ADVANCED SOLID MECHANICS

I Semester: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTB02	**Core**	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

UNIT-I	INTRODUCTION TO ELASTICITY	Classes: 09

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

UNIT-II	STRAIN AND STRESS FIELD	Classes: 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.

UNIT-III	EQUATIONS OF ELASTICITY AND TWO-DIMENSIONAL PROBLEMS OF ELASTICITY	Classes: 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.

UNIT-IV	TORSION OF PRISMATIC BARS	Classes: 09

Torsion of Prismatic Bars: Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.

UNIT-V	PLASTIC DEFORMATION	Classes: 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.

Text Books:

1. Timoshenko and Goodier , "Theory of Elasticity" , McGraw Hill Publishing Company, 1970.
2. RagabA.R.,BayoumiS.E , "Engineering Solid Mechanics"., CRC Press,1999.
3. Kazimi S. M. A, "Solid Mechanics"., Tata McGraw Hill,1994.

Reference Books:

1. SaddM.H , "Elasticity",Elsevier,2005.
2. Ameen.M, "Computational Elasticity", Narosa,2005.
3. KazimiS. M. A, "Solid Mechanics", Tata McGraw Hill,1994.
4. SrinathL.S "Advanced Mechanics of Solids", Tata McGraw Hill,2000.

Web References:

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

E-Text Books:

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