THEORY OF ELASICITY AND PLASTICITY

Course Code	22MEMD1T6A	**Year**	I	**Semester**	I
Course Category	Programme Elective	**Branch**	ME	**Course Type**	Theory
Credits	4	**L-T-P**	4-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	40	**Semester End Evaluation:**	60	**Total Marks:**	100

Course outcomes: At the end of the course, the student will be able to:

CO	Statement	BTL	Units
CO1	Demonstrate the application of plane stress and plane strain in a given situation.	L3	1
CO2	Understand the two dimensional problems in polar coordinate system.	L3	2
CO3	Apply stress-strain relations for linearly elastic solids, and Torsion	L3	3
CO4	Demonstrate the ability to analyze the structure using plasticity.	L3	4

Contribution of Course outcomes towards achievement of programme outcomes & Strength of correlations (High:3, Medium: 2, Low:1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2				2			1		2	3	1
CO 2	3	3	2				2			1		2	3	1
CO 3	3	3	2				2			1		2	3	1
CO 4	3	3	2				2			1		2	3	1

Syllabus		
Unit	**Contents**	**Mapped CO**
1	**Introduction**: Elasticity – notation for forces and stresses – components of stresses – components of strain – stress strain relationship – Generalized Hooke's law. **Plane stress and plane strain analysis** – plane stress – plane strain – differential equations of equilibrium – boundary conditions – compatibility equations – stress function – boundary condition.	**CO1**

2	**Two dimensional problems in rectangular coordinates** – solution by polynomials – Saint Venant's principle – determination of displacements – bending of simple beams – application of corier eries or two dimensional problems – gravity loading. Two dimensional problems in polar coordinates – stress distribution symmetrical about an axis – pure bending of curved bars – strain components in polar coordinates – displacements for symmetrical stress distributions – simple symmetric and symmetric problems – general solution of two – dimensional problem in polar coordinates – application of general solution in polar coordinates.	**CO2**
3	**Torsion of Prismatic Bars**:torsion of prismatic – bars with elliptical cross sections – other elementary solution – membrane analogy – torsion of rectangular bars – solution of torsion problems by energy method – use of soap films in solving torsion problems – hydro dynamical analogies – torsion of shafts, tubes, bars etc. **Bending of Prismatic Bars**: Stress function – bending of cantilever – circular cross section – elliptical cross section – rectangular cross section – bending problems by soap film method – displacements.	**CO3**
4	**Plasticity:** Physical Assumptions – Yield criteria – Failure theories – Applications of thick cylinder – Plastic stress strain relationship. Elasto – plastic problems in bending and torsion.	**CO4**

Learning Resources
Text Book(s): 1. Theory of Elasticity (third edition) by Timeshanko, McGrawhill Publications, 2010. 2. Theory of Plasticity (third edition) by J.Chakarbarthy, McGrawhill Publications, 2006.
References: 3. Theory of Elasticity by Y.C.Fung. 4. Theory of Elasticity by Gurucharan Singh 5. Theory of Elasticity by Sadhu Singh, Khanna Publishers, New Delhi