

GUJARAT TECHNOLOGICAL UNIVERSITY
ME SEMESTER-1 EXAMINATION – WINTER 2013

Subject Code: 712003N**Date: 19 /06/2014****Subject Name: Theory of Elasticity and Stability****Time: 2:30 to 5:30****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) Explain the classification of structures based on Stiffness and Geometry. **07**
 (b) Explain with neat sketch the state of stress at a point in three dimensions and write Cauchy Stress Tensor in rectangular, cylindrical and spherical coordinate systems. **07**
- Q.2** (a) Write a short note on general design failures and the structural systems adopted to prevent that type of failure. **07**
 (b) The state of stress at a particular point relative to the xyz coordinate system is given by $[\tau_{ij}] = \begin{bmatrix} 10 & 5 & 25 \\ 5 & 15 & 30 \\ 25 & 30 & 20 \end{bmatrix}$ N / mm². Find the normal and shearing stresses with $\alpha_{nx} = 0.7$, $\alpha_{ny} = 0.8$ and $\alpha_{nz} = 0.5$. **07**
OR
 (b) Explain with neat sketch octahedral stress **07**
- Q.3** (a) Explain the state of strain applied to a small neighbourhood about a point. **07**
 (b) If $[\epsilon_{ij}] = \begin{bmatrix} 0.001 & 0.001 & -0.002 \\ 0.001 & -0.003 & 0.0005 \\ -0.002 & 0.0005 & 0.002 \end{bmatrix}$. Find the strain invariants and principal strains. **07**
OR
- Q.3** (a) Explain the state of plane strain. **07**
 (b) Write basic equations of equilibrium, compatibility and stress-strain relations for plane stress condition in polar coordinate system. **07**
- Q.4** (a) Enlist various methods to solve two dimensional stress problems and explain the Airy Stress function method in brief. **07**
 (b) Show that the Airy Stress function $\phi = A[xy^3 - 0.75xyh^2]$ represents stress distribution in a cantilever beam loaded at the free end with load “P”. Find the value of A if $\tau_{xy} = 0$ at $y = \pm h/2$, where b = width and h = height of the section. **07**
OR
- Q.4** (a) Explain Saint Venant’s Principle applicable for torsion of prismatic bars. **07**
 (b) Write basic equations of equilibrium, compatibility and stress-strain relations for plane strain condition in polar coordinate system. **07**
- Q.5** (a) What do you mean by beam-column? Derive differential equation for beam-column with a concentrated central load. **07**
 (b) Explain various parameters of safety and stability. **07**
OR
- Q.5** (a) Explain different types of buckling with neat sketches. **07**
 (b) What do you mean by critical load? Enlist the assumptions made in Euler’s **07**

column buckling theory of column and explain the limitation of theory of Euler's column buckling.
