Reg. No.												

Question Paper Code	12337

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

Fourth Semester

Mechanical Engineering

(Common to Mechanical and Automation Engineering)

20CEPC405 - STRENGTH OF MATERIALS

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	Define Poisson's Ratio.	*2,K1,CO1*
2.	Give the Relation between Modulus of Elasticity and Modulus of Rigidity.	*2,K1,CO1*
3.	What is Principal Stress?	*2,K1,CO2*
4.	Differentiate between Thin and Thick Shells.	*2,K2,CO2*
5.	Define Torsional Rigidity.	*2,K1,CO3*
6.	List the applications of Springs.	*2,K1,CO3*
7.	List the types of beams.	*2,K1,CO4*
8.	State the assumptions made in the theory of bending.	*2,K1,CO4*
9.	List the methods for determining slope and deflection of loaded beam.	*2,K1,CO5*
10.	What is the relationship between deflection and bending moment?	*2,K1,CO5*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a)	A mild steel bar 20 mm in diameter and 300 mm long is enclosed in a brass tube, whose outer diameter is 30 mm and inner diameter is 25 mm. The composite bar is subjected to an axial pull of 40 kN. Find the stresses developed in the bar and tube. Also find the extension produced. E_S = 200 GPa; E_B = 100 GPa;	*13,K2,CO1*
		OR	
	b)	In an experiment, a bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the values of the three moduli.	*13,K2,CO1*
12.	a)	An element in a stressed material has tensile stress of 500 N/mm^2 and a compressive stress of 350 N/mm^2 acting on two mutually perpendicular planes and equal shear stresses of 100 N/mm^2 on these planes. Find principal stresses and position of the principal planes. Find also maximum shearing stress.	*13,K3,CO2*
		OR	

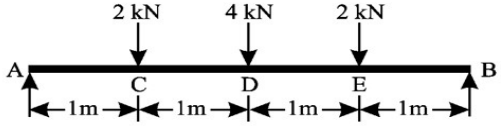
b) A cylindrical vessel whose ends are closed by means of rigid flange plates is made of 4 mm thick steel plate. The length and internal diameter of the vessel is 100 cm and 30 cm respectively. Determine the change in dimensions and change in volume of the shell if it is subjected to an internal fluid pressure of 2 N/mm^2. E = 200 GPa; μ = 0.3; *13,K3,CO2*

13. a) A solid shaft subjected to a torque of 45kN-m undergoes a twist of 0.5° per metre length. The maximum permissible shear stress in the shaft material is not to exceed 90 N/mm^2. Determine suitable diameter for the shaft. C = 80 GPa. *13,K3,CO3*

OR

b) A closely coiled helical spring of round steel wire 8mm in diameter having 10 complete turns with a mean diameter of 10 cm is subjected to an axial load of 250 N. Determine (i) Deflection; (ii) Maximum shear stress induced; (iii) Stiffness. C = 80 GPa. *13,K3,CO3*

14. a) Draw the S.F. and B.M. diagrams for simply supported beam loaded as shown in Figure. *13,K3,CO4*



OR

b) A rectangular beam 60 mm wide and 150 mm deep is simply supported over a span of 4 metres. If the beam is subjected to a uniformly distributed load of 4.5 kN/m, find the maximum bending stress induced in the beam. *13,K3,CO4*

15. a) A beam of uniform section, 14m long, is simply supported at the ends. It carries point loads of 90kN & 60kN at distances 3m & 4.5m respectively from the left end and right end respectively. Calculate the deflection under the loads. E = 210GPa & I = 64 x 10^{-4} m^4. *13,K3,CO5*

OR

b) A simply supported beam AB of span 5 metres is carrying a point load of 30kN at a distance 3.75 m from the left end A. Calculate the slopes at A and B and deflection under the load. Take EI = 26 × 10^{12} $N\text{-}mm^2$. *13,K3,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) A solid round bar 4m long and 6cm in diameter is used as a strut. Determine the crippling load if (i) Both ends are hinged; (ii) One end is fixed and other end is free; (iii) Both ends are fixed; E = 200GPa. *15,K3,CO6*

OR

b) Find the Rankine's crippling load for a hollow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3m and hinged at its both ends. Take: σ_c = 335 MN/m^2; a = 1/7500. *15, K3,CO6*