ADVANCED SOLID MECHANICS

I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTC02	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

This course introduces the principles of elasticity, components of stresses and strains, differential equations of equilibrium, boundary conditions, compatibility conditions and stress function. This course also covers the two dimensional problems in rectangular coordinates and polar coordinates, Fourier series for two dimensional problems stress distribution symmetrical about an axis, pure bending of curved bars, strain components in polar coordinates, displacements for symmetrical stress distributions, simple symmetric and asymmetric problems, analysis of stress strain in three dimensions, torsion of prismatical bars and plasticity.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The transformation of stresses and strains in two and three Dimensional problems related to structural elements.
II. The Engineering properties of materials, force-deformation and stress-strain relationships.
III. The plastic behaviour of deformable bodies in Cartesian coordinates and polar coordinates.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:		
CO 1	Explain theory of elasticity including strain/displacement and Hooke's law relationships for analysing the structures with in elastic range.	Understand
CO 2	Develop constitutive relationships between stress and strain in linearly elastic solid for analysing the stresses in the field.	Apply
CO 3	Analyze the Stresses and Strains, Strain Displacement and Compatibility Relations for Boundary Value Problems in the Principal Directions.	Analyze
CO 4	Explain the Plane Stress and Plane Strain Problems using Airy's stress Function and Two-Dimensional Problems in Polar Coordinates.	Understand
CO 5	Analyze boundary value problems using Modified Galerkin Method.	Analyze
CO 6	Examine the properties of ideally plastic solids using different yield criterion.	Analyze

IV. SYLLABUS:

MODULE-I: INTRODUCTION TO ELASTICITY (09)

Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.

MODULE-II: STRAIN AND STRESS FIELD (09)
Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.

MODULE-III: EQUATIONS OF ELASTICITY AND TWO-DIMENSIONAL PROBLEMS OF ELASTICITY (09)
Equations of Equilibrium, Stress-Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.

Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.

MODULE-IV: BOUNDARY VALUE PROBLEMS (BVP) (09)
Boundary Value Problems: Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.

MODULE-V: PLASTIC DEFORMATION (09)
Plastic Deformation: Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.

V.TEXT BOOKS:

1. Timoshenko and Goodier, "Theory of Elasticity", McGraw Hill Publishing Company, 3rd Edition, 1970.
2. RagabA.R.,Bayoumi, S.E., "Engineering Solid Mechanics", CRC Press,1st Edition, 1998.
3. Kazimi S. M. A, "Solid Mechanics". Tata McGraw Hill, 2nd Edition, 2017.

VI.REFERENCE BOOKS:

1. SaddM.H, "Elasticity", Elsevier, 3rd Edition, 2014.
2. Ameen. M, "Computational Elasticity", Narosa, 1st Edition, 2008.
3. Srinath, L.S., "Advanced Mechanics of Solids", Tata McGraw Hill, 1st Edition, 2000.

VII. WEB REFERENCES:

1. http://nptel.ac.in/courses/105106049/77
2. https://lecturenotes.in/subject/162/advanced-mechanics-of-solids-amos

VIII. E-TEXT BOOKS:

1. http://nptel.ac.in/courses/105106049/pdf-assignments/main.pdf