Course Number: 28583

Course Name: Plate and Shell Theory

Course Type: Theory	Type & Max Unit: Constant 3
Prerequisite: Nothing.	Corequisite: Nothing.
Level: Graduate	First Presentation: 2014-2
Group: Solid Mechanics	Last Edition: 2017-2.

Objectives:

The main objective of this course is to introduce the mechanics of plates and shells as thin-walled elastic surfaces. Thin-walled plates and shells are used in many branches of technology such as in mechanical, civil, and aerospace engineering, where in the case of a suitable design, can support large loads. To this end, the load bearing mechanism, derivation the equations governing small and moderate deformations of these structures and their analytical and approximate methods of solution are presented in this course.

Topics:

1- Theory of plates

1-1- **Small deflection theory of bending**: definition of bending moment, axial force and load bearing mechanism, derivation of equilibrium equations and boundary conditions of a rectangular plate using energy method and Newtonian mechanics.

1-2- Developing solution for cylindrical bending and general bending of rectangular plates under different kinds of loading (Analytical methods and the Ritz method), Analysis of plates on elastic foundation, continuous rectangular plates and plates on elastic columns

1-3- **Buckling of rectangular plates:** Derivation of equations and buckling analysis

1-4- **Circular plates:** Derivation of the equations their solution for axisymmetric and asymmetric bending under various kinds of loading (Analytical and the Ritz method)

1-5- **Plates of various geometrical forms**

1-6- **Vibration of plates and Rayleigh-Ritz method**

1-7- **Bending of orthotropic plates**

2- Theory of shells

2-1- **Introduction:** Different shell theories including membrane theory and different bending theories

2-2- **A review on differental geometry**

2-3- **General theory of thin elastic shells (First approximation theory of Love)**

2-4- **Membrane theory and equlibrium equations of cylindrical, spherical and conical Shells and their solutions in some examples.**

References:

1- A. C. Ugural, Stresses in plates and shells, McGraw-Hill, 1999 (2nd Ed.).

2- J. N. Reddy, Theory and Analysis of Elastic Plates, Taylor & Francis, 1999.

3- S. Timoshenko, S. Woinowsky-Krieger, Theory of Plates and Shells, McGraw-Hill, 1970 (2nd Ed.).

4- E. Ventsel, T. Krauthammer, Thin Plates and Shells, Marcel Dekker, Inc., 2001.

5- C. M. Wang, J. N. Reddy, and K.H. Lee, Shear deformable beams and plates: Relationship with classical solutions, Elsevier Science Ltd. 2000.