Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. SEMESTER I (old course)–EXAMINATION (Remedial) – WINTER 2015

Subject code: 711503N **Date: 10/12/2015**

Subject Name: Advanced Solid Mechanics

Time: 10:30 AM to 1:00 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 assumptions made in Theory of Elasticity and explain ñGeneralized Hookeôs Lawò.	**07**
	(b)	Derive the expression for radial and tangential stress for a solid circular plate of small uniform thickness, material density **ρ**, rotating about the centre with angular velocity **ω**.	**07**
Q.2	**(a)**	What are characteristics of Airyôs stress function? Derive Airyôs stress function for the member subjected to pure bending in Polar Co-ordinate System.	**07**
	(b)	Explain the important observation made in equilibrium approach and derive its general equation to get critical load for end condition as both end fixed.	**07**
		OR	
	(b)	Discuss energy approach for stability of column and derives its general equation to get critical load for end condition as one fixed and one end free.	**07**
Q.3	**(a)**	A cylinder 120 mm internal diameter is subjected to an internal pressure 50 MPa. There is no external pressure. If the allowable stress in the metal is 150 MPa. Determine external diameter.	**07**
	(b)	Derive general equation of deflection to study initial effect of curvature using imperfection approach.	**07**
		OR	
Q.3	**(a)**	For the following state of stresses, find the principal stresses using CARDANôs method and direction cosines of any one principal stress. Normal stresses :$\mathring{u}_{xx}$ = 450 MPa, $\mathring{u}_{yy}$ = 300 MPa, $\mathring{u}_{zz}$ = -200 MPa Shear Stresses : $\acute{U}_{xy}$ = 140 MPa, $\acute{U}_{yz}$ = 200 MPa, $\acute{U}_{zx}$ = 120 MPa	**07**
	(b)	Draw the neat sketch for the displacement of an element, derive the equation for various strain in Polar Coordinate System.	**07**
Q.4	**(a)**	Explain Airyôs stress function for a circular plate with hole.	**07**
	(b)	The biaxial state of stresses is acting at a point in a strained ductile material as $\mathring{u}x$ = - 150 MPa (Compressive), $\mathring{u}y$ = 0 and $\acute{U}xy$ = 160 MPa. If yield strength of the material is 270 MPa, check whether the material is safe using maximum shear stress theory and/or maximum distortion energy theory.	**07**
		OR	
Q.4	**(a)**	Derive the following equation with usual notations. $$\varepsilon_\theta = \frac{1}{2}(\varepsilon_x + \varepsilon_y) + \frac{1}{2}(\varepsilon_x - \varepsilon_y)\cos 2\theta + \varepsilon_{xy}\sin 2\theta$$	**07**
	(b)	Explain the effect of transverse shear on buckling of the beam and derive equation of critical load for the same.	**07**
Q.5	**(a)**	Explain the terms: Modulus of elasticity and rigidity, Lamiôs constant, bull modulus and Poissonôs ratio.	**07**
	(b)	Explain in detail about inelastic buckling of column.	**07**

OR

Q.5	**(a)**	Differentiate plane stress and plain strain problem with suitable examples.	**07**
	(b)	Find the principal stresses and direction cosines of any one principal stress for the following state of stresses. $\begin{bmatrix} 5 & 4 & 8 \\ 4 & 5 & 7 \\ 8 & 7 & 9 \end{bmatrix}$	**07**

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