

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2013

Subject code: 712003N**Date: 13-06-2013****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 the terms 1. Stress Function and 2. Boundary conditions in detail. **07**
 (b) State and explain Saint Venant's principle for two dimensional problems. **07**
- Q.2** (a) Explain the principal stresses and stress invariants. **07**
 (b) Explain and derive the equations for compatibility. **07**
- OR**
- (b) Explain the stress at a point and strain at a point. **07**
- Q.3** (a) What is beam-column? Derive the differential equation for the central point load case. **07**
 (b) Derive an equation for critical load for column based on Euler's theory when column is fixed at bottom and hinged at top end. **07**
- OR**
- Q.3** (a) Classify structures based on geometry and stiffness criteria with neat sketches. **07**
 (b) Discuss various important aspects for safety and stability of structures. **07**
- Q.4** (a) At a point P the body is subjected to tensile stress as given below. Determine the normal and shearing stress on a plane whose normal has the following directions **07**
 $x = 15\text{N/mm}^2$, $y = 10\text{N/mm}^2$, $z = 10\text{N/mm}^2$, $xy = yz = zx = 5\text{N/mm}^2$
 Case-1: $n_x = 0.5$, $n_y = 0.5$, $n_z = 0.707$
 Case-2: $n_x = 0.707$, $n_y = 0.5$, $n_z = 0$
 (b) At a point P the rectangular stress components are **07**
 $x = 5\text{MPa}$, $y = -2.5\text{MPa}$, $z = 2.5\text{MPa}$,
 $xy = -3\text{MPa}$, $yz = 3\text{MPa}$, $zx = 2\text{MPa}$
 Find the principle stress, also check on the Invariance of I_1 , I_2 , and I_3 . **07**
- OR**
- Q.4** (a) If $u_x = x^3 + 4$, $u_y = 2y^2z$, and $u_z = x + 4z$, find the strain at a point (1,2,3) **07**
 (b) Check whether the $\phi = Ax^3 + By^2 + Cz^2$ is a valid stress function and examine the stress distribution represented by it. **07**
- Q.5** (a) What is buckling of a column? Explain types of column buckling and discuss the factors affecting buckling with post buckling column behavior. **07**
 (b) Explain with neat sketches, the fundamental behavior of main structural elements in detail. **07**
- OR**
- Q.5** (a) State and explain the Hook's Law in a generalized form. Also draw and explain the stress-strain curve for mild steel with all important terms. **07**
 (b) Define torsion. Explain torsion in non circular sections and derive equation of torsion for the curved elements with standard notations. **07**
