Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013

Subject code: 712003N **Date: 03-01-2014**

Subject Name: Theory of Elasticity and Stability

Time: 10.30 am – 01.00 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)**	Explain state of plane strain and stress in detail.	**07**
	(b)	Give detailed classification of structures based on Geometry and Stiffness.	**07**
Q.2	**(a)**	Derive an equation of critical load based on Euler's buckling theory for a column having fixed at end and hinged at top.	**07**
	(b)	Explain Airy stress function. With example discuss its application for solving two dimensional stress problems.	**07**
		OR	
	(b)	Explain various parameters for Safety and Stability of structures.	**07**
Q.3	**(a)**	Check whether $\varphi = Ax^4+By^3+Cz^3$ is a valid stress function and examine the stress distribution given by this equation.	**07**
	(b)	With neat sketches explain the fundamental behavior of linear and planar type structural elements under vertical and horizontal forces.	**07**
		OR	
Q.3	**(a)**	State and explain Saint Venant's principle with its application to the solution of a cantilever beam loaded at free end.	**07**
	(b)	Investigate what problem of plane stress is solved by the stress function $Ø = ((3F/4c)*(xy-xy^3/3c^2))+Py^2/2$	**07**
Q.4	**(a)**	Explain in detail: Equations of equilibrium, Boundary conditions and Compatibility conditions for Cartesian coordinate system.	**07**
	(b)	Distinguish between the rigid and flexible structural systems with neat sketches and appropriate examples.	**07**
		OR	
Q.4	**(a)**	If $u_x = x^3+3$, $u_y = 4y^2z$ and $uz = x+5z$ find the stress at a point (1, 2, 3).	**07**
	(b)	What is Beam-column system? Derive an equation for beam column system with point load at center.	**07**
Q.5	**(a)**	At a point Q, in a body subjected to tensile stress are $\sigma_x = 10$ N/mm^2, $\sigma_y = 15$ N/mm^2 and $\sigma_z = 10$ N/mm^2 and $\tau_{xy} = \tau_{yz} = \tau_{xz} = 8$N/mm^2. Determine the normal and shear stress on a plane whose normal has following directions Case 1: $n_x = 0.5$ $n_y = 0.5$ and $n_z = 0.707$, case 2: $n_x = 0.707$, $n_y = 0.5$ and $nz = 0$.	**07**
	(b)	Explain post buckling of columns and frames with appropriate examples.	**07**
		OR	
Q.5	**(a)**	Explain stress and strain invariants with neat sketches and examples.	**07**
	(b)	Explain Hook's law and Poisson's ratio. Write the strain components in compression induced due to stress in a vertically placed linear axially loaded element.	**07**

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