

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E Sem-I Examination January 2010****Subject code: 712003****Subject Name: Theory of Elasticity & Stability****Date: 25 / 01 / 2010****Time: 12.00 – 2.30 pm****Total Marks: 60****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Explain the stress Components on an arbitrary plane **06**
 (b) Classify the structure based on geometry & stiffness. **06**
- Q.2** (a) At a point P in a body subjected only one axial tensile stress along y direction $\sigma_y = 1 \text{ kN/cm}^2$. Determine the normal and shearing stress on a plane whose normal has the following direction **06**
 Case 1 : $n_x = 0.707$, $n_y = 0.707$, $n_z = 0$,
 Case 2 : $n_x = 0$, $n_y = 0.707$, $n_z = 0.707$
 (b) Explain fundamental behavior of beam & column in stability. **06**
 OR
 (b) Indicate in detail behavior of walls & plates in structure. **06**
- Q.3** (a) What are the parameters of safety & stability? Explain any one. **06**
 (b) (1) Explain the More general theorem. **03**
 (2) Define the state of stress at a point and explain normal & shear stress components. **03**
 OR
- Q.3** (a) What do you mean by buckling? Explain various types of buckling. **06**
 (b) Explain the equality of cross shear of rectangular element. **06**
- Q.4** (a) Define critical load & mention assumptions of Euler's theory for columns. **06**
 (b) (1) Explain the strain Invariants **03**
 (2) Explain the relation between the elastic constant. **03**
 OR
- Q.4** (a) A hollow tube 4 cm outside diameter, 2 cm inside diameter is 4 m long. One end is fixed & other end is free. Find buckling load. Also, find out maximum deflection at the centre due to buckling if the yield stress is 25000 N/cm^2 . $E = 200 \times 10^5 \text{ N/cm}^2$ **06**
 (b) Explain the saint-venant's equations of compatibility. **06**
- Q.5** (a) What do you mean by beam-column? Derive differential equation for beam-column. **06**

- (b) Explain the octahedral stress and Determine octahedral normal & shearing stress on an octahedral plane. The state of stress characterized by τ_{ij} . **06**

$$\tau_{ij} = \begin{bmatrix} 12 & 4 & 8 \\ 4 & 2 & 8 \\ 8 & 8 & 6 \end{bmatrix}$$

OR

- Q.5** (a) Explain the plane state of stress and plane state of strain **06**
(b) A simply supported beam of span 6m is made of solid steel pipe of 120mm diameter. The axial load acting on the beam is 100 kN. The beam is laterally loaded by uniformly distributed load of 1kN/m on entire span. Calculate maximum deflection, maximum slope and maximum moment induced in beam. $E=210\text{GPa}$. **06**
