Register Number: ……..

B.E. DEGREE EXAMINATIONS: NOV / DEC 2010

Fifth Semester

MECHATRONICS ENGINEERING

U07MH501: Strength of Materials

Time: Three Hrs **Maximum Marks: 100**

Answer ALL the Questions:-

PART A (10 x 1 = 10 Marks)

1. The ratio of normal stress of each face of a solid cube to volumetric strain is called

   (a) Poisson's ratio (b) bulk modulus (c) modulus of rigidity (d) modulus of elasticity

2. Hook's law holds good up to

   (a) Proportional limit (b) yield point (c) elastic limit (d) Plastic limit

3. A cantilever of length (l) carries a point load (W) at the free end. The bending moment diagram will be a

   (a) Parabola with maximum ordinate at the centre of the beam

   (b) Parabola with maximum ordinate at the cantilever end

   (c) Triangle with maximum ordinate at the free end

   (d) Triangle with maximum ordinate at the cantilever end

4. The point of contra-flexure occurs only in

   (a) Continuous beams (b) Cantilevers beams

   (b) (c) Overhanging beams (d) Simply supported beams

5. The torsional rigidity of a shaft is defined as the torque required to produce

   (a) Maximum twist in the shaft (b) maximum Shear stress in the shaft

   (c) minimum twist in the shaft (d) a twist of one radian per unit length of the shaft.

6. When a closely coiled spring is subjected to an axial load, it is said to be under

   (a) Bending (b) shear (c) torsion (d) all of these

7. The maximum slope of a cantilever carrying a point load at its free end is at the

   (a) Fixed end (b) centre of span (c) free end (d) none of these

8. We can find the deflection of a beam carrying

   (a) Uniformly distributed load (b) central point load

   (c) gradually varying load (d) all of these

9. The design of a thin cylindrical shell is based on

   (a) Internal pressure (b) diameter of shell (c) longitudinal stress (d) all of these

10. If a member is subjected to an axial tensile load, the plane normal to the axis of loading carries

(a) Minimum normal stress (b) maximum normal stress

(c) maximum shear stress (d) none of the above.

PART B (10 x 2 = 20 Marks)

11. State Hooke's law
12. Define the terms (a) Lateral strain (b) Poisson's ratio
13. Write a note on (a) shear force diagram (b) bending moment diagram
14. What do you understand by the term flitched beam?
15. Write the assumptions for finding out the shear stress in a circular shaft, subjected to torsion.
16. Distinguish clearly between bending springs and torsion springs
17. A simply supported beam of a span 3 m is subjected to a central load of 10 kN. Find the maximum slope of the beam. Take I =$12 \times 10^6 mm^4$ and E = 200 GPa.
18. A simply supported beam of span 4 m is carrying a uniformly distributed load of 2 kN/m over the entire span. Find the maximum deflection of the beam. Take EI for the beam as 80×10^9 N-mm^2.
19. A steam boiler of 800 mm diameter is made up of thick plates. If the boiler is subjected to an internal pressure of 2.5 Mpa, find the circumferential stress induced in the boiler plates.
20. A spherical vessel of 2 m diameter is subjected to an internal pressure of 2 MPa. Find the minimum thickness of the plates required, if the maximum stress is not to exceed 100 MPa. Take efficiency of the joint as 80%.

PART C (5 x 14 = 70 Marks)

21. a) A compound tube consists of a steel tube 140 mm internal diameter and 160 mm external diameter and an outer brass tube 160 mm internal diameter and 180 mm external diameter. The two tubes are of the same length. The compound tube carries an axial load of 900 kN. Find the stresses and the load carried by each tube and the amount shortens. Length of each tube is 140 mm. Take E for steel as 2×10^5 N/mm^2 and for brass as 1×10^5 N/mm^2.

(OR)

b) A metallic bar 300 mm × 100 mm × 40 mm is subjected to a force of 5 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 × 10^5 N/mm^2 and Poisson's ratio = 0.25.

22. a) Draw the shear force and bending moment diagram for a simply supported beam of a length 9 m and carrying a uniformly distributed load of 10 kN/m for a distance of 6 m from the left end. Also calculate maximum B.M. on the section.

(OR)

b) A – T shaped cross section of a beam shown in **Fig.1.** is subjected to a vertical shear force of 100 kN. Calculate the shear stress at important points and draw the shear stress distribution diagram. Moment of inertia about the horizontal neutral axis is 113.4 × 10^6 mm^4.

23. a) A solid cylindrical shaft is to transmit 300 kw power at 100 r.p.m. (a) If the shear stress is not to exceed 80 N/mm^2, find its diameter. (b) What percent saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals to 0.6 of the external diameter, the length, the material and maximum shear stress being the same?

(OR)

b) A closely coiled helical spring of round steel wire 10 mm in diameter having 10 complete turns with a mean diameter of 12 cm is subjected to an axial load of 200 N. Determine : (i) the deflection of the spring (ii) Maximum shear stress in the wire (iii) stiffness of the spring. Take C= 8 ×10^4 N/mm^2.

24. a) A cantilever of length 3 m is carrying a point load of 50 kN at a distance of 2 m from the fixed end. If I =$10^8$$mm^4$ and E = 2 × 10^5 N/mm^2, find (i) slope at the free end (ii) deflection at the free end.

(OR)

b) A hollow mild steel tube 6 m long 4 cm internal diameter and 6 mm thick is used as a strut with both ends hinged. Find the crippling load and safe load taking factor of safety as 3. Take E = 2 ×10^5 N /mm^2.

25. a) A cylinder of internal diameter 0.50 m contains air at a pressure of 7 N/mm^2 (gauge). If the maximum permissible stress induced in the material is 80 N/mm^2, find the thickness of the cylinder.

(OR)

b) The principle tensile stresses at a point across two mutually perpendicular planes are 120 N/mm^2 and 60 N/mm^2. Determine the normal, tangential and resultant stress on a plane inclined at 30° to the axis of the minor principal stress. Using Mohr's circle method.

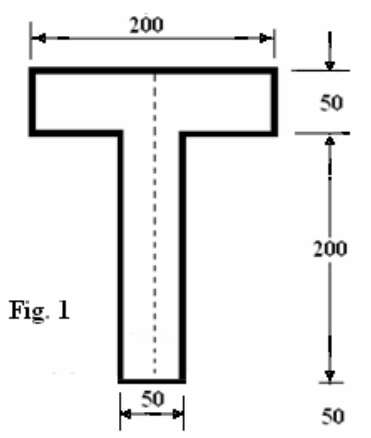

Fig. 1

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