Reg. No.												

Question Paper Code	12088

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023

Fourth Semester

Civil Engineering

(Common to Mechanical Engineering, Mechanical and Automation Engineering & Production 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.	List any two factors that influence factor of safety.	2,K1,CO1
2.	Give the Relation between Young's Modulus and Shear Modulus.	2,K2,CO1
3.	Classify Pressure Vessels.	2,K2,CO2
4.	List the methods to increase the load carrying capacity of thin cylinders.	2,K1,CO2
5.	Hollow Shaft is better than Solid Shaft. Why?	2,K2,CO3
6.	Define Spring Stiffness.	2,K1,CO3
7.	State the sign convention for drawing bending moment diagram.	2,K2,CO4
8.	State the assumptions made in the theory of bending.	2,K2,CO4
9.	Define Column.	2,K1,CO5
10.	What is Crippling Load?	2,K1,CO5

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a)	A mild steel rod of 20 mm diameter and 300 mm long is enclosed centrally inside a hollow copper tube of external diameter 30 mm and internal diameter 25 mm. The ends of the rod and tube are brazed together, and the composite bar is subjected to an axial pull of 40 kN. If E for steel and copper is 200 GPa and 100 GPa respectively, find the stresses developed in the rod and the tube.	13,K3,CO1
		OR	
	b)	A gun metal rod 20 mm diameter, screwed at the ends, passes through a steel tube 25 mm and 30 mm internal and external diameters respectively. The nuts on the rod are screwed tightly home on the ends of the tube. Find the intensity of stress in each metal, when the	13,K3,CO1

common temperature rises by 200°F. Take Coefficient of expansion for steel = 6×10^{-6}/°F; Coefficient of expansion for gun metal = 10×10^{-6}/°F; Modulus of elasticity for steel = 200 GPa; Modulus of elasticity for gun metal = 100 GPa.

12. a) A thin spherical shell 1 m in diameter with its wall of 1·2 cm thickness is filled with a fluid at atmospheric pressure. What intensity of pressure will be developed in it if 175 cm^3 more of fluid is pumped into it? Also, calculate the circumferential stress at that pressure and the increase in diameter. E = 200 GPa and 1/m = 0.3 *13,K3,CO2*

OR

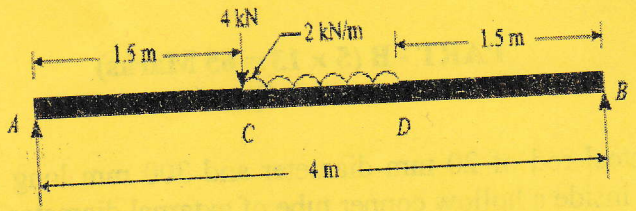
b) A cast iron pipe of 400 mm internal diameter and 100 mm thickness carries water under a pressure of 8 N/mm^2. Determine the maximum and minimum intensities of hoop stress across the section. *13,K3,CO2*

13. a) A hallow shaft with diameter ratio 3/8 is required to transmit 250 kW at 500 rpm. The maximum torque is likely to exceed the mean torque by 25 %. The maximum permissible shear stress in the shaft material is not to exceed 50 N/mm^2 and the angle of twist is not to exceed 1° in a length of 2 m. Determine the diameter of the shaft. C = 80 GPa. *13,K3,CO3*

OR

b) A close coiled helical spring has a stiffness of 10 N/mm. Its length when compressed with adjacent coils touching each other is 400 mm.
(i) If the spring index is 10, find the wire diameter and mean coil diameter. *6,K3,CO3*
(ii) If gap between two adjacent coils is 2 mm find the maximum load that can be applied and the maximum shear stress induced. C = 80 GPa. *7,K3,CO3*

14. a) Draw the shear force and bending diagrams for the beam shown in the below 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 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. *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 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. *15,K3,CO6*

OR

b) A 1·5 m long C.I. column has a circular cross-section of 5 cm diameter. One end of the column is fixed in direction and position and the other is free. Taking factor of safety as 3, calculate the safe load, using Rankine-Gordon formula; Take: σ_c = 560 MN/m^2; a = 1/1600. *15,K3,CO6*