

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-III (NEW) EXAMINATION – WINTER 2021****Subject Code:3130608****Date:25-02-2022****Subject Name:Mechanics of Solids****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

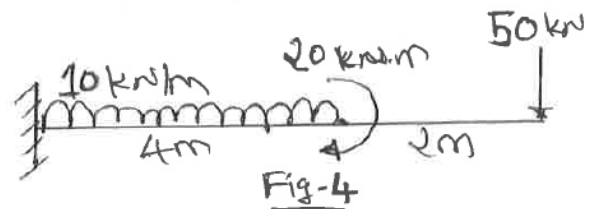
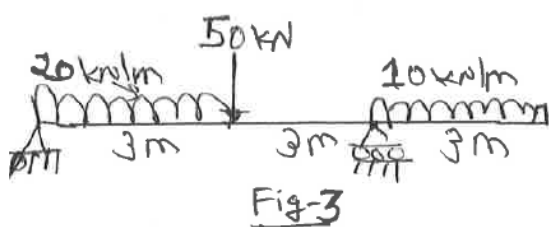
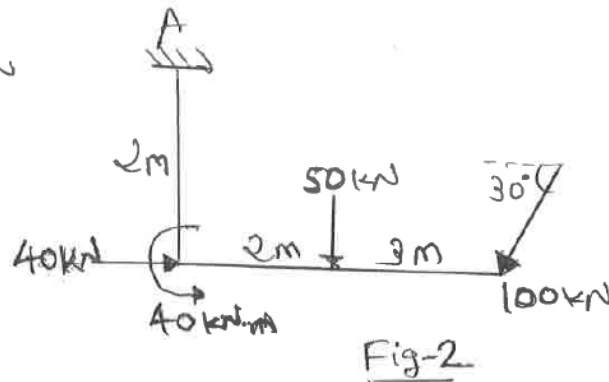
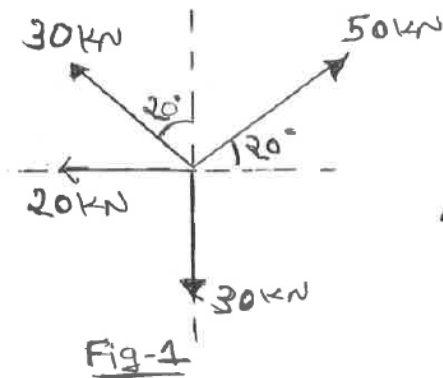
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

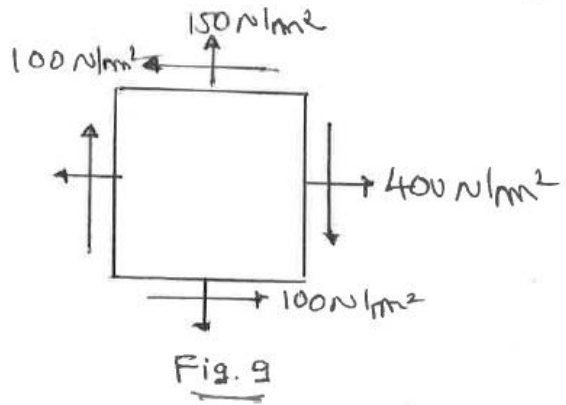
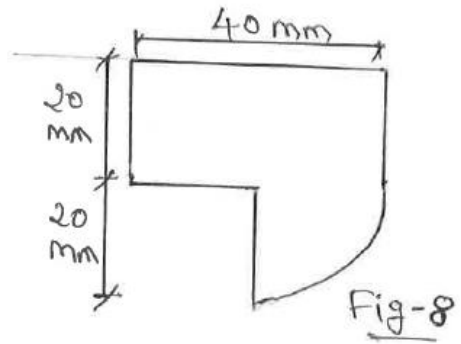
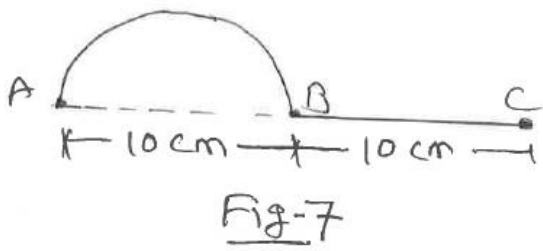
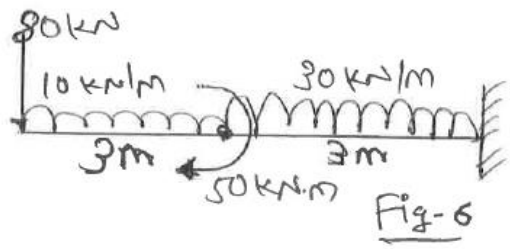
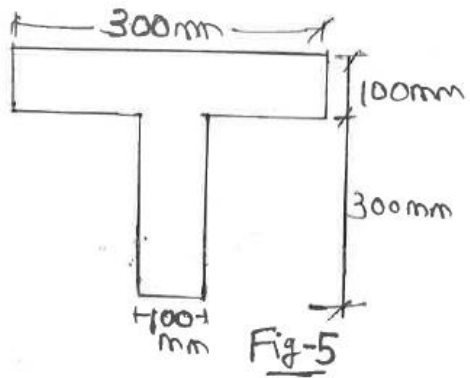
- Q.1**
- (a) State and explain Lami's theorem. **03**
- (b) Determine resultant of given force system shown in **Fig. 1**. **04**
- (c) The forces are acting on a rigid body as shown in **Fig. 2**. Find the resultant of the given force system, in terms of magnitude and direction. Find perpendicular distance of resultant force with respect to point A. **07**
- Q.2**
- (a) Explain various types of statically determinant beams and their support system. **03**
- (b) Differentiate between joint method and section method in analysis of plane truss. **04**
- (c) Draw Shear Force and Bending Moment diagram for the beam shown in **Fig. 3**. **07**
- OR**
- (c) Draw Shear Force and Bending Moment diagram for the beam shown in **Fig. 4**. **07**
- Q.3**
- (a) Draw shear stress distribution diagram for rectangular, circular and I section. **03**
- (b) A beam simply supported over a span of 8 m and carries an U.D.L. of 50 kN/m over whole span. The size of beam is 150 mm x 400 mm. Find the maximum bending stress and draw the bending stress diagram. **04**
- (c) A beam of T shaped cross section shown in **Fig. 5** is subjected to bending about x-x axis due to a moment of 20 kN.m. Find the bending stress at top and bottom of the beam. **07**
- OR**
- Q.3**
- (a) Write assumptions made in theory of pure bending. **03**
- (b) Find the support reaction for beam which is loaded as shown in **Fig. 6**. **04**
- (c) A beam of T shaped cross section shown in **Fig. 5** is subjected to maximum shear force of 50 kN. Determine maximum shear stress. **07**
- Q.4**
- (a) Derive with usual notations the theorem of perpendicular axis. **03**
- (b) Write equation of Moment of inertia for rectangular section and triangular section about its neutral axis and base of section. **04**
- (c) Determine the location of centroid of wire which is bent as shown in **Fig. 7**. **07**
- OR**
- Q.4**
- (a) Write assumption made in the theory of torsion. **03**
- (b) External and internal diameter of propeller shaft are 400 mm and 200 mm respectively. Find maximum shear stress developed in the cross section when a twisting moment of 50 kN.m is applied. **04**
- (c) Determine moment of inertia about ( $I_{xx}$ ) of a plane area as shown in **Fig. 8**. **07**

- Q.5** (a) Define (i) Stress (ii) Strain (iii) Modulus of elasticity. **03**
- (b) An underground cable is laid in a summer at  $32^{\circ}\text{C}$ . What stress would be induced in it when temperature in winter is  $-3^{\circ}\text{C}$ . The cable is unable to contract in any direction. Take,  $\alpha = 12 \times 10^{-6}$  per  $^{\circ}\text{C}$ ,  $EI = 200$  GPa. **04**
- (c) A steel rod of 100 mm in diameter is inserted inside a copper tube of 200 mm external diameter and 100 mm internal diameter. The composite section is subjected to axial tensile force of 100 kN. Length of the composite section is 0.5 m. Calculate stress in each material. Take  $E$  for steel =  $2.1 \times 10^5$  MPa,  $E$  for copper =  $1.3 \times 10^5$  MPa. **07**

**OR**

- Q.5** (a) Define principal planes and principal stresses. **03**
- (b) A steel bar 16 mm diameter and 3 m long is subjected to an axial pull of 80 kN. Determine the change in dimension and change in volume of the bar. Take  $E = 2 \times 10^5$  MPa and  $\mu = 0.3$ . **04**
- (c) The state of stress in two-dimensionally stress body at a point is shown in **Fig. 9**. Determine (i) principal stresses (ii) maximum shear stress and its location of planes. **07**





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