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Register No: .... Name: ....

SAINTGITS COLLEGE OF ENGINEERING
KOTTAYAM, KERALA

(AN AUTONOMOUS COLLEGE AFFILIATED TO
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH. DEGREE EXAMINATION(R), MARCH 2021
(STRUCTURAL ENGINEERING AND CONSTRUCTION MANAGEMENT)

Course Code: 20CESCT103

Course Name: THEORY OF ELASTICITY

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

PART A

(Answer all questions. Each question carries 3 marks)

1. Explain plain stress and plain strain problems with examples
2. Write down the compatibility conditions ?
3. Explain the term Membrane Analogy
4. Briefly explain Prandtl's Stress function Approach
5. Explain Saint Venant's semi-inverse theory
6. Explain the terms i. Plastic Bending ii. Plastic Hinge
7. Differentiate torsion of a straight bar having elliptical and equilateral triangular cross section.
8. write short notes on axi-symmetric problems

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. Derive the 3D Equilibrium Eqns in terms of stresses (6)

OR

10. Using the equilibrium equations, Strain displacement relations and the Stress - Strain relations, show that in the absence of body force, the compatibility equation for a plane stress problem in Isotropic Elasticity can be written as (6)
$\nabla^2(\sigma xx + \sigma yy) = 0$

MODULE II

11. The state of stress at a point is given by the following array of terms (6)

$$\begin{bmatrix} 7 & 2 & 0 \\ 2 & 6 & 2 \\ 0 & 2 & 5 \end{bmatrix} \text{ MPa.}$$

Determine the principal stresses and principal directions with respect to first principle stress.

OR

12. The strain components are given as (6)

$\epsilon xx = 6xy$, $\epsilon yy = 3(z + x)$, $\epsilon zz = 8xz$, $\gamma_{xy} = 3(x^2 + y)$, $\gamma_{yz} = 3y + 10xy$, $\gamma_{xz} = 4z^2 + 5y^2$

Verify whether the given strain field satisfies the compatibility equations or not

MODULE III

13. Derive the biharmonic Equation $\nabla^4\varphi = 0$ in 2-D polar co-ordinates, where $\nabla^2( ) = (\partial 2 / \partial r2 + 1/r\ \partial/\partial r + 1/r2\ \partial 2 / \partial\theta 2)\ ( )$ (6)

OR

14. Check whether the "Strength of Materials" based solution is an acceptable solution for the plane elasticity problem of a cantilever of unit width subjected to a concentrated load at the free end. (6)

MODULE IV

15. Prove that the radial and tangential stress at the centre of a rotating disc are the same. (6)

OR

16. Discus the effect of circular hole in stress distribution of plates. (6)

MODULE V

17. A thin wall box section of dimensions (2a X a) with wall thickness 't' is subjected to a twisting moment 'T'. Determine the Maximum Shear and Angle of twist per unit length. (6)

OR

18. Explain the torsion of thin walled closed and open tubes (6)

MODULE VI

19. List out the theories of failure and explain any two of them with the help of case study. (6)

OR

20. Prove that the fully plastic moment is 50 % more than the yield moment (6)

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