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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2014

MECHANICAL ENGINEERING

Fourth Semester

CE8353 – Strength of Materials

(Regulation 2012)

Time: 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. State the principle of superposition.
2. A steel bar 2.5 m long, 20 mm wide and 15 mm thick is subjected to a tensile load of 35 kN. If Poisson's ratio is 0.25 and Young's modulus is 200 GPa, find the change in volume.
3. Give the relationship between shear force and bending moment.
4. Draw the shear stress distribution of a 'T' section.
5. Define torsional rigidity?
6. Give the polar modulus of a hollow circular section of outer diameter 'D' and inner diameter 'd'.
7. If a cantilever beam of span 'L' and flexural rigidity 'EI' carries a concentrated load 'W' at the free end, find the deflection at the free end using moment area method.
8. State the Maxwell's reciprocal theorem.
9. If a thin cylindrical shell of diameter of 1.5 m and thickness 15 mm is subjected to an internal fluid pressure of 1.2 N/mm^2, determine the circumferential stress.
10. Differentiate between a thin and thick cylinder.

Part – B (5 x 16 = 80 marks)

11. A thick metallic cylindrical shell of 160 mm internal diameter is required to withstand an internal pressure of 40 N/mm^2. Find the necessary thickness of the shell, if the permissible tensile stress in the section is 120 N/mm^2. (16)

12. a) An element in a stressed material has tensile stress of 500 MN/m^2 and a compressive stress of 350 MN/m^2 acting on two mutually perpendicular planes and equal shear of 100 MN/m^2 on these planes. Find the principal stresses and position of the principal planes. Find also the maximum shearing stress and the direction of their planes. (16)

(OR)

b) A solid steel bar 500 mm long and 70 mm diameter is placed inside an aluminium tube having 75 mm inside diameter and 100 mm outside diameter. The aluminium cylinder is 0.15 mm longer than the steel bar. An axial load of 600 kN is applied to the bar and the cylinder through rigid cover plates. Find the stresses developed in the steel bar and aluminium tube. Take Young's modulus as 2.2×10^5 N/mm^2 and 0.7×10^5 N/mm^2 for steel and aluminium respectively. (16)

13. a) Draw the shear force and bending moment diagrams for the loaded overhanging beam shown in figure. Also determine the point of contraflexure. (16)

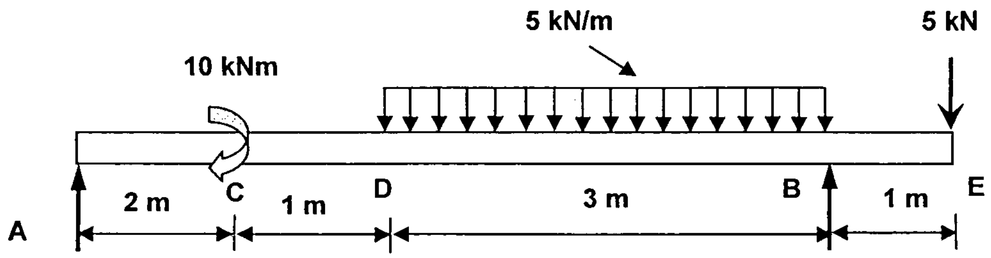

Fig Q.13.a

(OR)

b) (i) State the assumptions in the theory of simple bending (4)
(ii) Derive the bending equation. (12)

14. a) (i) A solid aluminium shaft 1m long and of 50 mm diameter is to be replaced by a hollow steel shaft of the same length and same outside diameter, so that the hollow shaft could carry the same torque and has the same angle of twist. What must be the inner diameter of the hollow shaft? Take rigidity modulus for aluminium and steel as 28 GPa and 85 GPa respectively. (12)

(ii)A solid shaft of 120 mm diameter is required to transmit 200 kW at 100 r.p.m. If the angle of twist is not to exceed 2°, find the length of the shaft.Take rigidity modulus as 90 GPa. (4)

(OR)

b) In a close coiled helical spring, the diameter of each coil is to be 10 times that of diameter of wire of the spring and the maximum shear stress is not to exceed 60 N/mm^2. Maximum permissible deflection under a load of 400 N is 100 mm. Take rigidity modulus as 90×10^3 N/mm^2. Determine the number of coils, the diameter of the coil and the energy stored in the coil. (16)

15. a) A single overhanging beam ABC is simply supported at A and B and free at C. It carries a point load of 4.5 kN at its free end C and a uniformly distributed load of 3 kN/m for a length of 3 m starting at a distance of 1 m from end A. If flexural rigidity EI = 2700 kNm^2. Determine (i) slope at end A (ii) deflection at the free end (iii) the maximum deflection between A and B. (16)

(OR)

b) A simply supported beam AB of span 4 m carries a point load of 100 kN at its centre C. The value of moment of inertia for the left half is 1×10^8 mm^4 and for the right half is 2×10^8 mm^4. Find the slopes at the two supports and deflection under the load using conjugate beam method. Take Young's modulus as 200 GN/m^2. (16)
