Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NCEC513	Theory of Elasticity and Plasticity	3	1	0	4

Course Objective
The primary focus of this course is to explore the theoretical background for the modelling and simulation of the response of elastic and inelastic solids.
Learning Outcomes
Upon successful completion of this course, the students should be able to: ● comprehend the concepts of stress, strain and also the stress-strain relations. ● explore the theories of failure and energy approach. ● understand the buckling, bending, torsion, fatigue and fracture principles.

Unit No.	Topics to be Covered	Contact Hours	Learning Outcome
1	**Analysis of Stress:** Body Force, Surface Force and Stress Vector, Normal and Shear Stress Components, Principal Stresses, Stress Invariants, The State of Stress, Mohr's Circles, Equilibrium Equations, Boundary Conditions.	**7L+3T**	Understand the preliminary concepts of stress
2	**Analysis of Strain:** Deformations, Change in Length of a Linear Element, Rectangular Strain Components, The State of Strain at a Point, Shear Strain Components, Principal Axes of Strain and Principal Strains, Plane State of Strain, Compatibility Conditions.	**7L+3T**	Understand the concept of strain
3	**Stress-Strain Relations for Linearly Elastic Solids:** Hooke's Law, Stress-Strain Relations for Isotropic Materials, Modulus of Rigidity, Bulk Modulus, Young's Modulus and Poisson's Ratio, Relations between Elastic Constants.	**3L+1T**	Understand the stress-strain relations
4	**Theories of Failure or Yield Criteria and Introduction to Ideally Plastic Solid:** Theories of Failure, Factor of Safety in Design, Mohr's Theory of Failure, Ideally Plastic Solid, Yield Locus, Stress-Strain Relations, Saint Venant-Von Mises Equations.	**5L+1T**	Identify the failure theories

Unit No.	Topics to be Covered	Contact Hours	Learning Outcome
5	**Energy Methods:** Hooke's Law and the Principle of Superposition, Maxwell–Betti–Rayleigh Reciprocal Theorem, First Theorem of Castigliano, Theorem of Virtual Work, Kirchhoff 's Theorem, Maxwell–Mohr Integrals.	**5L+2T**	Comprehend energy methods
6	**Bending and Buckling of Beams:** Straight Beams, Asymmetrical Bending, Euler–Bernoulli Hypothesis, Shear Centre, Centre of Flexure, Deflections. Euler's Buckling Load, Beam Columns, Beam Column with a Concentrated Load. Inelastic Bending.	**7L+2T**	Understand bending and buckling of beams
7	**Torsion:** Torsion of General Prismatic Bars–Solid Sections, Torsion of Circular Bars, Torsion of Thin-Walled Tubes, Centre of Twist, Flexural Centre, Inelastic Torsion.	**5L+1T**	Explore torsion of prismatic sections
8	**Fatigue and Fracture Mechanics:** Brittle Fracture, Stress Intensity Factor, Fracture Toughness, Fracture Conditions, Fracture Modes, Bauschinger Effect, Strain Hardening, Crack Growth, Fatigue.	**3L+1T**	Introduce fatigue and fracture mechanics principle
	Total Contact Hours	**42L+14T**	

Text Books:

1. L.S. Srinath. Advanced Mechanics of Solids. Tata McGraw-Hill Publishing Company Limited.
2. A.P. Boresi, R.J. Schmidt. Advanced Mechanics of Solids. John Wiley & Sons Inc.

Reference Books:

1. O. T. Bruhns. Advanced Mechanics of Solids. Springer Berlin, Heidelberg.
2. L. E. Malvern. Introduction to the Mechanics of a Continuous Medium. Prentice-Hall Inc.