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 $[\tau_{ij}] = \begin{bmatrix} 2 & 2 & 2 \\ 2 & 5 & 1 \\ 2 & 1 & 1 \end{bmatrix}$ KN / mm^2. Find the stress tensor relative to a new x'y'z' coordinate system obtained by a rotation through 30˚ about the z axis.	07
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 / m^2. 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 / mm^2. Find the normal and shearing stresses with α_{nx}= 0.7 , α_{ny}= 0.8 and α_{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 / mm^2.	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 $[\varepsilon_{ij}] = \begin{bmatrix} 0.002 & 0.002 & -0.002 \\ 0.002 & 0.004 & 0.0005 \\ -0.002 & 0.0005 & 0.002 \end{bmatrix}$. 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 $\varphi = A\,x^4 + B\,y^3 + C\,z^3$ 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

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