25 JAN 2023

Reg. No.

Question Paper Code	11677

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

Fourth Semester

Civil Engineering

(Common to Mechanical 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.	State Hooke's Law.	*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 Circumferential Stress and Longitudinal Stress.	*2,K2,CO2*
5.	State the assumptions made in deriving torsion equation.	*2,K1,CO3*
6.	List the applications of Springs.	*2,K1,CO3*
7.	Define Point of Contra flexure.	*2,K1,CO4*
8.	Differentiate between Centroidal Axis and Neutral Axis.	*2,K2,CO4*
9.	List the methods for determining slope and deflection of loaded beam.	*2,K1,CO5*
10.	State Mohr's Theorem.	*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)	A bar of diameter 30 mm was subjected to a tensile load of 54 kN and the extension measured on a gauge length of 300 mm was 0.112 mm. The change in diameter observed during the test was 0.00366 mm. Calculate Young's Modulus, Poisson's Ratio, Bulk Modulus and Rigidity Modulus.	*13,K2,CO1*
12.	a)	A piece of steel plate is subjected to perpendicular stresses 6 N/mm^2 (T) and 4 N/mm^2 (C). Calculate the normal, tangential and resultant stress on an oblique plane which is inclined at 30° with the axis of the second 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 45 kN-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 8 mm 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) A Cantilever Beam of length 4 m carries point loads of 1 kN, 2 kN, 3kN at 1m, 2m, 4m respectively from the fixed end. Draw the Shear Force and Bending Moment Diagrams. *13,K3,CO4*

OR

b) A rolled joist of I section has the dimensions as follows: Width of the flanges 100 mm and thickness 10 mm; Height of the hub 180 mm and thickness 5 mm. The beam carries a UDL of 20 kN/m over a span of 5m. Calculate the maximum stress induced in the beam. *13,K3,CO4*

15. a) A cantilever of length 3 m carries a point load of 60 kN at a distance of 2 m from the fixed end. If I = $10^{-4} m^4$ &E = 200 GPa, find the slope and deflection at the free end. *13,K3,CO5*

OR

b) A beam of uniform section, 14m long, is simply supported at the ends. It carries point loads of 90 kN & 60 kN 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*

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) Determine the crippling load for a T section of dimension 12 cm x 12 cm x 2cm and of length 6m when it is used as a strut with both of its ends hinged. E = 200 GPa. *15,K3,CO6*