

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-III (NEW) EXAMINATION – WINTER 2017

Subject Code: 2130003

Date: 09/11/2017

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.

- Q.1** (a) Define: 1] Rigid body, 2] Newton's second Law **03**
(b) Define Force and classify the force system with neat sketch. **04**
(c) Find magnitude and direction of resultant of force system shown in **Fig.1** **07**

- Q.2** (a) Define Moment & Couple giving two suitable examples **03**
(b) Find magnitude, direction and location of resultant wrt point 'O' of force system shown in **Fig.2** **04**
(c) Find the Tensions T_1 , T_2 and T_3 in respective strings as shown in **Fig 3.** **07**

OR

- (c) A chord supported at A and B carries a load of 20KN at point C and an unknown weight of W KN at D as shown in **Fig 4.** Find the value of unknown weight W so that CD remains horizontal. **07**
- Q.3** (a) Derive with usual notations the theorem of perpendicular axis. **03**
(b) Define Centroid and With usual notations find the centroid of a triangle by method of integration **04**
(c) Find the Centroid of the Lamina shown in **Fig 5.** **07**

OR

- Q.3** (a) Define: 1] Moment of Inertia, 2] Axis of symmetry **03**
(b) Explain the Pappu's Guldinus Theorem I **04**
(c) Find the moment of Inertia of an I section shown in the **Fig 6** about its centroidal axis. **07**
- Q.4** (a) Define: 1] Poisson's Ratio 2] composite bar **03**
(b) Derive relation between bulk modulus (K), Poisson's ratio ($1/m$), and modulus of elasticity (E). **04**
(c) A stepped bar carries loads as shown in **Fig 7.** Find total deformation in bar by taking modulus of elasticity $2 \times 10^5 \text{ N/mm}^2$. Length and cross sectional area are as under: **07**

Parameter	AB	BC	CD
Length	1.2 m	1.35 m	1.1 m
Area	30 mm x 30 mm	50mm diameter	10 mm x 50 mm

OR

- Q.4** (a) Define: 1] Lateral stress, 2] Modulus of Rigidity **03**
(b) Derive the equation for deformation of a body due to self weight. **04**
(c) A steel rod 25mm in diameter is inserted inside a brass tube of 25mm internal diameter and 35mm external diameter, the ends are rigidly connected together. The assembly is heated by 30° . Find value and nature of stress developed in both the materials. Take, $E_{\text{steel}} = 200 \text{ GPa}$, $E_{\text{brass}} = 80 \text{ GPa}$, $\alpha_{\text{steel}} = 12 \times 10^{-6} \text{ per } ^\circ\text{C}$, $\alpha_{\text{brass}} = 18 \times 10^{-6} \text{ per } ^\circ\text{C}$. **07**
- Q.5** (a) Define: 1] Point of Contra flexure, 2] Shear force **03**
(b) Explain with neat sketch types of beams, types of loads and types of supports **04**
(c) Draw the Shear force and Bending Moment diagram for the beam shown in the **Fig 8** **07**

OR

- Q.5

(a)

Define: Coefficient of Static Friction and state the Laws of Friction.

03

(b)

Derive with usual notation the relation between shear force and Bending moment.

04

(c)

At a point in a strained material the state of stress is as shown in Fig.9 Determine (i) location of principal planes (ii) principal stresses and (iii) maximum shear stress and location of plane on which it acts

07

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