Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

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

Course Code: PCMRT303

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	Find the Young's modulus of a brass rod of diameter 25 mm and of length 250mm which is subjected to a tensile load of 50 kN when the extension of the rod is equal to 0.3 mm.	1	(3)
2	Explain the stress-strain curve for an elastic material.	1	(3)
3	Derive the expression for strain energy stored in a body when the load is applied suddenly.	2	(3)
4	Define the terms resilience, proof resilience and modulus of resilience.	2	(3)
5	Define (i) Polar modulus (ii) Strength of a shaft (iii) Torsional rigidity	3	(3)
6	What are the sign conventions for shear force and bending moment in general?	3	(3)
7	A cantilever of length 3m is carrying a point load of 25kN at the free end. If the moment of inertia of the beam is 10^8 mm^4 and the value of $E = 2 \times 10^5\ N/mm^2$, find i) Slope of the cantilever at the free end. ii) Deflection at the free end.	4	(3)
8	Explain the importance of section modulus and flexural rigidity in the analysis of a beam.	4	(3)

PART B

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

Module -1

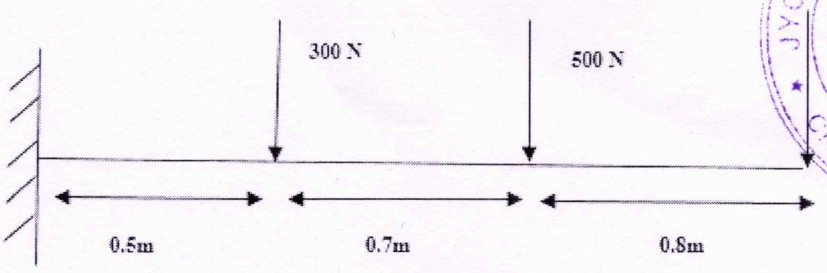
9		A steel tube of 30mm external diameter and 20mm internal diameter encloses a copper rod of l5mm diameter to which it is rigidly joined at each end. If at a temperature of 10"C, there is no stress, calculate the stresses in the rod and the tube when the temperature is raised to 200oC. E_{steel} = 2.1×10^5 N/mm^2 and $E_{copper} = 1 \times 10^5$ N/mm^2, $\propto_{steel} = 1 \times 10^5$ /^{0}C and $\propto_{copper} = 18 \times 10^{-6}$ /^{0}C.	1	9
10		Calculate the modulus of rigidity and bulk modulus of a cylindrical bar of diameter 30mm and of length 1.5m if the longitudinal strain in a bar during a tensile stress is four times the lateral strain. Find the change in volume, when the bar is subjected to a hydrostatic pressure of 100 N/mm^2. Take $E_{steel} = 1 \times 10^5$ N/mm^2	1	9

Module -2

11		A point in a body is subjected to the following stresses $\sigma_{xx} = 80\ N/mm^2$ (T), $\sigma_{yy} = 40\ N/mm^2$ (C) and $\tau_{xy} = 60\ N/mm^2$. Shear stress on a plane inclined at 30^0 with the direction of the minor normal stress. Draw the Mohr's circle and determine the principal stresses and the inclination of principal planes, maximum shear stress and inclination of maximum shear stress planes.	2	9
12	a)	A tension bar 5m long is made up of two parts, 3m of its length has a cross-sectional area of 10cm^2 while the remaining 2m has a cross-sectional area of 20cm^2. An axial load of 80 kN is gradually applied. Find the total strain energy produced in the bar and compare this value with that obtained in a uniform bar of the same length and having the same volume when under the same load. Take $E = 2 \times 10^5\ N/mm^2$	2	9

Module -3

13		Draw SFD and BMD of a cantilever beam carrying loads as shown in the figure:	3	9



14	A hollow shaft, having an internal diameter 40% of its external diameter, transmits 562.5 kW power at 100 rpm. Determine the external diameter of the shaft if the shear stress is not to exceed 60 N/mm^2 and the twist in a length of 2.5m should not exceed 1.3^0. Assume maximum torque=1.25 mean torque and modulus of rigidity=$9 \times 10^4\ N/mm^2$	3	9

Module -4

15	A beam of length 6m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of lm and 3m respectively from the left support. Find: 1. Deflection under each load. 2. Maximum deflection 3. The point at which maximum deflection occurs. Given $E = 2 \times 10^5\ N/mm^2$and $I = 85 \times 10^6\ mm^4$	4	9
16	Discuss and compare any three theories of failures	4	9

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