Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–I&II EXAMINATION – SUMMER 2025

Subject Code:BE01000091 Date:09-06-2025

Subject Name:Mechanics of Solids

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define: (i) Rigid body, (ii) deformable body, (iii) Elastic body.	**03**
	(b)	State and explain parallelogram law of forces.	**04**
	(c)	**Find resultant force in magnitude and direction if a particle is acted upon by following forces.** 1. 20 N inclined at 30 north of east. 2. 25 N towards north 3. 30 N towards north-west 4. 35 N inclined at 40 to south of west 5. 24 N inclined at 30 to east of south.	**07**
Q.2	**(a)**	State and explain Varignon's theorem.	**03**
	(b)	Explain various types of load, beams and their support system.	**04**
	(c)	The beam AB of span 12 m shown in Fig. 1 is hinged at A and is on rollers at B. Determine the reactions at A and B for the loading shown in the Fig.	**07**

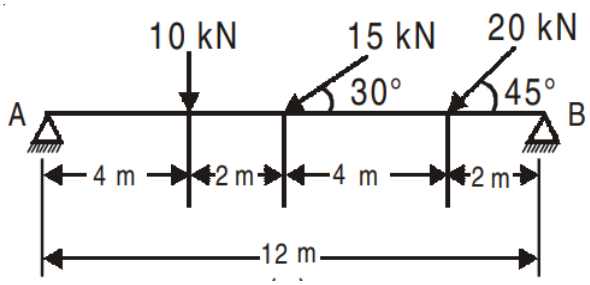

Fig. 1

OR

	(c)	Draw shear force and bending moment diagram for the cantilever beam shown in Fig. 2	**07**

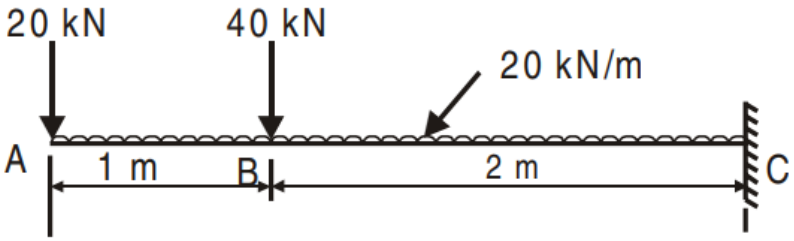

Fig. 2

Q.3	**(a)**	A cantilever of length 2 meters fails when a load of 2 kN is applied at the free end. If the section of the beam is 40 mm×60 mm, find the stress at the failure.	**03**
	(b)	Derive using first principle the equation for calculation of maximum shear stress at a section for a beam with rectangular cross section.	**04**

(c) A wooden beam 100 mm wide and 150 mm deep is simply supported over a span of 4 meters. If the shear force at a section of the beam is 4500 N, find the shear stress at a distance of 25 mm above the neutral axis (N.A.). **07**

OR

Q.3 **(a)** Define: (i) Bending Moment (ii) Point of Contra-flexure **03**

(b) Draw shear stress distribution diagram for Rectangular, Circular T section and I section. **04**

(c) A simply supported wooden beam of span 1.3 m having a cross-section 150 mm wide by 250 mm deep carries a point load W at the center. The permissible stresses are 7 N/mm^2 in bending and 1 N/mm^2 in shearing. Calculate the safe load W. **07**

Q.4 **(a)** Define: (1) Centroid, (2) Center of gravity, (3) Center of mass **03**

(b) State assumptions made in theory of torsion. **04**

(c) Find the center of gravity of the I-section shown in Fig.3 **07**

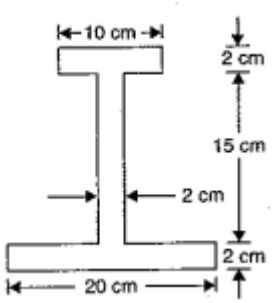

Fig. 3

OR

Q.4 **(a)** Derive with usual notations the theorem of perpendicular axis. **03**

(b) Derive torsion equation with usual notations. **04**

(c) Find the moment of inertia of ISA 100×75×6 about the centroidal XX and YY axes, shown in Fig.4 **07**

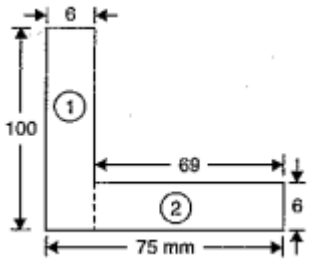

Fig. 4

Q.5 **(a)** Explain Stress-Strain diagram for Ductile Material. **03**

(b) A rod 150 cm long and of diameter 2.0 cm is subjected to an axial pull of 20 kN. If the modulus of elasticity of the material of the rod is 2×10^5 N/mm^2, determine:(i) the stress, (ii) the strain, and(iii) the elongation of the rod. **04**

(c) A metallic bar 300 mm×100 mm×40 mm is subjected to a force of 5kN (tensile),6kN (tensile), and 4 kN (tensile) along x, y, and z directions, respectively. Determine the change in the volume of the block.Take $E=2\times10^5$ N/mm^2 and Poisson's ratio =0.25 **07**

OR

Q.5 **(a)** Define stress, strain and poisson ratio. **03**

(b) A short concrete column 450 mm × 450 mm in section is axially loaded to 500 kN. The column is strengthened by four, 16 mm diameter steel bars each one at corner. Calculate stresses in concrete and steel. Take Ec = 14 GPa and Es = 210 GPa. **04**

(c) A brass bar, having a cross-sectional area of 1000 mm^2 is subjected to axial forces as shown in Fig.5. Find the total elongation of the bar. Take E=1.05×10^5 N/mm^2 **07**

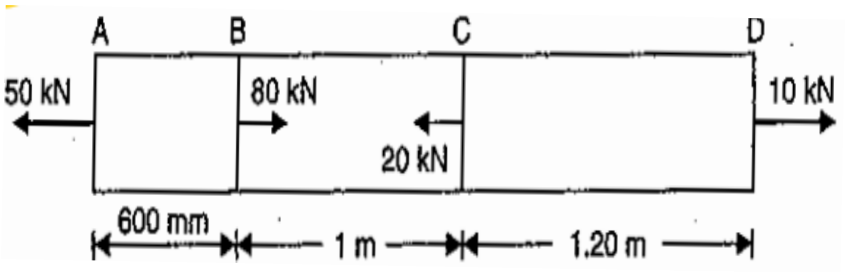

Fig. 5

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