06CE6031 EXAM SLOT : C

Reg. No _____

Name _____

A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY

M.TECH DEGREEEXAMINATION, DECEMBER 2016

FIRST SEMESTER

Branch: Civil Engineering

Computer Aided Structural Engineering

Theory of Elasticity

Time: 3 Hours **Max. Marks: 60**

PART A

Answer ALL questions

1. Define strain tensor and rotation tensor, show that the first one is symmetric and the other is antisymmetric. Add sketches and illustrate the strain components – nature
2. Define plane stress state. Write down the transformation equations for plane stress. Express the principal stress in terms of Cartesian components.
3. What is stress ellipsoid. What is its equation and what it represents? If one of the principal stresses is negative, what will be the surface?
4. What is meant by Airy's stress function and define the stress components. Illustrate the application of Airy's function to solve 2D problems (at least two examples)

(4 x 5 marks =20 marks)

PART B

5. With reference to xyz coordinates, the state of stress at a point is given as

$$[\sigma_{ij} = \begin{bmatrix} 200 & 400 & 300 \\ 400 & 0 & 0 \\ 300 & 0 & -100 \end{bmatrix} \text{Mpa}$$

Find the stress vector on a plane with normal n=1i+2j+2k. Knowing the stress vector components, determine the normal and shear components of stresses on this plane

OR

6. Define octahedral plane, octahedral normal stress and octahedral shear stress. Express the stresses in terms of principal stresses and also in terms of first invariant and second invariants of stresses and second invariant of deviatoric part of stresses if possible.
7. Derive the equation of equilibrium in polar coordinates and express the stress equations of compatibility in terms of Airy's stress function, in polar coordinates.

OR

8. Write the expressions for stresses σ_{rr}, $\sigma_{\theta\theta}$, $\sigma_{r\theta}$ in terms of Airy stress functions. What is an axisymmetric problem? Express the polar components of stresses in terms of Φ, general solution for Φ and stress component.
9. Distinguish between Isotropic hardening and kinematic hardening. What is Bauschinger effect and its effect on hardening? Explain yield surfaces, initial and subsequent, form of yield function in both cases of isotropic and kinematic hardening with help of neat sketches.

OR

10. Discuss Prandtl- Reuss equations in plasticity. Express plastic strain rate and proportional parameter λ in terms of effective plastic strain rate. Define that also.
11. Distinguish between associated flow rule and non associated flow rule and express them. What is plastic potential and sketch the convexity and concaveness of yield surface marking the increment in plastic strain and that in stress. Discuss the normality criterion.

OR

12. Discuss the application of Mohr- Coulomb criterion and Drucker Prager criterion. What are their salient features. Sketch them in stress space and in π – plane.

(4 x 10 marks =40 marks)