Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. IST Semester–Remedial Examination – July- 2011

Subject code: 712003N

Subject Name: Theory of Elasticity & Stability

Date:11/07/2011 **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 Hooke's law and derive the equations for strains ε_x, ε_y and ε_z for a 3D element submitted simultaneously to the action of normal stresses σ_x, σ_y and σ_z. **07**

(b) State the equations of equilibrium on a 2D element and explain the entities involved in brief. With the help of equilibrium equations, explain plane strain and plane stress problems. **07**

Q.2 **(a)** Explain Saint-Venant's principle and explain with a neat sketch (without equations), the effect of circular holes on a rectangular plate under effect of far-field stresses. **07**

(b) Determine if the following is a valid stress function: **07**

$$\phi = \frac{3F}{4c}\left[xy - \frac{xy^3}{3c^2}\right] - \frac{P}{4c}y^2$$

OR

(b) Derive radial, tangential and shear stresses on an element in polar coordinates **07**

Q.3 **(a)** Explain why re-entrant corners must be avoided in plates under membrane forces. If they cannot be avoided, give your recommendations for safeguarding against their adverse effects. **07**

(b) Explain membrane analogy for solution of torsional problems **07**

OR

Q.3 **(a)** Explain conceptually the first order shear deformation theory. **07**

(b) Calculate the maximum shear stress in a narrow rectangular bar having width c = 20mm, height b = 200mm and subjected to a twisting moment of 500N-mm. Assume the shear modulus G of the material = 72000MPa. **07**

Q.4 **(a)** Explain buckling in structures under axial compression. **07**

(b) Derive the equation to calculate the Euler's buckling load for a column fixed at the base and free at the upper end. **07**

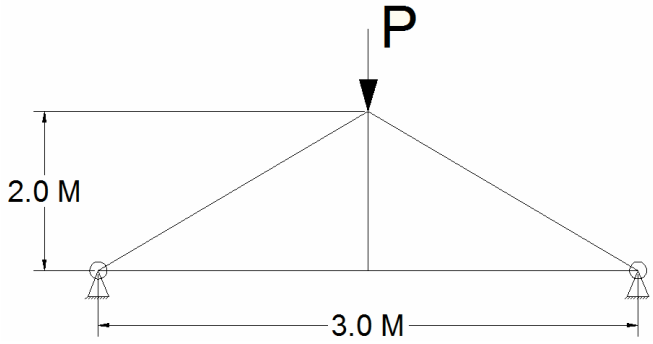
OR

Q.4 **(a)** Write a note on effect of initial curvature on the capacity of the column. **07**

(b) Derive the equation to calculate the Euler's buckling load for a column pinned at the base and pinned at the upper end (pinned – pinned condition). **07**

Q.5 **(a)** Explain buckling phenomena in portals. **07**

(b) Find the critical load 'P' that the truss shown below can withstand before the compression members buckle. Assume the E = 200000 MPa and I = 1000000 mm^4. All joints in the truss should be considered to be hinged. **07**



OR

Q.5 **(a)** Explain conceptually, the effect of shear force on buckling of columns **07**

(b) Explain snap-through buckling conceptually. **07**

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