I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T6A   THEORY OF ELASTICITY AND PLASTICITY   Credits 4

Lecture: 4 periods/week   **Internal assessment: 40 marks**

Tutorial: - -   **Semester end examination: 60 marks**

COURSE OBJECTIVES:

- To impart knowledge of Principal stresses and strains
- To develop analytical skills of solving problems using plain stress and plain strain.
- To impart knowledge of engineering application of plasticity.

COURSE OUTCOMES:
After completion of the course, student should be able to

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

UNIT-I
ELASTICITY
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.

UNIT-II
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.

UNIT-III
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.

UNIT-IV
PLASTICITY
Physical Assumptions – Yield criteria – Failure theories – Applications of thick cylinder –
Plastic stress strain relationship. Elasto – plastic problems in bending and torsion.

Learning Resources

Text Books
1. Theory of Elasticity (third edition) by Timeshanko, McGrawhill Publications, 2010.
2. Theory of Plasticity (third edition) by J.Chakarbarthy, McGrawhill Publications, 2006.
Reference Books
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