Code: ING-IND/14   **Credits: 9**
Matter: Machinery Design
Main language of instruction: Italian
Other language of instruction: English

Teaching Staff

Head instructor
Prof. Riccardo Panciroli - riccardo.panciroli@unicusano.it

Introduction
Primarily objectives of the course are: to understand complicated 3-D stress states for both determinate and indeterminate problems. Learn advance theory of elasticity. Gain fundamental knowledge of bodies in contact. Learn solution methods for the analysis of axisymmetric bodies under complex load states. To teach students how to apply computer based techniques in the analysis, design and/or selection of machine components.

Objectives
The course is organized in several subjects. The main subjects are: bending of Long Rectangular Plates to a Cylindrical Surface. Membrane theory of cylindrical shells; Bending theory of cylindrical shells loaded Symmetrically. Differential equation for cylindrical bending of plates. Rectangular plates under simply supported boundary conditions loaded out of plane by distributed or localized loads. Navier solution and its application to concentrated load – Levy's solution for uniformly distributed load or hydrostatic pressure. Buckling of rectangular plates loaded in-plane. Relations between bending moments and curvature. Strain energy in pure bending. Symmetrical bending of circular plates: Differential equation and Boundary conditions Linear and torsional springs. Joining and fastening methods: design and verifies.

Competences:

- To know how bodies interact utilizing the Hertz's contact theory
- To illustrate the most utilized joining and connections systems
- To know how to design and verify the strength of connections and terminals
- Be able to solve the complex stress state in axisymmetric bodies
- Be able to design and verify springs and elastic elements

- Be able to simplify a complex structures and external loadings into models, and to apply mathematical solutions
- To acquire the abilities to solve problems and make decisions using relevant information, applying the appropriate solution methods.
- The selection, sizing and analysis of springs
- To acquire skills for independent learning.
- To acquire the ability to put knowledge into practice.
- To be able to retrieve and manage information.

Syllabus

Subject 1. Membrane stresses and deformations in axisymmetric bodies
Subject 2. Flexural stresses in Axisymmetric bodies
Subject 3. Rectangular plates: stresses and instability
Subject 4. Rotating discs
Subject 5. Thick cylinders
Subject 6. Connection and joining systems
Subject 7. Springs and elastic elements
Subject 8. Hertz' contact in impact problems

Evaluation system and criteria

The exam is graded on a scale of 30, being 18 the threshold.

The assessments of course is based on the following criteria:

I) **Final exam** (**100%** of grade):

This exam is divided in two sections:

1) 20 multiple choice quiz. (0.5 points if correct, -0.5 if wrong, 0 if skipped). Such quiz is waived for students turning in a series of projects (E-tivities) submitted to the class regularly.

2) Two exercises covering the majority of the course topics. The exercises will be marked not only on the correctness of the final result, but also on the clarity of the solution scheme and on the eventual assumptions made to develop the solution.

Bibliography and resources

Lecture notes by the Professor