Take $E = 200 \text{ GPa}$.
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 $E = 200 \text{ GPa}$ 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.