

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E –Ist SEMESTER–EXAMINATION – JULY- 2012****Subject code: 712003N****Date: 09/07/2012****Subject Name: Theory of Elasticity & Stability****Time: 2:30 pm – 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.

Q 1 (a) Write basic equations of equilibrium, compatibility and stress-strain relations for a point in Cartesian coordinate system. 07

Q 1 (b) The state of stress at a point with respect to xyz coordinate system is given by 07

$[\tau_{ij}] = \begin{bmatrix} 2 & 2 & 2 \\ 2 & 5 & 1 \\ 2 & 1 & 1 \end{bmatrix}$ KN / mm². Find the stress tensor relative to a new x'y'z' coordinate system obtained by a rotation through 30° about the z axis.

Q 2 (a) The stress tensor of a point is given by $[\tau_{ij}] = \begin{bmatrix} 1 & 2 & -3 \\ 2 & 5 & 3 \\ -3 & 3 & 2 \end{bmatrix}$ KN / m². Find the stress invariants and the principal stresses. 07

Q 2 (b) The state of stress at a particular point relative to the xyz coordinate system is given by $[\tau_{ij}] = \begin{bmatrix} 12 & 5 & 25 \\ 5 & 18 & 20 \\ 25 & 20 & 20 \end{bmatrix}$ N / mm². Find the normal and shearing stresses with $\alpha_{nx} = 0.7$, $\alpha_{ny} = 0.8$ and $\alpha_{nz} = 0.5$. 07

OR

Q 2 (b) Find octahedral normal and shearing stress on an octahedral plane whose state of stress is $[\tau_{ij}] = \begin{bmatrix} 11 & 5 & 8 \\ 5 & 4 & 8 \\ 8 & 8 & 6 \end{bmatrix}$ N / mm². 07

Q 3 (a) Explain the state of plane stress. 07

Q 3 (b) Explain with neat sketch octahedral stress. 07

OR

Q 3 (a) Enlist various methods to solve two dimensional stress problems and explain the Airy Stress function method in brief. 07

Q 3 (b) If $[\epsilon_{ij}] = \begin{bmatrix} 0.002 & 0.002 & -0.002 \\ 0.002 & 0.004 & 0.0005 \\ -0.002 & 0.0005 & 0.002 \end{bmatrix}$. Find the strain invariants and principal strains. 07

Q 4 (a) Explain Saint Venant's Principle applicable for two dimensional beam problems. 07

Q 4 (b) Check whether $\phi = A x^4 + B y^3 + C z^3$ is a valid stress function and examine the stress distribution represented by it. 07

OR

Q 4 (a) Write basic equations of equilibrium, compatibility and stress-strain relations for plane strain condition in polar coordinate system. 07

Q 4 (b) What do you mean by beam-column? Derive differential equation for beam-column with a concentrated central load. 07

Q 5 (a) Explain the classification of structures based on Stiffness and Geometry. 07

Q 5 (b) What do you mean by critical load? Enlist the assumptions made in Euler's column buckling theory of column and explain the limitation of theory of Euler's column buckling. 07

OR

Q 5 (a) Derive the equation to calculate the critical load based on Euler's column buckling theory for the column having both the ends fixed. 07

Q 5 (b) Explain various parameters of safety and stability. 07
