Reg. No.																

Question Paper Code	13961

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Fourth Semester

Mechanical Engineering

(Common to Mechanical and Automation Engineering)

20CEPC405 - STRENGTH OF MATERIALS

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	The ability of a material to deform without breaking is called (a) Elasticity (b) Plasticity (c) Creep (d) None of these	1	K1	CO1
2.	Relation amongst Young's modulus, Poisson's ratio and Bulk modulus is given by (a) $E = 3K(1 - 2\mu)$ (b) $E = 3K / (1 - 2\mu)$ (c) $E = 2K(1 + \mu)$ (d) none of these	1	K1	CO1
3.	In a thick cylinder, the radial stress at the inner surface is (a) Less than the magnitude of the internal fluid pressure (b) Equal the magnitude of the internal fluid pressure (c) Greater than the magnitude of the internal fluid pressure (d) Independent of the magnitude of the internal fluid pressure	1	K1	CO2
4.	A cylindrical steel pressure vessel 400 mm in diameter with a wall thickness of 20 mm is subjected to an internal pressure of 4.5 MPa. The circumferential stresses in the steel vessel is (a) 22.5 MPa (b) 45 MPa (c) 90 MPa (d) 180 MPa	1	K2	CO2
5.	In a close coiled springs, other quantities remaining same if the wire diameter is doubled, then the stiffness of spring compared to original one will become (a) Twice (b) Four Times (c) Eight Times (d) Sixteen Times	1	K2	CO3
6.	The angle of twist is ..... proportional to the twisting moment. (a) directly (b) inversely (c) either (a) or (b) (d) none of the above	1	K1	CO3
7.	When the bending moment is parabolic curve between two points, it indicates that there is (a) No loading between the two points (b) Point loads between the two points (c) U.D.L. between the two points (d) Uniformly varying load between the two points	1	K1	CO4
8.	Which of the following are the statically indeterminate beams? (a) Fixed beams (b) Continuous beams (c) Both (a) and (b) (d) none of the above.	1	K1	CO4
9.	A simply supported beam of span L is carrying point load W at the mid span. What is the deflection at the centre of the beam? (a) $wL^2 / 48EI$ (b) $wL^3 / 48EI$ (c) $5wL^3 / 384EI$ (d) $11wL^3 / 120EI$	1	K1	CO5
10.	The ratio of equivalent length of the column to the minimum radius of gyration is called (a) Poisson's ratio (b) buckling factor (c) factor of safety (d) none of the above	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	Draw Stress-Strain Curve for ductile material.	2	K2	CO1
12.	Define Poisson's Ratio.	2	K1	CO1
13.	Classify Pressure Vessels.	2	K1	CO2
14.	State the Assumptions made in Lame's Theorem.	2	K1	CO2
15.	Define Torsional Rigidity.	2	K1	CO3
16.	Distinguish between Open Coil Helical Spring and Close Coil Helical Spring.	2	K2	CO3

17.	Define Point of Contraflexure.	2	K1	CO4
18.	State the assumptions made in the theory of bending.	2	K1	CO4
19.	Write the expression for maximum deflection of a simply supported beam carrying a uniformly distributed load over the entire span.	2	K1	CO5
20.	List the methods for determining slope and deflection of loaded beam.	2	K1	CO5
21.	What is Crippling Load?	2	K1	CO6
22.	List the types of end conditions used in the design of columns.	2	K1	CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	A 20 cm long steel tube having 100 mm internal diameter and 10 mm thickness is surrounded closely by a brass tube of same length and same thickness of 10 mm. They carry an axial thrust of 100 kN. Calculate the stresses developed in each tube. E_S = 200 GPa E_B = 100 GPa.	11	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.	11	K2	CO1
24.	a)	Two mutually perpendicular planes of an element of material are subjected to direct stresses of 10.5 N/mm^2 (T) and 3.5 N/mm^2 (C) and shear stress of 7 N/mm^2. Calculate the magnitude of principal stress.	11	K3	CO2
		OR			
	b)	A cylindrical shell 3m long and 100 cm internal diameter having thickness 12mm is subjected to an internal fluid pressure of 1.5 N/mm^2. Determine the stresses induced and corresponding changes in dimension and volume of the shell. Take Young's modulus as 200GPa and poisson's ratio as 0.3.	11	K3	CO2
25.	a)	A solid circular shaft transmits 75 kW power at 200 r.p.m. Calculate the shaft diameter, if the twist in the shaft is not to exceed 1° in 2 metres length of shaft, and shear stress is limited to 50 N/mm^2. Take C = 100 GPa.	11	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 250N. Determine (i) Deflection (ii) Maximum shear stress induced (iii) Stiffness. Assume C = 80 GPa.	11	K3	CO3
26.	a)	Draw the S.F. and B.M. diagrams for simply supported beam loaded as shown in Figure 1.	11	K3	CO4

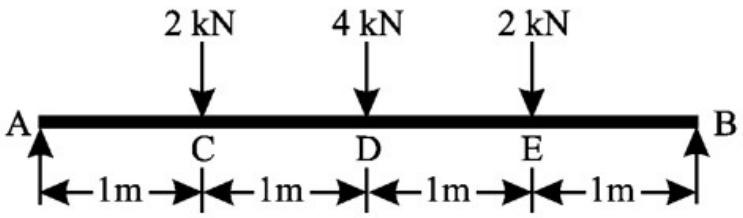

Figure 1

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, calculate the magnitude of maximum bending stress induced in the beam.	11	K3	CO4

27. a) A simply supported beam of span 4 m is carrying a uniformly distributed load of 2 kN/m over the entire span. Determine the maximum deflection of the beam. Take EI for the beam as 80×10^9 N-mm^2. *11 K3 CO5*

OR

b) 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. *11 K3 CO5*

28. a) A hollow alloy tube 4 m long with external and internal diameters of 40 mm and 25 mm respectively was found to extend 4.8 mm under a tensile load of 60 kN. Determine the buckling load for the tube with both ends pinned. Also find the safe load on the tube, taking a factor of safety as 5. *11 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. *11 K3 CO6*