Reg. No.												

Question Paper Code	12822

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

Fourth Semester

Mechanical Engineering

20CEPC405 - STRENGTH OF MATERIALS

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

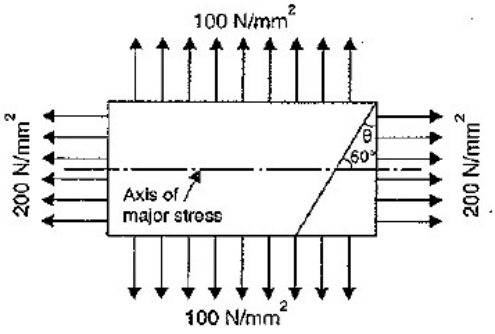
		Marks	K – Level	CO
1.	Define Shear Stress.	2	K1	CO1
2.	State Hooke's Law.	2	K1	CO1
3.	List down the stresses induced in thin cylindrical shell subjected to internal pressure.	2	K1	CO2
4.	Under what conditions, a cylinder is considered as a thick cylinder?	2	K2	CO2
5.	Write down the assumptions made in Torsion equation.	2	K1	CO3
6.	Mention the applications of helical springs.	2	K1	CO3
7.	Classify beams based upon its supports.	2	K1	CO4
8.	What do you understand by neutral axis & neutral plane? How do you locate Neutral axis?	2	K2	CO4
9.	Define Slenderness Ratio.	2	K1	CO6
10.	Define column.	2	K1	CO6

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

			Marks	K – Level	CO
11.	a)	A circular rod of diameter 16 mm and 500 mm long is subjected to a tensile force 40 kN. The modulus of elasticity for steel may be taken as 200 kN/mm^2. Find stress, strain, and elongation of the bar due to applied load.	13	K3	CO1
		OR			
	b)	A compound bar of length 600 mm consists of a strip of aluminum 40 mm wide and 20 mm thick and a strip of steel 60 mm wide × 15 mm thick rigidly joined at the ends. If elastic modulus of aluminum and steel are 1×10^5 N/mm^2 and 2×10^5 N/mm^2, determine the stresses developed in each material and the extension of the compound bar when axial tensile force of 60 kN acts.	13	K3	CO1

12. a) The stresses at a point in a bar are 200 N/mm^2 (tensile) and 100 N/mm^2(compressive) as shown in Figure. Calculate the stress in magnitude and direction on a plane inclined at 60º to the axis of the major stress. Also determine the maximum intensity of shear stress in the material at that point. Compare the solution of analytical method and Mohr's circle method. *13 K3 CO2*



OR

b) A closed cylindrical vessel made of steel plates 4 mm thick with plane ends, carries fluid under a pressure of 3 N/mm^2. The diameter of the cylinder is 25 cm and length is 75 cm. Take E = 105 N/mm^2 and μ = 0.286 .Compute the following *13 K3 CO2*

(i) Longitudinal stress in the cylinder wall.
(ii) Hoop stress in the cylinder wall.
(iii) Change in length.
(iv) Change in volume.

13. a) A hollow shaft is to transmit 200 kW at 80 r.p.m. If the shear stress is not to exceed 60 MPa and internal diameter is 0.6 of the external diameter, find the diameters of the shaft. *13 K3 CO3*

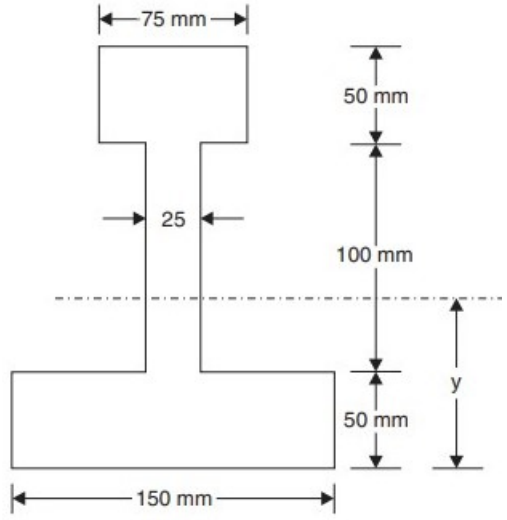
OR

b) A closely coiled helical spring of round steel wire 10mm in diameter having 10 complete turns with a mean diameter of 12 cm is subjected to an axial load of 250 N. Determine (i) Deflection; (ii) Maximum shear stress induced; (iii) Stiffness. Assume C = 80 GPa. *13 K3 CO3*

14. a) A Cantilever Beam of length 4 m carries point loads of 1 kN, 2kN, 3kN at 1m, 2m, and 4m respectively from the fixed end. Draw the Shear Force and Bending Moment Diagrams. *13 K3 CO4*

OR

b) The cross-section of a cast iron beam is as shown in Figure. The top flange is in compression and bottom flange is in tension. Permissible stress in tension is 30 N/mm^2 and its value in compression is 90 N/mm^2. What is the maximum uniformly distributed load the beam can carry over a simply supported span of 5 m? *13 K3 CO4*



15. a) A solid round bar 60 mm in diameter and 2.5 m long is used as a strut. One end of the strut is fixed, while its other end is hinged. Find the safe compressive load for this strut, using Euler's formula. Assume E = 200 GPa and factor of safety = 3. *13 K3 CO6*

OR

b) Determine the crippling loads for a bar of length 4 m with EI = 6.66 × 10^6 Nm^2, when it is used as a column with following end conditions:(i) Both ends pin-jointed;(ii) One end fixed and other end hinged;(iii) Both ends fixed. *13 K3 CO6*

PART - C (1× 15 = 15 Marks)

16. a) A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support. Using Macaulay's method, Determine: *15 K3 CO5*
(i) Deflection under each load,
(ii) Maximum deflection, and
(iii) The point at which maximum deflection occurs.
Take E = 2 x 10^5 N/mm^2 and I = 85 x 10^6 mm^4.

OR

b) A cantilever of length 2 m carries a point load of 30 kN at the free end. If I = $10^{-4}m^4$& E = 200 GPa, find the slope and deflection at the free end. *15 K3 CO5*