THEORY OF THIN PLATES AND SHELLS

I Semester: M.Tech(ST)

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BSTB03	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

COURSE OBJECTIVES:

The course should enable the students to:

I. Use analytical methods for the solution of thin plates and shells.
II. Use analytical methods for the solution of shells.
III. Apply the numerical techniques and tools for the complex problems in thin plates.
IV. Apply the numerical techniques and tools for the complex problems in shells.

COURSE OUTCOMES (COs):

CO 1	Understand the concept of concepts of Space Curves, surfaces, shell co-ordinates, boundary conditions.
CO 2	Describe the governing equation for a rectangular plate, Navier solution for simply- supported rectangular plate under various loadings, Levy solution for rectangular plate with other boundary conditions.
CO 3	Analyze under axi- symmetric loading, governing differential equation in polar co-ordinates. Approximate methods of analysis- Rayleigh-Ritz approach for simple cases in rectangular plates.
CO 4	Understand the membrane theory of cylindrical, conicaland spherical shells.
CO 5	Understand the cylindrical and conical shells, application to pipes and pressure vessels, thermal stresses in plate/shell.

COURSE LEARNING OUTCOMES (CLOs):

1. Understand the concepts of space curves, surfaces, shell co-ordinates, boundary Conditions.
2. Understand the concept of displacement field approximations, stress resultants.
3. Determination of equation of equilibrium using principle of virtual work.
4. Understand the concept of bending of thin plates and assumptions.
5. Determination of Navier solution for simply- supported rectangular plate under various loadings.
6. Determination of deflection of uniformly loaded simply supported rectangular plate.
7. Solution of Navier and Levy type, large plate loaded at equidistant points by concentrated forces.
8. Understand Basic Relations in Polar Coordinates of Circular Plates.
9. Analyze the use of superposition for the axisymmetric analysis of circular plates.
10. Able to analyze the circular plates on elastic foundation, asymmetric bending of circular plates.
11. Analysis of Rayleigh-Ritz approach for simple cases.
12. Analysis of membrane theory for cylindrical shells.
13. Understand the general theory in bending of cylindrical shell, simplified method for cylindrical shell.
14. Understand the simplified method for cylindrical shell.
15. Understand the thermal stresses in plates/shells.

16. Analyze shells of revolution under axisymmetric loads.
17. Able to analyze the Axisymmetric loaded conical shells.
18. Able to analyze the axisymmetric deformation of toroidal shells.

UNIT-I	**INTRODUCTION**	**Classes: 09**

Space curves, surfaces, shell co-ordinates, strain displacement relations, assumptions in shell theory, displacement field approximations, stress resultants, equation of equilibrium using principle of virtual work, boundary conditions.

UNIT -II	**STATIC ANALYSIS OF PLATES**	**Classes: 09**

Governing equation for a rectangular plate, Navier solution for simply- supported rectangular plate under various loadings, Levy solution for rectangular plate with other boundary conditions.

UNIT-III	**CIRCULAR PLATES**	**Classes: 09**

Introduction, basic relations in polar coordinates, analysis under axi-symmetric loading, governing differential equation in polar co-ordinates.

Approximate methods of analysis: Asymmetrical bending of circular plates, Rayleigh-Ritz approachfor simple cases in rectangular plates.

UNIT-IV	**STATIC ANALYSIS OF SHELLS: MEMBRANE THEORY OF SHELLS**	**Classes: 09**

Introduction, membrane theory, membrane stresses, cylindrical shells under general load and buckling, conical shells and spherical shells.

UNIT-V	**SHELLS OF REVOLUTION: WITH BENDING RESISTANCE**	**Classes: 09**

Cylindrical and conical shells, application to pipes and pressure vessels, thermal stresses in plate/shell, stress-strain and displacement relations, the governing differential equation.

Text Books:

1. Timoshenko S. and Krieger, “Theory of Plates and Shells”, McGraw Hill.
2. Chandra shekhara. K, “Theory of Plates”, Universities Press.
3. Timoshenko ,”Theory of Plates and Shells” , Tata McGraw Hill.

Reference Books:

1. Ugural AnselC, “Stresses in Plates and Shells”, McGraw Hill.
2. Kraus.H, “Thin Elastic Shells”, John Wiley and Sons.

Web References:

1. https://pdfs.semanticscholar.org/presentation/ce6d/b61238325d60d3f6dc0f1fbe7af33e397 2c1.pdf

E-Text Books:

1. https://ocw.mit.edu/courses/mechanical-engineering/2-081j-plates-and-shells spring2007/readings/lecturenote.pdf
2. http://community.wvu.edu/~bpbettig/MAE456/Lecture_10_Shell_Elements_b.pdf