

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.

		Marks
Q.1	(a) State's Law of Parallelogram of forces.	03
	(b) Define force and writes its characteristics.	04
	(c) Find the magnitude and direction of resultant of force system shown in fig. 01.	07
Q.2	(a) What is meant by free body diagram? Draw free body diagram for box place on a table.	03
	Define : (1) Isotropic material (2) Anisotropic material (3) Homogeneous material (4) Orthotropic material.	04
	(b) Find the minimum (least) value of force P to keep the sphere in the position shown in fig. 02.	
	(c) The radius of sphere 1 is 5cm and sphere 2 is 10cm. The weight of sphere 1 is 100N and sphere 2 is 200N.	07
OR		
	(c) Draw shear force diagram and bending moment diagram for a beam shown in fig. 03.	07
Q.3	(a) What is difference between deficient truss and redundant truss.	03
	(b) Explain types of supports with usual notations.	04
	(c) Find the CG of plane lamina shown in fig 4.	07
OR		
Q.3	(a) Explain : (1) Poisson's ratio (2) Hook's law (3) Bulk modulus.	03
	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 $E = 2 \times 10^5 \text{ N/mm}^2$.	04
	(b) State and explain with figure Pappu's – Guildinus theorem of surface area of Revolution.	07
Q.4	(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 is 150mm x 400mm.. If maximum stress in the material of beam is 100N/mm ² find the span of beam.	03
	(b) Determine the centroid of the section shown in fig. 05.	04
	(c)	07

- 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 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) Poisson'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° 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. If $E = 150 \text{ GPa}$, calculate the changes in dimensions, change in volume of metal. $\mu = 0.36$. **07**

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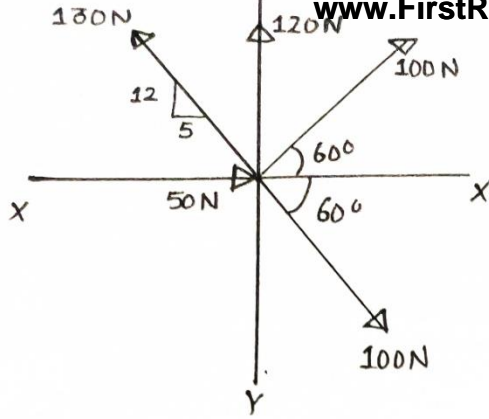


Fig. 01

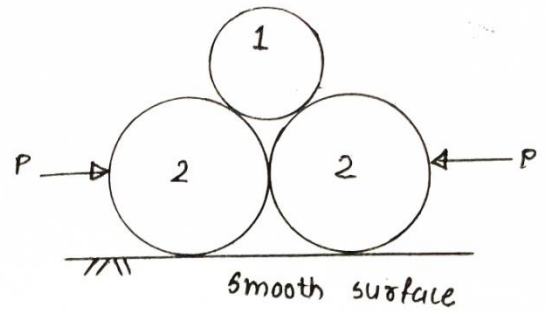


Fig. 02

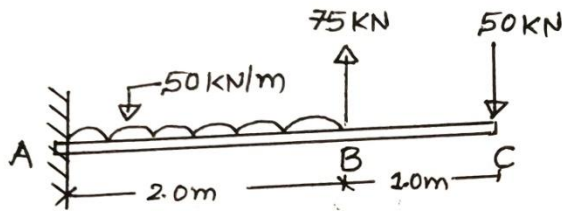


Fig. 03

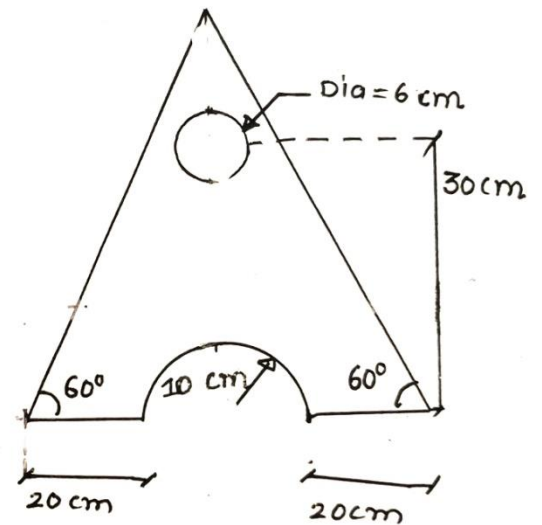


Fig. 04

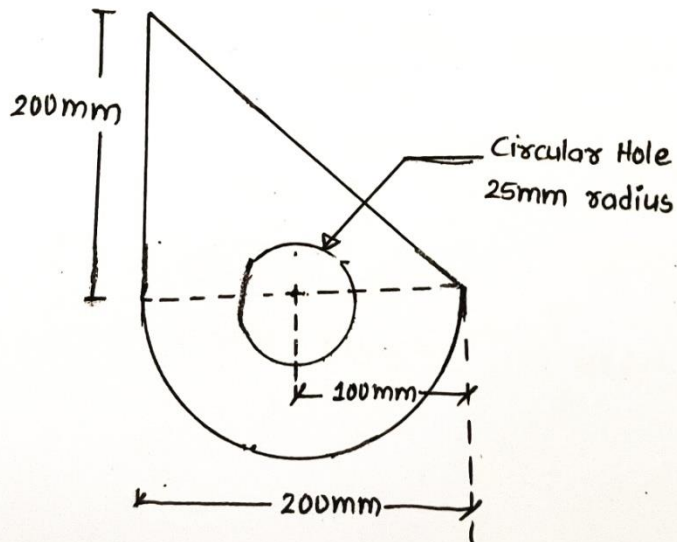


Fig. 05

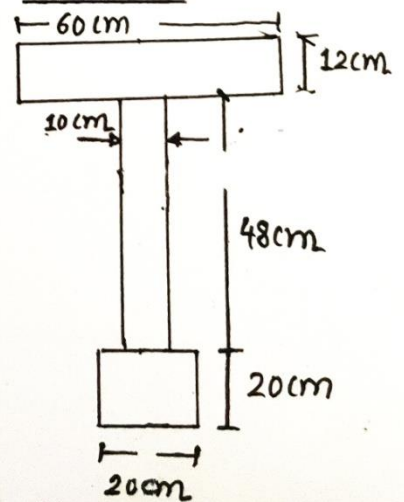


Fig. 06