Seat No: _____ Enrollment No: _____

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

M.Tech., Winter 2017 - 18 Examination

Semester: 1 **Date: 30/12/2017**
Subject Code: 03209104 **Time: 02:00PM to 04:30PM**
Subject Name: Theory of Elasticity **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 A) Mention the significance of theory of elasticity. What are the applications of theory of elasticity? **(05)**

B) Write a short note on macroscopic behavior of material. **(05)**

C) What is Cauchy's stress principle? Explain with mathematical expression. **(05)**

Q.2 **Answer the following questions**. (Attempt any three) **(15)**

A) Write a comprehensive note on stress concentration

B) The following are the principal stress at a point in a stressed material. Taking E= 210 kN/mm^2 and ν = 0.3, calculate the volumetric strain and the Lame's constants.

σ_x=200 N/mm^2, σ_y=150 N/mm^2, σ_z=120 N/mm^2

C) Derive boundary conditions for 3D elasticity.

D) Explain complementary shear stresses.

Q.3 A) Write a short note on following. (Mention the statement and Equation) **(07)**

(i) Tresca's criteria

(ii) Von Mise's criteria.

B) Under what conditions are the following expressions for the components of strain at a point compatible? **(08)**

$\varepsilon_x = 2axy^2 + by^2 + 2cxy$

$\varepsilon_y = ax^2 + bx$

$\gamma_{xy} = \alpha x^2 y + \beta xy + ax^2 + \eta y$

OR

B) Determine normal and shear strains and test if they satisfy necessary conditions of compatibility for the displacement field given below **(08)**

$u = 5x^2y + 8xy^2 + x + y + z^3$

$v = 11y^3 + 8x^2y + y^2z$

$w = 3x^2 + 2xy + z^2$

Q.4 A) Derive generalized Hooke's law for a 3 D body. State the assumptions made in this derivation. **(07)**

OR

A) Derive Airy's stress function. What is the use of defining such function in practice? **(07)**

B) Derive equilibrium equation for 2-d differential element. **(08)**