B

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER MTECH DEGREE EXAMINATION

CIVIL ENGINEERING

(Structural Engineering and Construction Management)

04CE 6403 Theory of Elasticity

Maximum Marks: 60 ` Duration: 3 Hours

Part A

(Answer all questions. Each question carries 3 marks)

1. Differentiate body forces and surface forces with examples.
2. What are plane stress and plane strain problems?
3. Explain axisymmetric problems with examples.
4. Differentiate thick cylinder and thin cylinder.
5. Briefly explain on Prandtl's stress function approach.
6. List the assumptions involved with Coulomb's equation for torsion of circular bars.
7. Expalin ductility with reference to mild steel.
8. What is plastic potential?

Part B

(Answer all questions. Each question carries 6 marks)

9. The state of stress at a point in an isotropic material is given by
   $\sigma_x = 200$ MPa $\sigma_y = -100$ MPa $\sigma_z = 50$ MPa
   $\tau_{xy} = 40$ MPa , $\tau_{yz} = 50$ MPa $\tau_{zx} = 60$ MPa
   if $E = 2 \times 10^5$ N/ mm^2 and $G = 0.8 \times 10^5$ N/mm^2 . Find out the corresponding strain components from Hook's Law. Take $\upsilon = 0.2$.

   OR

10. The state of stress at a point for a given reference axes *xyz* is given by

$$\begin{bmatrix} & & \\ & & \\ & & \end{bmatrix} \text{KN/m}^2$$

    a. Determine the stress invariants

b. If a new set of axes $x^1y^1z^1$ is formed by rotating the *xyz* about the *z*-axis in anticlockwise direction by 45^0, determine the stress components in the new co-ordinate system

11. Derive equations of equilibrium in Cartesian coordinate for a 3D State.

OR

12. Explain the compatibility conditions and their physical significance. Derive Beltrami – Mitchell compatibility equations in plane strain
13. Discuss the Airy's stress function approach for the analysis of boundary value problems in elastic solid mechanics

OR

14. A cantilever beam of span l, unit width, depth 2C is subjected to a concentrated load P at the free end. Assuming a stress function $\phi = Axy + (B/6)\, xy^3$, determine the stresses σ_{xx}, σ_{yy} and $\tau_{xy.}$ Give your comments on results obtained.

15. Derive the governing differential equation and the stress components of a rotating disc of uniform thickness and mass density

OR

16. Derive Lame's equations for a thick walled cylinder subjected to internal and external pressures.
17. Discuss Prandtl's membrane analogy.

OR

18. Derive the St. Venant's equations for torsion of a prismatic bar.

19. Discuss yield criterions and their application.

OR

20. Explain elasto-plastic bending of beams in detail.