B.Tech-4
SOM

STENGTH OF MATERIALS
Full Marks 70
Time 3 hours
Answer SIX questions including Q.No.1 which is compulsory
Figures in the right-hand margin indicate marks

1. (a) State Hook's law? (2*10)
(b) What are types of stress in a thin cylindrical vessel subjected to internal Pressure?
(c) Draw the stress strain diagram for mild steel and cast iron?
(d) What are principal planes?
(e) A circular shaft is subjected to a torque of 15kNm. The power transmitted by the shaft is 210.33kW. Find the speed of shaft in revolution per minute.
(f) A cantilever beam of span 4m is subjected to a uniformly distributed load of 2 kN/m over its entire length. Sketch the bending moment diagram for the beam.
(g) State the importance of Mohr's circle. The state of stress at a point is given by σ_x=40 *MPa*, σ_y=100 *MPa*, and τ_{xy}=40 *MPa*. What is the radius of the Mohr's circle representing the given state of stress in *MPa*.
(h) A beam subjected to a bending stress of 5N/mm^2 and the section modulus is 3530 cm^3. What is the moment of resistance of the beam?
(i) Why hollow circular shafts are preferred when compared to solid circular shafts?
(j) What are the assumptions made in the theory of torsion?

2 (a) Derive an expression for bending equation (6+4)

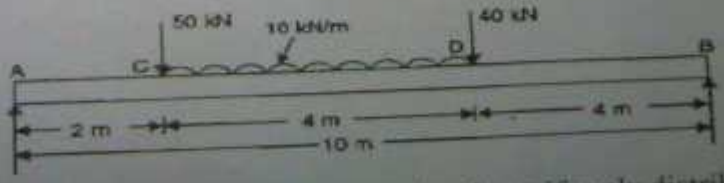
(b) A rectangular beam 300 mm deep is simply supported over the span of 4 m. Determine the uniformly distributed load per metre which the beam may carry, if the bending stress should not exceed 120N/mm^2. Take I=8×10^6 mm^4

3. (a) Derive relations for normal and shear stresses acting on an inclined plane at a point in a stained material subjected to two mutually perpendicular direct stresses. (6+4)

(b) A short metallic column of 500mm^2 cross sectional area carries a axial compressive load of 100kN.For a plane inclined at 60^0 with the direction of the load calculate i) Normal stress ii) Resultant stress iii) Tangential stress iv) Maximum shear stress

4. (a)A flitched timber beam consists of two joist 100 mm wide and 300 mm deep with a steel plate 200mm deep and 20 mm thick placed symmetrically in between and clamped to them. Calculate the total moment of resistance of the section if allowable stress in joint is 9MN/m^2. Given E_s= 20 E_w? (4+6)

(b)



A simply supported beam of length 10m carries the uniformly distributed load and two point loads as shown in the above Fig. Draw the S.F and B.M diagram for the beam and also calculate the maximum bending moment.

5. (a) A copper tube 47.5 mm inside diameter, 50mm outside diameter, is closely wound with steel wire of 0.7mm diameter. Find the winding tension on the tube if an internal pressure of 1.42 N/mm^2 is required before the copper is subjected to tension, the tube being free to expand or contract axially. E_s= 210,000 N/mm^2, E_c= 126,000 N/mm^2 (7+

(b) What is the importance of wire winding in thin cylinder? What are the assumptions made in the analysis wire winding in thin cylinder?

6. (a) A beam is simply supported at its ends over an 8m span is loaded with 40,80, and 120 kN at 2,4 and 6 m respectively from one end. The maximum stress is 90N/mm^2 and the beam is 300 mm deep. If E=203,000 N/mm^2 Find the maximum deflection and state where it occurs. (5+

(b) Three bars made of copper; zinc and aluminum are of equal length and have cross section 500, 700, and 1000 sq.mm respectively. They are rigidly connected at their ends. If this compound member is subjected to a longitudinal pull of 250 kN, estimate the proportional of the load carried on each rod and the induced stresses. Take the value of E for copper = 1.3×10^5 N/mm^2, for zinc = 1×10^5 N/mm^2 and for aluminum = 0.8×10^5 N/mm^2

7. (a) A close coiled helical spring has a stiffness of 5N/mm. its length when fully compressed With adjacent coils touching each other is 40 cm. the modulus of rigidity of the material of the spring is 8×10^4 N/mm^2. Determine the wire diameter and mean coil diameter if their ratio is 1/10. What is the corresponding maximum shear stress in the spring? (5-

(b) A steel shaft ABCD having a total length of 2400mm is contributed by three different sections as follows. The portion AB is hollow having outside and inside diameters 80mm and 50mm respectively, BC is solid and 80mm diameter. CD is also solid and 70mm in diameter. If the angle of twist is same for each section, determine the length of each portion and the total angle of twist. Maximum permissible shear stress is 50 MPa and shear modulus 0.82×10^5 MPa

8. (a) State the maximum shear stress theory and maximum distortion energy theory of failure. Which one is more conservative? (5

(b) A strut 3 meter long is 60mm in diameter. One end of the strut is fixed while its other end is hinged. Allowing a factor of safety of 3 find the safe compressive load. Using Euler's formula. Take E=2×10^5 N/mm^2.