

B 205

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005

Second Semester

Electrical and Electronics Engineering

CE 151 — SOLID MECHANICS

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A --- (10 × 2 = 20 marks)

1. What is a perfect frame?
2. Define tension coefficient.
3. Derive the relationship between Young's modulus and bulk modulus.
4. Define principal planes.
5. Derive the relationship between bending moment and shear force.
6. Define point of contra flexure.
7. Give the formula for determination of bending stress in a section.
8. Show that the shear stress distribution over a rectangular section is parabolic.
9. Derive a relation for the twisting moment carrying capacity of a solid shaft.
10. Write down the formula for deflection of an open coiled helical spring subjected to an axial load 'W'.

11. Determine the direction of principal p truss and its magnitude for the given stressed material as shown in Fig. Q. 11.

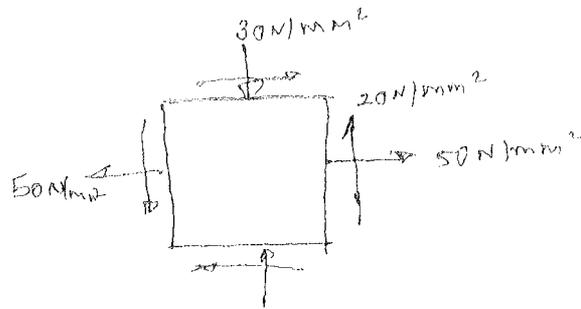


Fig. Q. 11

12. (a) A truss of 8 m span is loaded as shown in Fig. Q. 12 (a). Find the forces in the members. Adopt method of joints.

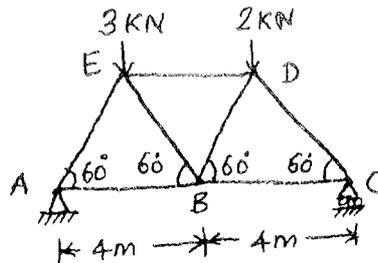


Fig. Q. 12 (a)

Or

- (b) Two vertical rods of steel and copper are rigidly fixed with the ceiling at their upper end at 100 cm apart. Each rod is 3 m long and 25 mm diameter. A horizontal cross piece connects the lower ends of the rods. Where should a load of 3.5 tonnes be placed on the cross piece so that it remains horizontal after being loaded. Take E for steel = 2×10^5 N/mm² and E for copper = 1×10^5 N/mm².
13. (a) A cantilever 2 m long carries an UDL 2 kN/m over its entire length and two point loads 4 kN and 5 kN at distances 0.5 m and 1 m respectively from fixed end. Draw shear force and bending moment diagrams and calculate maximum shear force and bending moment.

Or

- (b) The intensity of loading on a simply supported beam of 4 m span, increases gradually from 500 N at one end to 900 N at the other end. Draw SFD and BMD. Also calculate the maximum bending moment.

14. (a) A timber beam of 3 m span carries a uniformly distributed load of 5000 N/m over entire length and a point load 1000 N at the centre of the span. If the permissible stress be 100 N/mm^2 , find the section taking depth as twice the breadth.

Or

- (b) A vertical power transmission pole is 6 m high, square section $280 \text{ mm} \times 280 \text{ mm}$ at bottom and $140 \text{ mm} \times 140 \text{ mm}$ at top. A horizontal pull of 8 kN applied at the top of the pole through the centroid parallel to the sides of the section. Find the position and magnitude of maximum bending stress.
15. (a) Derive torsional formula.

Or

- (b) A solid shaft is subjected to a torque of 100 Nm. Find the necessary shaft diameter if the allowable shear stress is 100 N/mm^2 and the allowable twist is 3° per 10 diameter length of the shaft. Take $C = 1 \times 10^5 \text{ N/mm}^2$.