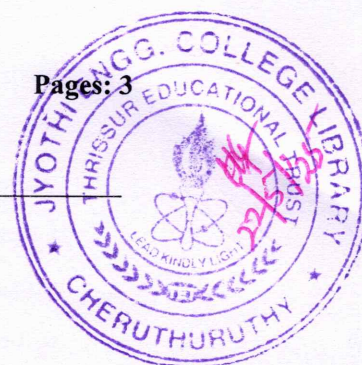


Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY****B.Tech Degree S2 (R) Examination May 2025 (2024 Scheme)****Course Code: PCCET205****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	Define Factor of Safety. Calculate the working load on a cantilever beam if it carries an ultimate load of 200 kN with a factor of safety of 2.	CO1	(3)
2	Define Poisson's ratio. Write the relationship between bulk modulus of elasticity and Young's modulus of elasticity	CO1	(3)
3	Write the relationship between rate of loading, shear force and bending moment.	CO1	(3)
4	Draw shear force and bending moment diagram for a simply supported beam of span L carrying central concentrated load of W kN	CO3	(3)
5	Write the equation of simple bending and state each term involved in it.	CO1	(3)
6	Explain the concept of beams of uniform strength and provide an example.	CO2	(3)
7	Define the terms: Principal stress and principal planes.	CO5	(3)
8	Define Kern of section and describe its importance.	CO2	(3)

**PART B***(Answer any one full question from each module, each question carries 9 marks)***Module -1**

- |    |    |   |     |     |
|----|----|---|-----|-----|
| 9  | a) | Derive an expression to determine the elongation of a uniformly tapering circular section under axial loading   | CO2 | (5) |
|    | b) | An axial pull of 20 kN is suddenly applied on a steel rod 2.5 m long and 1000 mm <sup>2</sup> in cross-section. Calculate the strain energy, which can be absorbed in the rod. Take E = 200 GPa   | CO3 | (4) |
| 10 | a) | A gun metal rod 20 mm diameter, screwed at the ends, passes through a steel tube 25 mm and 30 mm internal and external diameters respectively. The nuts on the rod are screwed tightly home on the ends of the tube. Find the intensity | CO3 | (9) |



of stress in each metal, when the common temperature rises by  $200^{\circ}\text{C}$ . 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

### Module -2

- 11 a) Analyse the overhanging beam shown in fig:1. Draw the shear force diagram and bending moment diagram showing all salient points including point of contraflexure. CO3 9

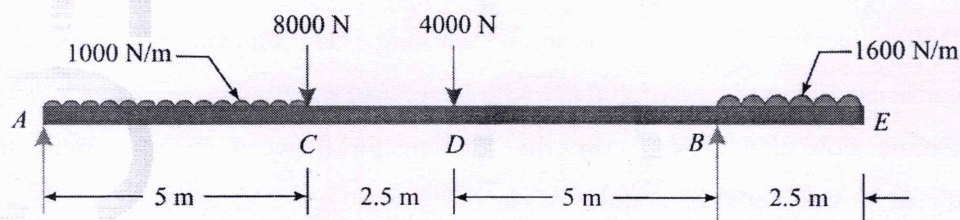


Fig:1

- 12 a) A 10 m long simply supported beam carries two point loads of 10 kN and 6kN at 2m and 9m respectively from the left end. It also has a uniformly distributed load of 4kN/m run for the length between 4m and 7m from the left end. Draw shear force and bending moment diagrams. State the position and amount of maximum bending moment CO3 9

### Module -3

- 13 a) A simply supported timber beam of 4.5 m span carries a UDL of 8 kN/m and two point loads of 10 kN each at 1.5 m and 3 m respectively from right end. If the depth of beam is twice the width, design the section of beam for flexure and shear. Permissible stresses are  $10\text{N/mm}^2$  in flexure and  $1\text{N/mm}^2$  in shear. Neglect self-weight of the beam. CO6 9
- 14 a) Determine the strain energy of a cantilever beam of span 2 m having size 20 mm width X 60 mm depth, take  $E = 200\text{ GPa}$  CO3 9
- When 1000 N concentrated load is placed at free end.
  - When total 1000 N load is distributed uniformly over the entire length.

### Module -4

- 15 a) In a material subjected to strain, the resultant stress across a certain plane is CO5 7



$60\text{N/mm}^2$  tensile, inclined at  $30^\circ$  to its normal inducing clockwise shear on the plane. The normal stress across the plane at right angles to this one is  $40\text{N/mm}^2$  tensile. Find the magnitude of maximum shear stress and magnitude of principal stresses and locate their planes.

- |    |    |  |     |   |
|----|----|--|-----|---|
|    | b) | Define slenderness ratio of a column. List any 2 limitations for Euler's buckling theory   | CO1 | 2 |
| 16 | a) | A steel rod 5 m long and of 40 mm diameter is used as a column, with one end fixed and the other free. Determine the Young's modulus of the material of the column if the crippling load by Euler's formula is 2.476 kN. | CO4 | 4 |
|    | b) | Find the angle of twist per metre length of a hollow shaft of 10 cm external and 6 cm internal diameter, if the shear stress is not to exceed 35 MPa. Take $G = 85\text{ GPa}$ .   | CO6 | 5 |

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