THEORY OF THIN PLATES AND SHELLS

I Semester : ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BSTB03	Elective	3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: 0	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Plates and shells exhibit two dimensional structural actions that result in stronger, thinner and lighter structures and therefore, have economic advantage. This has opened the scope for the wide use of such elements in all fields of engineering due to significant increase of strength/weight ratio. The exposure to this course and its completion are very essential in understanding the behaviour of thin structures for their applications in design.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The Formulation of differential equations for bending of thin rectangular and circular plates.
II. The theory of large deflection of plates for efficient and economical design.
III. The numerical techniques and tools for the complex problems in thin plates.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:		
CO 1	Analyse the analytical solutions for rectangular plates by using Navier and Levy's methods, distributed and concentrated loads	Analyse
CO 2	Explain Governing differential equations in polar coordinate system of a annular plate subjected to different loading conditions for the design of thin plates.	Understand
CO 3	Examine the governing differential equation of rectangular plates on elastic foundations for the design of foundations.	Analyse
CO 4	Outline the general theory in bending of cylindrical shell, simplified method for analysis and design of the shells.	Apply
CO 5	Solve the governing equation of plate bending under the combined action of in plane loading and lateral loads for the design of plates.	Apply
CO 6	Examine the buckling of rectangular plates by compressive forces acting in one and two directions for the analysis of plates.	Analyze

IV. SYLLABUS

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 approach for 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 BENDINGRESISTANCE**	**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. UguralAnsel C,”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-spring-2007/readings/lecturenote.pdf
2. http://community.wvu.edu/~bpbettig/MAE456/Lecture_10_Shell_Elements_b.pdf