

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E. Sem – I Examination January 2011****Subject code: 710901****Subject Name: Theory of Elasticity****Date: 07/07/2011****Time: 10:30 am – 01:00 pm****Total Marks: 60****Instructions:**

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

- Q.1** (a) At a point in a body $\sigma_x=10000$ Mpa, $\sigma_y=-5000$ Mpa, $\sigma_z=-5000$ Mpa, $\tau_{xy}=\tau_{yz}=\tau_{zx}=10000$ Mpa. Determine the normal and shearing stresses on a plane that is equally inclined to all the three axes. **06**
- (b) Find the principal stresses and check for invariance if the values of stresses at a point are : $\sigma_x=1$ Mpa, $\sigma_y=-2$ Mpa, $\sigma_z=4$ Mpa, $\tau_{xy}=2$ Mpa, $\tau_{yz}=-3$ Mpa $\tau_{zx}=1$ Mpa. **06**
- Q.2** (a) The state of stress at a point is such that $\sigma_x=\sigma_y=\sigma_z=\tau_{xy}=\tau_{yz}=\tau_{zx}=\rho$. Determine the principal stresses and their directions. **06**
- (b) Explain Mohr's circle for the three-dimensional state of stress. **06**
- OR**
- (b) Explain stress components on an arbitrary plane. **06**
- Q.3** (a) What is the significance of Octahedral stresses **06**
- (b) Explain plane state of stress with its mathematical expressions **06**
- OR**
- Q.3** (a) What is the significance of compatibility conditions. **06**
- (b) Explain plane state of strain with its mathematical expressions **06**
- Q.4** (a) Explain first law of Castigliano **06**
- (b) Explain Kirchhoff's theorem **06**
- OR**
- Q.4** (a) Explain second theorem of Castigliano **06**
- (b) What do you understand by Reciprocal relation and explain Maxwell-Betti-Rayleigh reciprocal theorem. **06**
- Q.5** (a) What do you understand by axisymmetric problems and how it is analyzed for stress and strain. **06**
- (b) Discuss thermo elastic stress-strain relations, equations of equilibrium and strain-displacement relations if thermal stresses are considered **06**
- OR**
- Q.5** (a) Derive the expressions for the normal stresses in a straight beams due to the thermal loading **06**
- (b) Derive the expressions for the thick cylinder subjected to internal and external pressures. **06**
