Q.P. Code: 20CE1002

**R20**

**Reg. No:** | | | | | | | | | | |

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR**

(AUTONOMOUS)

**M.Tech I Year I Semester Regular & Supplementary Examinations May/June-2022**

**ADVANCED SOLID MECHANICS**

(Structural Engineering)

Time: 3 hours Max. Marks: 60

(Answer all Five Units **5 x 12 = 60** Marks)

**UNIT-I**

| | | | | |
|---|---|---|---|---|
| 1 | **a** | Derive the differential equation of equilibrium in terms of displacement components for plane stress problem in the presence of body forces. | **L2** | **6M** |
| | **b** | Explain plane stress and plane strain with examples. | **L2** | **6M** |

**OR**

| | | | | |
|---|---|---|---|---|
| 2 | **a** | What is Airy's stress function? Discuss the application of stress function approach for solving of two dimensional bending problems. | **L2** | **6M** |
| | **b** | Obtain the relationship between three elastic moduli for plane stress problem. | **L2** | **6M** |

**UNIT-II**

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|---|---|---|---|---|
| 3 | | Determine the stress components and sketch their variation in a region included y=o, y=d and x= 0 on the side is positive. For the given stress function: $\phi = \frac{-F}{d^3} xy^2(3d - 2y)$ | **L2** | **12M** |

**OR**

| | | | | |
|---|---|---|---|---|
| 4 | | Show that $\varphi = \frac{3F}{4C}\left[xy - \frac{xy^3}{3C^2}\right] + \frac{p}{2}y^2$ is a stress function and hence determine the expressions for $\sigma x$ , $\sigma y$ and $\tau xy$. | **L2** | **12M** |

**UNIT-III**

| | | | | |
|---|---|---|---|---|
| 5 | | Starting from fundamentals, derive the expression for hoop and radial stresses for a rotating hollow disc. | **L2** | **12M** |

**OR**

| | | | | |
|---|---|---|---|---|
| 6 | | Starting from a suitable stress function for an axially symmetric problem, derive Lame's expression for radial and hoop stresses in a thick cylinder subjected to internal fluid pressure P1 and external pressure P0. | **L2** | **12M** |

**UNIT-IV**

| | | | | |
|---|---|---|---|---|
| 7 | | A point P in a body is given by below, Determine the total stress, normal stress and shear stress on a plane which is equally inclined to all the three axes. $Z = \begin{bmatrix} 100 & 100 & 100 \\ 100 & -50 & 100 \\ 100 & 100 & -50 \end{bmatrix} mN/mm^2$ | **L3** | **12M** |

**OR**

| | | | | |
|---|---|---|---|---|
| 8 | | The state of stress at a point is given by following stress tensor. Calculate the stress invariants, magnitude and direction of principal stresses. $\begin{bmatrix} 45 & 45 & -30 \\ 45 & -20 & 20 \\ -30 & 20 & -80 \end{bmatrix} Mpa$ | **L3** | **12M** |

UNIT-V

| | | | | |
|---|---|---|---|---|
| 9 | Derive the governing equation and the boundary for non-circular section subjected to torque load | L2 | 12M |
| | **OR** | | |
| 10 | Explain the membrane analogy, applied to a narrow rectangular section. | L2 | 12M |

*** END ***