

## (ME 513) THEORY OF PLASTICITY ( *ELECTIVE - I* )

**Objective of the course:**

*Knowledge in the plastic stage stress distributions are very much essential to understand the failure of various materials. This subjects provide the knowledge about behaviour of metals under plastic state and various stress strain relationships existing.*

**UNIT - I**

Introduction : Modeling Uniaxial behavior in plasticity. Index notation, Cartesian tensors. Yield and failure criteria stress deviator tensors, invariants, principal, mean stresses. Elastic strain energy. Mohr's representation of stress in 2 & 3 dimensions. Haigh-westergaard stress space. Equilibrium equations of a body. Yield criteria: Tresca's von Mises rules, Drucker-prager criterion, anisotropic yield criteria.

**UNIT - II**

Strain at point : Cauchy's formula for strains, principal strains, principal shear strains, derivative strain tensor. Strain-displacement relationships. Linear elastic stress strain relations, Generalized Hook's law, nonlinear elastic stress strain relations. Principle of Virtual work and its rate forms, Drucker's stability postulate, normality, convexity and uniqueness for an elastic solid, Incremental stress strain relations.

**UNIT - III**

Criteria for loading and unloading : Elastic and plastic strain increment tensors, plastic potential and flow rule associated with different Yield criteria, Convexity, normality and uniqueness considerations for elastic-plastic materials. Expansion of thick walled cylinder.

**UNIT - IV**

Incremental stress strain relationship: Pradtl-Reuss material model.  $J_2$  deformation theory, Drucker-prager material, General Isotropic materials.

**UNIT - V**

Deformation theory of plasticity: Loading surface, Hardening rules. Flow rule and Druckers stability postulate. Concept of effective stress and effective strain mixed hardening material. Problems.

**TEXT BOOKS:**

1. M. Kachanov, "Fundamentals of theory of plasticity", 4<sup>th</sup> Edition, Courier Dover Publications, 2004.
2. Dr. Sadhu Singh, "Theory of plasticity", 2<sup>nd</sup> Edition, Khanna Publications, 1990.

**REFERENCE BOOK:**

1. J. Chakrabarty, "Theory of Plasticity", 3<sup>rd</sup> Edition, Elsevier Publications, 2006.