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Question Paper Code : 80077

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Third/Fourth Semester

Mechanical Engineering

CE 8395 — STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS

(Common to Aeronautical Engineering/Automobile Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Marine Engineering/Material Science and Engineering/Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering/Mechatronics Engineering/Production Engineering/Robotics and Automation Engineering)

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What do you meant by thermal stress?

2. Define principal plane and principal stresses.

3. What is meant by point of contra-flexure?

4. What is ratio of maximum shear stress to the average shear stress in the case of solid circular section?

5. Write down the expression for power transmitted by a shaft.

6. Define helical springs.

7. A beam 3 m long, simply supported at its ends, is carrying a point load W at the centre. If the slope at the beam should not exceed 1°, find the deflection at the centre of the beam.

8. State Maxwell's reciprocal theorems.

9. Differentiate between a thin cylinder and a thick cylinder.

10. State Lame's theorem.

PART B — (5 × 13 = 65 marks)

11. (a) A steel rod of 3 cm diameter and 5 m long is connected to two grips and the rod is maintained at a temperature of 95°C. Determine the stress and pull exerted when the temperature falls to 30°C, if (i) the ends do not yield, and (ii) the ends yield by 0.12 cm. Take $E = 2 \times 10^5$ MN/m^2 and $\alpha = 12 \times 10^{-6}$ /° C.

Or

(b) An elemental cube is subjected to tensile stresses of 30 N/mm^2 and 10 N/mm^2 acting on two mutually perpendicular planes and a shear stress of 10 N/mm^2 on these planes. Draw the Mohr's circle of stresses and hence or otherwise determine the magnitudes and directions of principal stresses and also the greatest shear stress.

12. (a) Draw the shear force and bending moment diagrams for the overhanging be a carrying uniformly distributed load of 2 kN/m over the entire length and a point load of 2 kN as shown in Fig. 1.

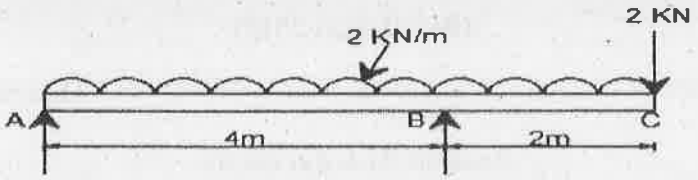

Fig. 1

Or

(b) A timber beam 100 mm wide and 200 mm deep is to be reinforced by bolting on two steel flitches each 150 mm by 12.5 mm in section. Calculate the moment of resistance when flitches are attached symmetrically at the top and bottom. Allowable stress in timber is 6 N/mm^2. Take $E_s = 2 \times 10^5$ N/mm^2 and $E_t = 1 \times 10^4$ N/mm^2.

13. (a) Two shafts of the same material and of same lengths are subjected to the same torque, if the shaft is of a solid circular section and the second shaft is of hollow circular section, whose internal diameter is 2/3 of the outside diameter and the maximum shear stress developed in each shaft is the same, compare the weights of the shafts.

Or

(b) A closely coiled helical spring of mean diameter 20 cm is made up 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 8×10^4 N/mm^2.

14. (a) A beam of length 5 m and of uniform rectangular section is simply supported at its ends. It carries a uniformly distributed load of 9 kN/m run over the entire length. Calculate the width and depth of the beam if permissible bending stress is 7 N/mm^2 and central deflection is not exceed 1 cm.

Take E for beam material = 1×10^4 N/mm^2.

Or

(b) A simply supported beam of length 5 m carries a point load of 5 kN at a distance of 3 m from the left end. If E = 2×10^5 N/mm^2 and I = 10^8 mm^4, determine the slope at the left support and deflection under the point load using conjugate beam.

15. (a) A cylindrical thin drum 80 cm in diameter and 3 m tong has a shell thickness of 1 cm. If the drum is subjected to an internal pressure of 2.5 N/mm^2, determine

(i) change in diameter

(ii) change in length and

(iii) change in volume.

Take E = 2×10^5 N/mm^2, Poisson's ratio = 0.25.

Or

(b) A spherical shell of internal diameter 0.9 m and of thickness 10 mm is subjected to an internal pressure of 1.4 N/mm^2. Determine the increase in diameter and increase in volume. Take E = 2×10^5 N/mm^2 and $\mu = 1/3$.

PART C — (1 × 15 = 15 marks)

16. (a) An I – section beam 350 mm × 150 mm has a web thickness of 10 mm and a flange thickness of 20 mm. If the shear force acting on the section is 40 kN, find the maximum shear stress developed in the I – section. Also sketch the shear stress distribution across the section.

Or

(b) Derive an expression for the slope and deflection of a simply supported beam subjected to uniformly distributed load.