

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S3 (S) Examinations May 2026 (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 minimum diameter of a steel wire, which is used to raise a load of 4000 N if the stress in the rod is not to exceed 95 MN/mm^2	1	(3)
2	Explain Tensile stress, compressive stress and shear stress	1	(3)
3	Explain principal stress and principal planes	2	(3)
4	Derive the expression for stress and strain energy stored in a body when the load is applied with impact.	2	(3)
5	Explain the assumptions of shear stress produced in a circular shaft subjected to torsion.	3	(3)
6	In a hollow circular shaft of outer and inner diameters of 20cm and 10cm respectively, the shear stress is not to exceed 40 N/mm^2 . Find the maximum torque which the shaft can safely transmit.	3	(3)
7	Explain any two theories of failures.	5	(3)
8	A steel wire of 6 mm diameter is bent into a circular shape of 6 m radius. Determine the maximum stress induced in the wire. Take $E=0.2 \text{ MN/mm}^2$.	3	(3)

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

Module -1

- 9 a) A steel tube of 30mm external diameter and 20mm internal diameter encloses a copper rod of 15mm 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 200°C . $E_{steel} = 2.1 \times 10^5 \text{ N/mm}^2$ and $E_{copper} = 1 \times 10^5 \text{ N/mm}^2$, $\alpha_{copper} = 11 \times 10^{-6}/^{\circ}\text{C}$ and $\alpha_{steel} = 18 \times 10^{-6}/^{\circ}\text{C}$ 1 9

- 10 A compound tube consists of a steel tube 140mm internal diameter and 160mm external diameter and an outer brass tube 160mm internal diameter and 180mm external diameter. The two tubes are of the same length. The compound tube carries an axial load of 900kN. Find the stresses and the load carried by each tube and the amount it shortens. Length of each tube is 140mm. Take E for steel as $2 \times 10^5 \text{ N/mm}^2$ and for brass as $1 \times 10^5 \text{ N/mm}^2$ 1 9

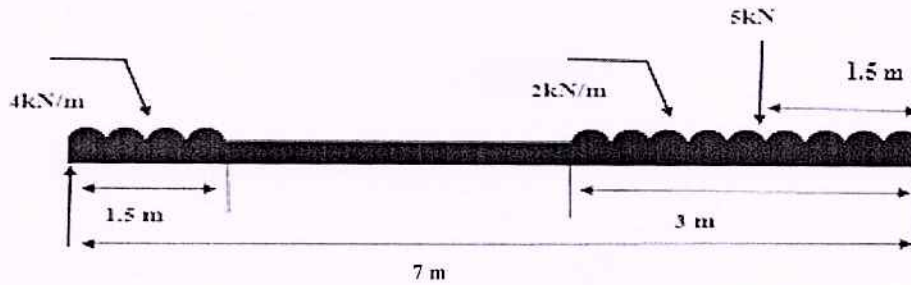
Module -2

- 11 The principal tensile stresses at a point across two mutually perpendicular planes are 100 N/mm^2 and 50 N/mm^2 . Determine the normal, tangential, and resultant stresses on a plane inclined at 30° to the axis of the minor principal stress. 2 9

- 12 a) A cylindrical pipe of diameter 2 m and thickness 20 mm is subjected to an internal pressure of 1.5 N/mm^2 . Determine the hoop stress and longitudinal stress developed in the pipe. 2 4
- b) Derive an expression for strain energy when load is gradually applied. 2 5

Module -3

- 13 Draw the SF and BM diagrams of a simply supported beam of length 7m carrying uniformly distributed loads as shown in fig: 3 9



- 14 Determine the diameters of a hollow steel shaft of diameter ratio 0.6 which will transmit 30 kW at 1600 rpm. Also find the length of the shaft if the twist must not exceed 1° over the entire length. The maximum shear stress is limited to 60 N/mm^2 . Take the modulus of rigidity: $8 \times 10^4 \text{ N/mm}^2$. 3 9

Module -4

- 15 A beam of length 7m simply supported at the ends A and B is loaded with two point loads of 60kN and 70kN at a distance of 1.2m and 4m from the left end. Determine the position and magnitude of maximum deflection. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and $I = 8500 \text{ mm}^4$ 4 9

Determine the diameter of the bolt which is subjected to an axial pull of 9 kN together with a transverse shear force of 4.5 kN using

- 16 i) Maximum principal stress theory 5 9
ii) Maximum principal strain theory

Given the elastic limit in tension= 225 N/mm^2 , factor of safety=3, and Poisson's ratio=0.3.
