

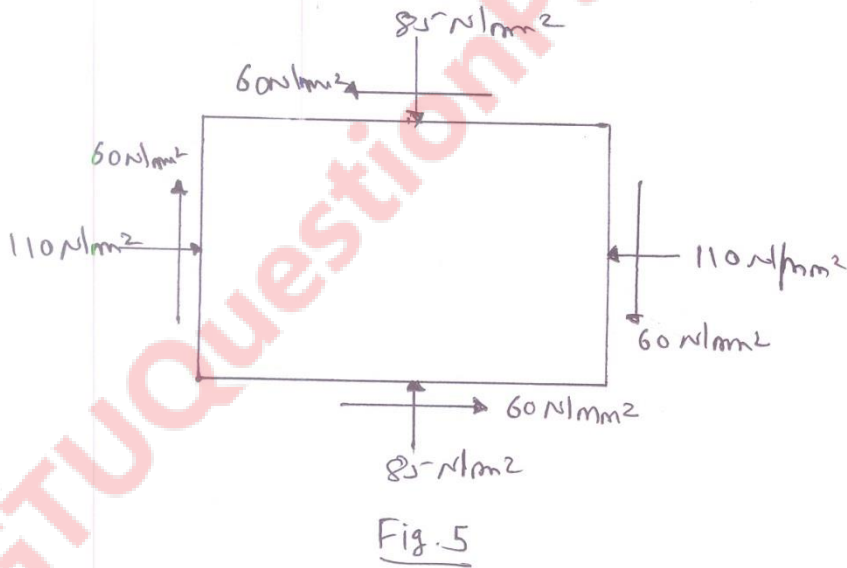
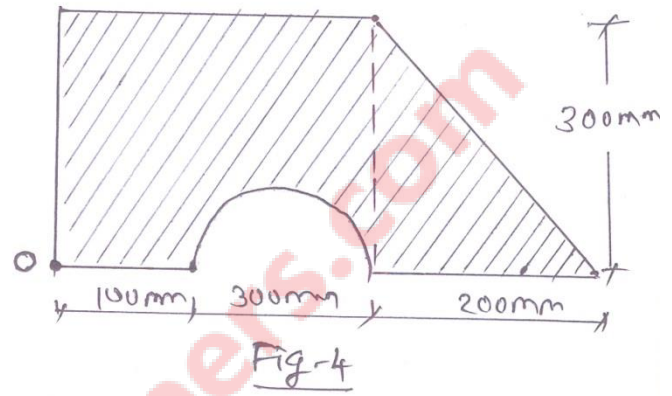
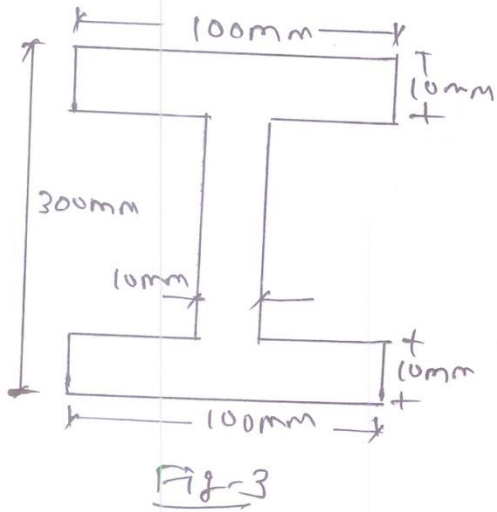
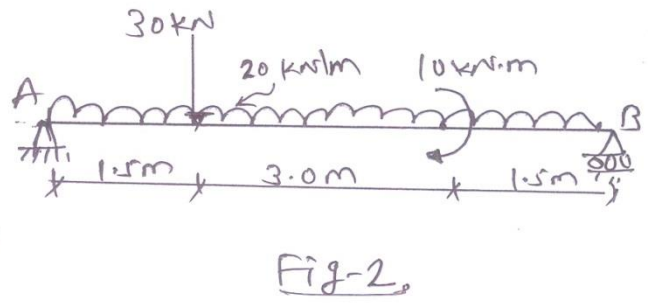
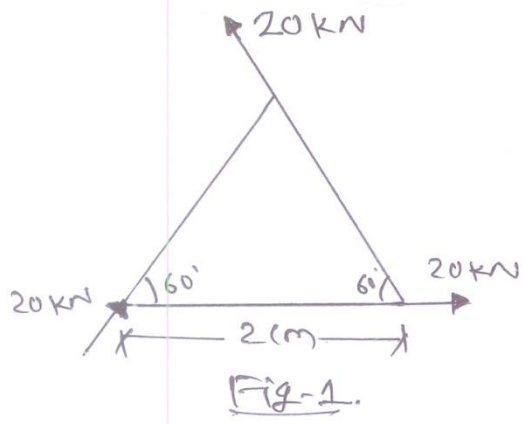
**GUJARAT TECHNOLOGICAL UNIVERSITY****BE- SEMESTER-III (NEW) EXAMINATION – WINTER 2020****Subject Code:3130608****Date:06/03/2021****Subject Name:Mechanics of Solids****Time:10:30 AM TO 12:30 PM****Total Marks:56****Instructions:**

1. Attempt any **FOUR** questions out of **EIGHT** questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1**
- (a) Explain following terms (i) Rigid body, (ii) Deformable body (iii) Elastic body. **03**
- (b) State Hook's law. Draw stress strain curve for Mild Steel Specimen and explain each point in detail. **04**
- (c) Three forces are acting on a weightless equilateral triangular plate as shown in **Fig. 1**. Determine magnitude, direction and position of resultant force. **07**
- Q.2**
- (a) Explain : (i) Type of beams (ii) Type of loading on the beams. **03**
- (b) Determine support reaction for the given beam shown in **Fig. 2**. **04**
- (c) A simply supported beam 10 m long carries three point loads at 100 kN, 150 kN and 200 kN at 3m, 5m and 8m from left support. Draw S.F. and B.M. diagram for the beam. **07**
- Q.3**
- (a) Discuss critically the assumption made in theory of Bending. **03**
- (b) A cantilever beam 2 m long has rectangular section 200 mm x 500 mm. Find out point load at free end of beam if permissible bending stress is  $20\text{N/mm}^2$ . **04**
- (c) A beam of I-section, having 5 m length is simply supported at each end and bears a u.d.l. of 20 kN/m as shown in **Fig. 3**. Determine maximum tensile and compressive bending stress. **07**
- Q.4**
- (a) Derive with usual notations the theorem of perpendicular axis. **03**
- (b) Derive relation between bulk modulus (K), Poisson's ratio ( $1/m$ ), and modulus of elasticity (E). **04**
- (c) A beam of I-section, having 5 m length is simply supported at each end and bears a u.d.l. of 20 kN/m as shown in **Fig. 3**. Determine maximum shear stress. **07**
- Q.5**
- (a) Define: (1) Centroid (2) Center of gravity (3) Center of mass. **03**
- (b) State and prove Pappu's guldinus theorem for surface area of bodies. **04**
- (c) Determine the location of centroid of plane lamina shown in **Fig. 4** with respect to point O. **07**
- Q.6**
- (a) Write assumption made in the theory of torsion. **03**
- (b) A solid steel shaft is to transmit 120 kW power at 600 r.p.m. Find the diameter of shaft if shear stress is to be limited to  $100\text{N/mm}^2$ . **04**
- (c) Determine moment of inertia about base of a plane area as shown in **Fig. 4**. **07**

- Q.7** (a) Define : (i) Modulus of Elasticity (ii) Poisson's ratio (iii) Modulus of rigidity **03**
- (b) In a tension test, a bar of 20 mm diameter undergoes elongation of 14 mm in a gauge length of 150 mm and a decrease in diameter of 0.85 mm at a tensile load of 6 kN. Determine the two physical constants Poisson's ratio and modulus of elasticity of the material. **04**
- (c) A steel rod 30 mm in diameter is inserted inside a brass tube of 30 mm internal diameter and 40 mm external diameter, the ends are rigidly connected together. The assembly is heated by 20°C. Find value and nature of stress developed in both the materials. **07**
- Take,  $\alpha$  for steel =  $12 \times 10^{-6}$  per °C,  $\alpha$  for brass =  $18 \times 10^{-6}$  per °C.  
 $E$  for steel = 200 GPa,  $E$  for brass = 80 GPa,
- Q.8** (a) Define principal planes and principal stresses. **03**
- (b) A R.C.C. column 300 mm in dia. is reinforced with 6 nos. of 16 mm diameter steel bars. If permissible stress in steel and concrete are 230 N/mm<sup>2</sup> and 5 N/mm<sup>2</sup>, respectively, find the load carrying capacity of the column. **04**
- (c) The state of stress in two-dimensionally stress body at a point is shown in **Fig. 5**. Determine principal stresses and maximum shear stress and its location of planes. **07**

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