

**PARUL UNIVERSITY**  
**FACULTY OF ENGINEERING & TECHNOLOGY**  
**M.Tech. Winter 2019 - 20 Examination**

**Semester: 1**  
**Subject Code: 203209102**  
**Subject Name: Advanced Solid Mechanics**

**Date: 17/12/2019**  
**Time: 10:30 am 01:00 pm**  
**Total Marks: 60**

**Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

**Q.1** A) Explain the torsion of Rectangular bar. **(05)**

B) Write difference between linear elasticity and strength of material. **(05)**

C) Define the following term. **(05)**

1) Elasticity 2) Stress 3) Shear Strain 4) Hooke's Law 5) Shear stress.

**Q.2** Answer the following questions. (Attempt any three) (Each five mark) **(15)**

A) Derive the equation between E, G, K

B) Prove that stiffness matrix  $D_{ij} = D_{ji}$

C) Write the assumptions associated with the elementary approach of bar under torsion.

D) Write the application of linear elasticity.

**Q.3** A) Write the types of stresses and strain. **(07)**

B) The following are the principal stress at a point in a stressed material. Taking  $E = 200$  **(08)**  
 $\text{N/mm}^2$  and  $\nu = 0.33$ , calculate the volumetric strain and the Lamé's constants.  $\sigma_x = 220 \text{ N/mm}^2$ ,  $\sigma_y = 140 \text{ N/mm}^2$ ,  $\sigma_z = 130 \text{ N/mm}^2$ .

**OR**

B) When the stress tensor at a point with reference to axes  $(x, y, z)$  is given by the array, show that **(08)**  
the stress invariants remain unchanged by transformation of the axes by  $45^\circ$  about the  $z$ -axis.

$$\begin{bmatrix} 4 & 1 & 2 \\ 1 & 6 & 0 \\ 2 & 0 & 8 \end{bmatrix} \text{ MPa}$$

**Q.4** A) Explain the Airy's Stress function **(07)**

**OR**

A) Write the short note on the linear elasticity **(07)**

B) Explain the St. Venant's principle. **(08)**