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Question Paper Code : 27099

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Third Semester

Mechanical Engineering

CE 6306 — STRENGTH OF MATERIALS

(Common to Mechatronics Engineering, Industrial Engineering and Management, Industrial Engineering, Manufacturing Engineering, Mechanical Engineering (Sandwich) Material Science and Engineering and also Common to Fourth Semester Automobile Engineering, Mechanical and Automation Engineering and Production Engineering)

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   Differentiate Elasticity and Elastic Limit.

2.   What is principle of super position?

3.   Write the assumption in the theory of simple bending?

4.   What are the types of beams?

5.   The shearing stress is a solid shaft is not to exceed 40 N/mm² when the torque transmitted is 20000 N-m. Determine the minimum diameter of the shaft.

6.   What are the various types of springs?

7.   What are the methods of determining slope and deflection at a section in a loaded beam?

8.   What is the equation used in the case of double integration method?

9.   State the expression for maximum shear stress in a cylindrical shell.

10. Define — hoop stress and longitudinal stress.

PART B — (5 × 16 = 80 marks)

11. (a) A metallic bar 300 mm × 100 mm × 40 mm is subjected to a force of 50 kN (tensile), 6 kN (tensile) and 4 kN (tensile) along x, y and z directions respectively. Determine the change in the volume of the block. Take $E = 2 \times 10^5$ N / mm² and Poisson's ratio = 0.25.

Or

(b) A steel rod of 3 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5 cm and internal diameter of 4 cm as shown in Fig-1. The composite bar is then subjected to axial pull of 45000 N. If the length of each bar is equal to 15 cm, determine: (i) The stresses in the rod and tube, and (ii) Load carried by each bar. Take E for steel = 2.1×10^5 N/mm² and for copper = 1.1×10^5 N/mm².
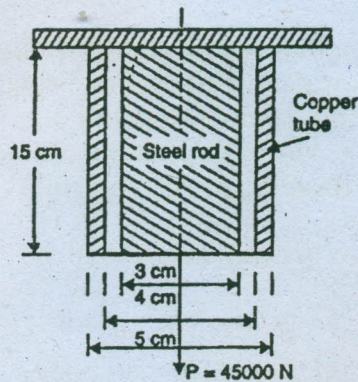

Fig. 1

12. (a) Draw the shear force and B.M diagrams for a simply supported beam of length 8 m and carrying a uniformly distributed load of 10 kN/m for a distance of 4m as shown in fig-2.
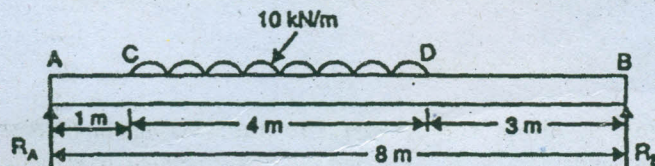

Fig. 2

Or

(b) A steel plate of width 120 mm and of thickness 20 mm is bent into a circular arc of radius 10 m. Determine the maximum stress induced and the bending moment which will produce the maximum stress. Take $E = 2 \times 10^5$ N/mm².

13. (a) A hollow shaft of external diameter 120 mm transmits 300 kW power at 200 r.p.m. Determine the maximum internal diameter if the maximum stress in the shaft is not to exceed 60 N/ mm².

Or

(b) A closely coiled helical spring of mean diameter 20 cm is made of 3 cm diameter rod and has 16 turns. A weight of 3 kN is dropped on this spring. Find the height by which the weight should be dropped before striking the spring so that the spring may be compressed by 18 cm. Take $C = 8 \times 10^4$ N/mm².

14. (a) A beam 6m long, simply supported at its ends, is carrying a point load of 50 kN at its centre. The moment of inertia of the beam is given as equal to 78×10^6 mm⁴. If E for the material of the beam = 2.1×10^5 N/mm², calculate : (i) deflection at the centre of the beam and (ii) slope at the supports.

Or

(b) A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 respectively from the left support as shown Fig-3.

Using Macaulay's method find:

(i) deflection under each load,

(ii) maximum deflection, and

(iii) the point at which maximum deflection occurs,

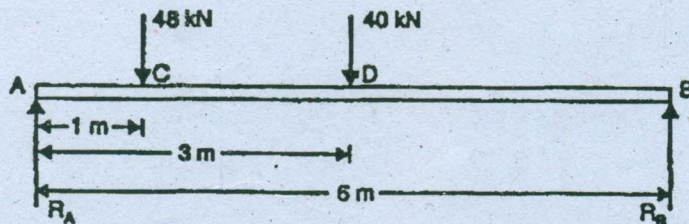Given E = 2×10^5 N/mm² and I = 85×10^6 mm⁴.

Fig. 3

15. (a) A boiler is subjected to an internal steam pressure of 2N/mm². The thickness of boiler plate is 2.6 cm and permissible tensile stress is 120 N/mm². Find the maximum diameter, when efficiency of longitudinal joint is 90% and that of circumference point is 40%.

Or

(b) Calculate: (i) the change in diameter, (ii) change in length and (iii) change in volume of a thin cylindrical shell 100 cm diameter, 1 cm thick and 5 m long when subjected to internal pressure of 3 N/mm². Take the value of E = 2×10^5 N/mm² and Poisson's ratio, $\mu = 0.3$.

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