Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (R) (FT/WP) Examination November 2025 (2024 Scheme)

Course Code: PCMET302

Course Name: MECHANICS OF SOLIDS

Max. Marks: 60 Duration: 2 hours 30 minutes

PART A

	(Answer all questions. Each question carries 3 marks)	CO	Marks
1	What is Factor of Safety and explain its importance in design.	CO1	(3)
2	Distinguish between linear and lateral strain.	CO1	(3)
3	What do you mean by shear force and bending moment?	CO2	(3)
4	Define the term torsional rigidity and mention its significance.	CO2	(3)
5	List out the assumptions made in Flexural formula?	CO3	(3)
6	What is pure bending? Explain with example.	CO3	(3)
7	Write short notes on principal planes and principal stress.	CO4	(3)
8	Differentiate between long columns and short columns.	CO4	(3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module -1

9	A steel rod of 20 mm diameter is enclosed in a copper tube of 40 mm external diameter and 25 mm internal diameter. The tube is enclosed at each end by rigid plates of negligible thickness. If the assembly is subjected to an axial load of 50 kN, find the stress developed in each material. Take the elastic modulus of copper and steel as 1.2×10^5 N/mm^2 and 2×10^5 N/mm^2.	CO1	(9)

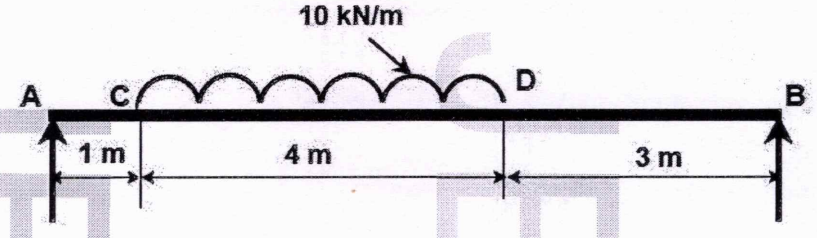
10 A bar of brass 20 mm is enclosed in a steel tube of 40 mm external diameter and 20 mm internal diameter. The bar and the tubes are initially 1.2 m long and are rigidly fastened at both ends using 20 mm diameter pins. If the temperature is raised by 60°C, find the stresses induced in the bar and the tube. Given: $E_s = 2 \times 10^5$ N/mm^2, $E_b = 1 \times 10^5$ N/mm^2, $\alpha_s = 11.6 \times 10^{-6}$/°C, $\alpha_b = 18.7 \times 10^{-6}$/°C. CO1 (9)

Module -2

11 a) Write down the assumptions in the theory of pure torsion. (3)

b) Derive the torsion formula for a prismatic shaft with circular cross section CO2 (6)

12 Draw the shear force and bending moment diagram for a simply supported beam of length 8 m and carrying a uniformly distributed load of 10 kN/m for a distance of 4 m as shown in figure. (9)



CO2

Module -3

13 a) A cantilever beam is 3 m long and carries a point load of 20 kN at a distance of 2 m from the fixed end. Determine the slope and deflection at the free end of the cantilever. Take EI = 8 x 10^{12} N-mm^2. CO3 (4)

b) A rectangular beam 300 mm deep is simply supported over a span of 4 metres. What uniformly distributed load the beam may carry, if the bending stress is not to exceed 120 MPa. Take I = 225 x 10^6 mm^4. CO3 (5)

14 A horizontal beam of uniform section and 6 m long is simply supported at its ends. Two vertical concentrated loads of 48 kN and 40 kN act at 1 m and 3 m respectively from the left hand support. Use Macaulay's method to determine the deflection under each load, if E = 2 x10^5 N/mm^2 and I = CO3 (9)

85×10^6 mm^4.

Module -4

15	Find the Euler'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 2.3 m and hinged at its both ends. Take E = 205 GPa. Also determine crippling load by Rankine's formula using constants as 335 MPa and 1/7500.	CO4	(9)
16	The state of stress at a point in a strained material is as shown in Fig. 1 Determine (i)the direction of principal planes (ii)the magnitude of principal stresses (iii)the magnitude of maximum shear stress and (iv) the plane of maximum shear stress.	CO4	(9)

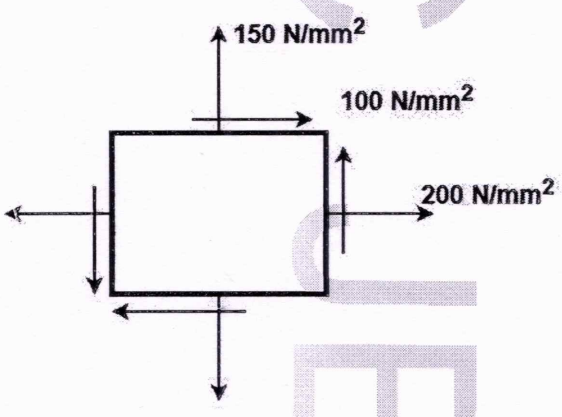


Fig 1

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