Sub Code: R2321032 **Set No. 1**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURAJADA VIZINAGARAM
II B. Tech I Semester Regular/Supply Examinations, November – 2025
Mechanics of Solids
(ME)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part A, Part B.
Part A is compulsory, Answer all questions.
In Part B, Answer any one question from each unit.
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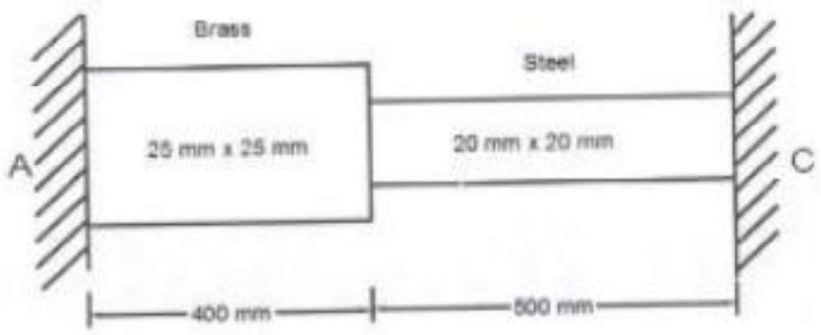
PART-A **(20 Marks)**

1	a)	Define elasticity and Plasticity. Give some examples for elastic and plastic materials	[2]
	b)	What is meant by composite bar. Draw a neat sketch of composite bar	[2]
	c)	Why is the bending moment zero at the free end of a cantilever beam?	[2]
	d)	Mention the significance of bending moment diagram (B.M.D.)?	[2]
	e)	Define neutral axis and section modulus.	[2]
	f)	What is shear stress in a beam?	[2]
	g)	List out the assumptions are made in the theory of pure torsion?	[2]
	h)	Why is the allowable deflection is considered in structural design?	[2]
	i)	State the difference between a column and a strut?	[2]
	j)	What is the difference between a thin cylinder and a thin spherical shell?	[2]

PART-B **(50 Marks)**

Unit-1

2 A bar made of brass and steel as shown in figure is held between two rigid supports A and C. Find the stress in each material if the temperature rises by 40^0C. Take $E_b=1x10^5 N/mm^2$, $\alpha_b = 19x10^{-6}/^0C$, $Es = 2x10^5$ N/, $\alpha_s = 12x10^{-6}$ / ^{0}C. [10]



(OR)

3	a)	A cylindrical bar is 20mm diameter and 800mm long. During a tensile test it is found that the longitudinal strain is 4 times the lateral strain. Calculate the modulus of rigidity and bulk modulus, if its elastic modulus is 1x105 N/mm^2. Find the change in volume, when the bar is subjected to hydrostatic pressure of $100N/mm^2$.	[5]
	b)	Derive the relationship between the young's modulus of elasticity and Shear modulus of elasticity	[5]

Unit-2

4 Derive the expressions for the shear force and bending moment for the cantilever beam experienced by the uniformly varying load from 0 at fixed end to the W at the free end of length L. Also draw the shear force and bending diagram [10]

(OR)

5 A simply supported beam of span 5 m carries two-point loads of 5kN and 7 kN at 1.5 m and 3.5 m from the left-hand support respectively. Draw S.F.D. and B.M.D. showing important values. [10]

Unit-3

6 A cantilever of length 3m carries a point load of 3KN at the free end. The cross section of cantilever is an unequal of dimensions 150X50X15 mm^3. The small leg of angle 50 mm is horizontal. The load passes through the centroid of the cross section. Determine a) position of neutral axis b) the magnitude of maximum stress setup at the fixed section of the cantilever [10]

(OR)

7 Derive the equation for shear stress distribution in a beam of rectangular cross-section. [10]

Unit-4

8 A beam is simply supported at its ends over a span of 10 m and carries two concentrated loads of 100 kN and 60 kN at a distance of 2 m and 5 m respectively from the left support. Calculate (i) slope at the left support (ii) slope and deflection under the 100 kN loads. Assume EI = 36 x 10^4 kN-m^2. [10]

(OR)

9 Derive the torsion equation [10]

$$\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{L}$$

Unit-5

10 A steel cylinder of 300 mm external diameter is to be shrunk to another steel cylinder of 150 mm internal diameter. After shrinking, the diameter at the junction is 250 mm and radial pressure at the common junction is 28 N/mm^2. Find the original difference in radii at the junction. Take E = 2 x 10 5 N/mm^2. [10]

(OR)

11 Derive Euler's formula for a column with both ends fixed. [10]