

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER- III EXAMINATION – SUMMER 2020****Subject Code: 3130608****Date:04/11/2020****Subject Name: Mechanics of Solids****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

|            |  | <b>Marks</b> |
|------------|--|--------------|
| <b>Q.1</b> | (a) State's Law of Parallelogram of forces.  | <b>03</b>    |
|            | (b) Define force and writes its characteristics.   | <b>04</b>    |
|            | (c) Find the magnitude and direction of resultant of force system shown in fig. 01.  | <b>07</b>    |
| <b>Q.2</b> | (a) What is meant by free body diagram? Draw free body diagram for box place on a table.   | <b>03</b>    |
|            | (b) Define : (1) Isotropic material (2) Anisotropic material (3) Homogeneous material (4) Orthotropic material.  | <b>04</b>    |
|            | (c) Find the minimum (least) value of force P to keep the sphere in the position shown in fig. 02. The radius of sphere 1 is 5cm and sphere 2 is 10cm. The weight of sphere 1 is 100N and sphere 2 is 200N.  | <b>07</b>    |
|            | <b>OR</b>  |              |
|            | (c) Draw shear force diagram and bending moment diagram for a beam shown in fig. 03.   | <b>07</b>    |
| <b>Q.3</b> | (a) What is difference between deficient truss and redundant truss.  | <b>03</b>    |
|            | (b) Explain types of supports with usual notations.  | <b>04</b>    |
|            | (c) Find the CG of plane lamina shown in fig 4.  | <b>07</b>    |
|            | <b>OR</b>  |              |
| <b>Q.3</b> | (a) Explain : (1) Poisson's ratio (2) Hook's law (3) Bulk modulus.   | <b>03</b>    |
|            | (b) A bar of 3m long and 20mm diameter is rigidly fixed in two supports at certain temperature. If temperature is raised by 60° C, find the thermal stress and strain of the bar. Also find thermal stress and strain if support yields by 2 mm. Take $\alpha = 12 \times 10^{-6} / ^\circ\text{C}$ and $E = 2 \times 10^5 \text{ N/mm}^2$ . | <b>04</b>    |
|            | (c) State and explain with figure Pappu's –Guildinus theorem of surface area of Revolution.  | <b>07</b>    |
| <b>Q.4</b> | (a) Enlist the assumptions made in theory of torsion. A beam simple supported and carries an U.D.L. of 50 kN/m over whole span. The size of beam   | <b>03</b>    |
|            | (b) is 150mm x 400mm.. If maximum stress in the material of beam is 100N/mm <sup>2</sup> find the span of beam.  | <b>04</b>    |
|            | (c) Determine the centroid of the section shown in fig. 05.  | <b>07</b>    |

**OR**

- Q.4** (a) A load of 10 kN is to be raised with help of a steel wire. Find the minimum diameter of the wire, if the stress is not to be exceed  $80 \text{ N/mm}^2$ . **03**
- (b) Explain types of beams with notations. **04**
- (c) Determine moments of inertia of a section shown in fig. 06 about horizontal centroidal axis. **07**

- Q.5** (a) Define: (1) Shear Force (2) Bending Moment (3) Points of contraflexure **03**
- (b) Derive the relation between : (1) Young's Modulus (2) Modulus of Rigidity (3) Possion's Ratio **04**
- (c) A hollow steel shaft, 3m of length must transmit a torque of 25 kNm. The total angle of twist in this length is not to exceed  $2.5^\circ$  and the allowable shearing stress in the material is 90 MPa. Calculate the inside diameter of the shaft and thickness of the metal.  $G = 85 \text{ GN/m}^2$ . **07**

**OR**

- Q.5** (a) Draw shear stress distribution diagram for : (1) I section (2) Circular section (3) Triangular section **03**
- (b) Explain assumptions made in theory of pure bending. **04**
- (c) A square prism of metal 60mm x 60mm in cross section and 300mm long is subjected to a tensile stress of 450 MPa along its longitudinal axis, lateral compression of 240 MPa and lateral tension of 120 MPa along the pair of sides. **07**
- If  $E = 150 \text{ GPa}$ , calculate the changes in dimensions, change in volume of metal.  
 $\mu = 0.36$ .

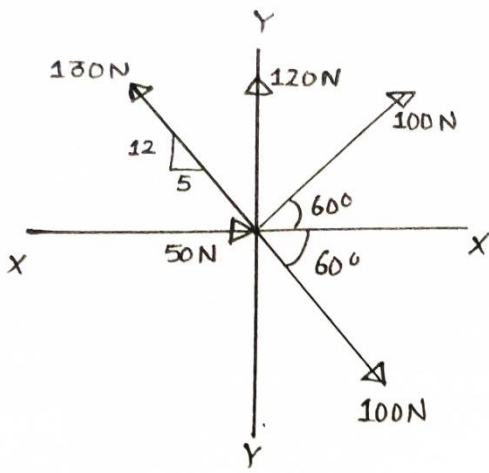


Fig. 01

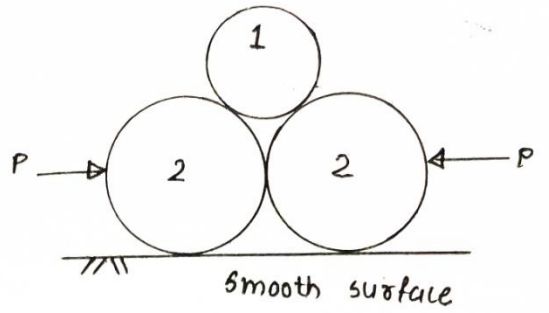


Fig. 02

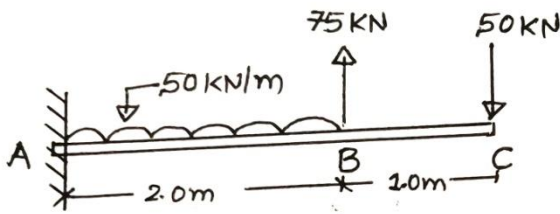


Fig. 03

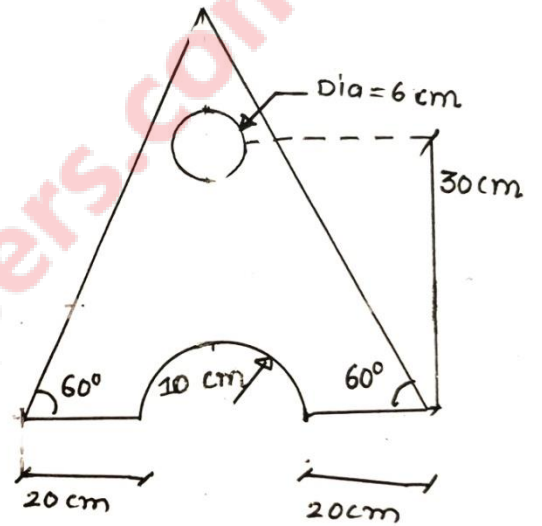


Fig. 04

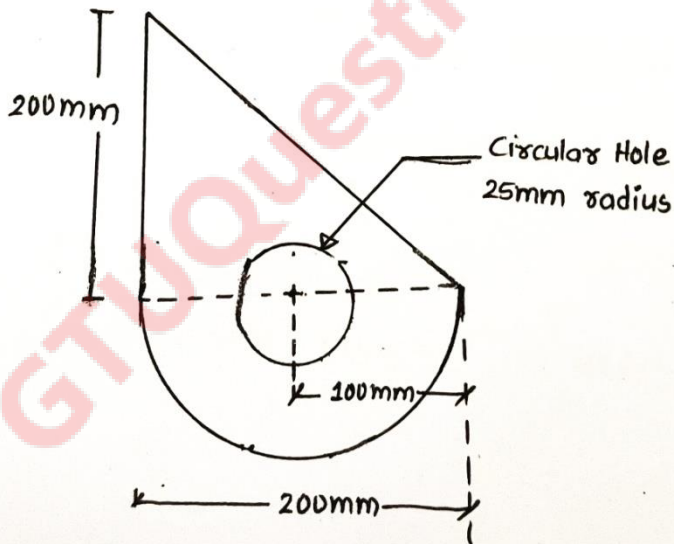


Fig. 05

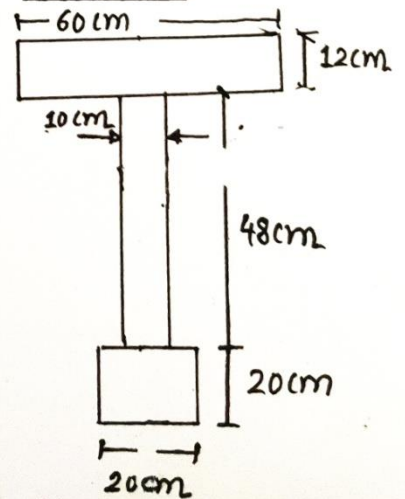


Fig. 06