USN | | | | | | | | | | |

10CV661

Sixth Semester B.E. Degree Examination, June/July 2016
Theory of Elesticity

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer FIVE full questions, selecting at least TWO questions from each part.*
2. *Assume any missing data suitably.*

PART – A

1 a. Derive the expression for normal stress $\sigma_x = \tau e + 2G\epsilon_x$ and write the comparison equations in y and z directions. **(10 Marks)**

b. Derive the differential equations of equilibrium for a 3 – dimensional system in Cartesian coordinate. **(10 Marks)**

2 a. At a point P in a 3 – D system the rectangular stress components are $\sigma_x = 1$; $\sigma_y = -2$; $\sigma_z = 4$; $\tau_{xy} = 2$; $\tau_{yz} = -3$ and $\tau_{xz} = 1$ all units are in KPa. Find the principal stresses and check for invariance. **(10 Marks)**

b. The displacement field in micro units for a body is given by $u = (x^2 + y)i + (3 + 2)j + (x^2 + 2y)K$. determine the principal strains at (3, 1, -2) and the direction of the minimum principal strain. **(10 Marks)**

3 a. Write a note on strain Rosette. By means of strain rosette, the following strains were recorded during the test on a structural member.
$\varepsilon_{0^\circ} = -13\times10^{-6}$; $\epsilon_{45^\circ} = 7.5\times10^{-6}$; $\epsilon_{90^\circ} = 13\times10^{-6}$
determine : i) Magnitude of principal strains
ii) Orientation of principal planes. **(10 Marks)**

b. Write a note on :
i) Plane stress problem
ii) Plane strain problem
iii) Mohr's circle. **(10 Marks)**

4 Find the expressions of stress for a bending of simply supported beam subjected to uniformly distributed loading. **(20 Marks)**

PART – B

5 a. Derive the parital differential equations of equilibrium in polar coordinates for 2-dimensional system. **(10 Marks)**

b. Check if $\phi = -\frac{P}{\pi} r\,\theta \sin\theta$ represents a stress function. **(10 Marks)**

6 a. Define axisymmetric problem with example. **(06 Marks)**

b. Derive Lame's equation for thick cylinders. **(14 Marks)**

7 Discuss the effect of circular hole on the stress distribution of rectangular plate. **(20 Marks)**

8 a. Show that the stress function satisfy $\nabla^2\phi = -2G\theta$ for torsion problems. **(10 Marks)**

b. Write short notes on
i) St. Venant's principle **(05 Marks)**
ii) Airy's stress function. **(05 Marks)**