

## Theory of Plates & Shells

### 01ST1307 (PEC)

**Objective of the Course:** Objectives of introducing this subject at first year level in Masters of civil engineering are:

- To study the behaviour and analysis of thin plates
- To study the procedure for rectangular plates and circular plates subjected to loads and different boundary conditions.
- To study the classification and behaviour of shells
- To study the membrane analysis of shells

**Course Credit: 3**

**Course outcomes:**

After successful completion of the course, it is expected that student will be able to

1. Understand the behaviour of plates under different types of loads
2. Analyze the plates using various techniques.
3. Classify & understand the behaviour of the different types of shells.
4. Analyze the shells using membrane theory.

#### Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
03	00	00	03	50	30	20	25	25	150

#### Detailed Syllabus

Sr No.	Title of the unit	Number of hours
<b>1</b>	<b>Plates:</b>	<b>26</b>
	Introduction and Background of Plate Theory, General theory of bending of plate, Introduction to thin plates, small deflection theory, Development of strain – displacement relationships - stress-strain relationships – Pure bending of plates – Small deflections of laterally loaded plates. Fourier series of loadings- rectangular plates - Differential equation - Solution of simply supported plates under various loading conditions - Uniformly distributed load – Hydrostatic pressure and a concentrated	

	load - Navier and Levy types of solutions Analysis of circular plate under Axi-Symmetric Loading, Governing Differential Equation in Polar Co-ordinates.	
<b>2</b>	<b>Shells:</b>	<b>16</b>
	Introduction to Shell Structures and Shell Geometry, Definitions and Assumptions, Classification of shells. Membrane theory for surface of revolution, Membrane analysis for cylindrical shell roof, Membrane analysis of circular shells.	
	<b>Total</b>	<b>42</b>

### Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember 10%	Understand 15%	Apply 10%	Analyze 35%	Evaluate 20%	Create 10%

### Instructional Method and Pedagogy:

1. Use of Learning Management system like canvas
2. Demonstration through presentations on power point and videos and lectures
3. Brainstorming and group discussion sessions
4. Collaborative learning

### Recommended Study Material:

#### Reference Book:

1. Timoshenko SP and Krager SW, "Theory of Plates & Shells", 2<sup>nd</sup> Edition 2010, McGraw Hill
2. Ramaswamy G. S, - "Design and construction of concrete shell roof"
3. J.N. Reddy, Theory and Analysis of Elastic Plates and Shells, CRC Press,
4. N. K. Bairagi – "Shell Analysis" Khanna Publishers
5. S.S. Bhavikatti, Theory of Plates and Shells, New-Age International Private Limited.
6. Varghese P. C., "Design of Reinforced Concrete Shells & Folded Plate", 1st Edition, PHI.
7. Kraus H., Thin Elastic Shells, John Wiley and Sons.
8. Chandra shikhara K., Theory of Plates, Universities Press.

### Web Resources

#### Plates and Shells-NPTEL Course

<https://nptel.ac.in/courses/105/103/105103209/>