Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

M.Tech. Summer 2017 - 18 Examination

Semester: I **Date: 26/05/2018**
Subject Code: 03209104 **Time: 2:00pm to 4:30pm**
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) Enlist the assumptions made in Theory of elasticity and justify them. **(05)**

B) Write a short note on Saint Venant's principle **(05)**

C) Explain two dimensional stress at a point. **(05)**

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

A) Explain Cauchy's stress principle with mathematical expression.

B) What are plane stress and plane strain problems?

C) Explain strain tensor in detail.

D) By means of strain rosette, the following strains were recorded during the test on a structural member.

$\varepsilon_0 = -13 \times 10^{-6}$ mm/mm, $\varepsilon_{45} = 7.5 \times 10^{-6}$ mm/ mm, $\varepsilon_{90} = 13 \times 10^{-6}$ mm/ mm

Determine (a) magnitude of principal strains (b) Orientation of principal planes.

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

(I) Tresca's criteria, (II) Von Mises criteria.

B) The state of strain at a point is given by **(08)**

$\varepsilon_x = 0.001$, $\varepsilon_y = -0.003$, $\varepsilon_z = \gamma_{xy} = 0$, $\gamma_{xz} = -0.004$, $\gamma_{yz} = 0.001$

Determine the stress tensor at this point. Take $E = 210 \times 10^6$ kN/m^2, Poisson's ratio = 0.28. Also find Lame's constant.

OR

B) The state-of-stress at a point is given by the following array of terms **(08)**

$$\begin{bmatrix} 9 & 6 & 3 \\ 6 & 5 & 2 \\ 3 & 2 & 4 \end{bmatrix} MPa$$

Determine the principal stresses and principal directions.

Q.4 A) If the displacement field in a body is specified as

$u = (x^2 + 3)10^{-3}$, v = $(3y^2 z)10^{-3}$ and $w = (x + 3z)10^{-3}$, **(07)**

Determine the strain components at a point whose coordinates are (1, 2, 3).

OR

A) The displacement components in a strained body are as follows: **(07)**

$u = 0.01xy + 0.02y^2$, $v = 0.02x^2 + 0.01z^3 y$, $w = 0.01xy^2 + 0.05z^2$

Determine the strain matrix at the point *P* (3,2, -5)

B) Derive Compatibility Equations in terms of stress components (plane stress case). **(08)**