



Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S3 (S) Examinations (FT/WP) May 2026 (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 | State and explain Hooke's law. | CO1 | (3) |
| 2 | Define Modulus of elasticity and Modulus of rigidity | CO1 | (3) |
| 3 | List the assumptions made in torsion equation. | CO2 | (3) |
| 4 | What do you mean by point of inflection and point of contraflexure in a beam? | CO2 | (3) |
| 5 | Explain the term flexural rigidity and its importance. | CO3 | (3) |
| 6 | Discuss Macaulay's method with suitable expressions. | CO3 | (3) |
| 7 | What do you mean by equivalent length of a column? Write the expression of equivalent length for both end fixed column. | CO4 | (3) |
| 8 | What are the limitations of Euler's column theory? | CO4 | (3) |

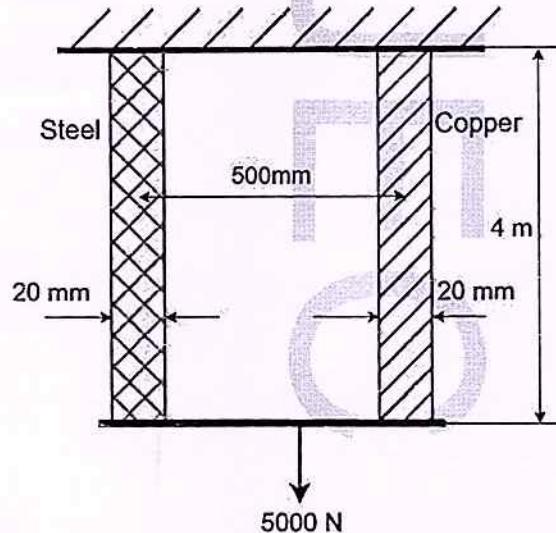
PART B

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

Module -1

| | | | |
|---|---|-----|-----|
| 9 | Two vertical rods one of steel and the other of copper are each rigidly fixed at the top and 500 mm apart. Diameters and lengths of each rod are 20 mm and 4 m respectively. A cross bar fixed to the rods at the lower end carries a | CO1 | (9) |
|---|---|-----|-----|

load of 5000 N such that the cross bar remains horizontal even after loading. Find the stress, and load in each rod and the position of the load on the cross bar. Take E for steel = $2 \times 10^5 \text{ N/mm}^2$ and E for copper = $1 \times 10^5 \text{ N/mm}^2$.

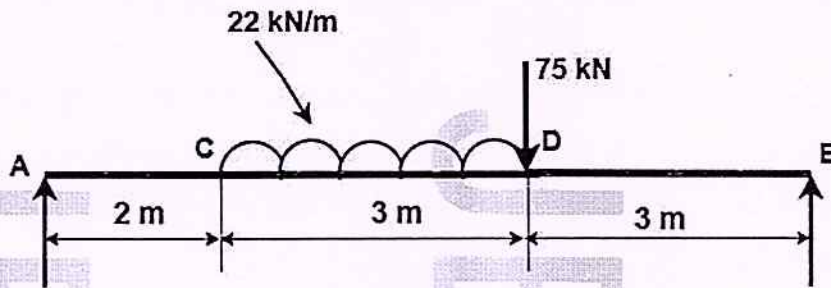


- 10 A gun metal rod 20 mm diameter, screwed at the ends, passes through a steel tube 25 mm and 30 mm in internal and external diameters, respectively. The nuts on the rod are screwed tightly home on the ends of the tube. Find the intensity of stress in each metal, when the common temperature rises by 200°C . Take Coefficient of expansion for steel = $6 \times 10^{-6}/^\circ\text{C}$, Coefficient of expansion for gun metal = $10 \times 10^{-6}/^\circ\text{C}$, Modulus of elasticity for steel = 200 GPa, Modulus of elasticity for gun metal = 100 GPa. CO1 (9)

Module -2

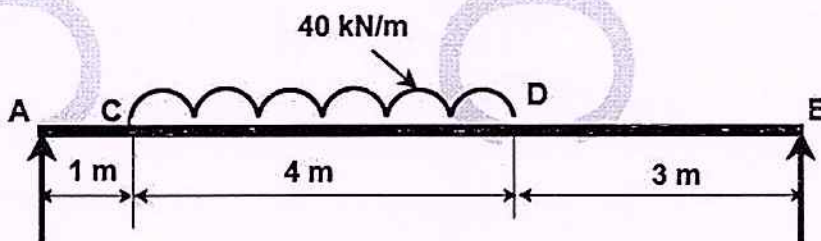
- 11 A solid shaft has 200 mm diameter and has the same cross-sectional area as that of a hollow shaft of the same material with inside diameter of 150 mm. Find the ratio of (a) powers transmitted by both the shafts at the same angular velocity. (b) angles of twist in equal lengths of these shafts, when stressed to the same intensity. CO2 (9)
- 12 Draw the shear force and bending moment diagram for the simply supported beam of span 8 m and carrying a uniformly distributed load and CO2 (9)

a concentrated load as shown in the figure.



Module -3

- 13 a) What are the assumptions made in bending equation? CO3 (4)
- b) A circular steel pipe of external diameter 60 mm and thickness 8 mm is used as a simply supported beam over an effective span of 2 m. If permissible stress in steel is 150 N/mm^2 , determine the maximum concentrated load that can be carried by it at mid span. CO3 (5)
- 14 A beam of length 8 m is simply supported at its ends. It carries a uniformly distributed load of 40 kN/m as shown in figure. Determine the deflection of the beam at its mid point and also the maximum deflection. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and $I = 4.3 \times 10^8 \text{ mm}^4$. CO3



Module - 4

- 15 a) Derive Euler's buckling load for a slender column with both ends hinged. CO4 (4)
- b) A hollow cylindrical cast iron column, 200 mm outer diameter and 150 mm inside diameter, 4 m long, has both ends fixed. It is subjected to an axial

compressive load. Taking the factor of safety as 6, crushing stress = 500 CO4 (5)
 N/mm², Rankine's constant $\frac{1}{1600}$. Determine Rankine's safe load

- 16 A point in a strained material is subjected to stresses as shown in the given CO4 (9)
 figure. Using Mohr's circle determine the normal stress, tangential stress
 and resultant stress on the oblique plane. Also find principal stresses, and
 maximum shear stress.

