

**FS**UNIVERSITY OF LJUBLJANA
Faculty of Mechanical Engineering

Advanced Dynamics (6035-M)

5 ECTS**Lecturer:** G. Čepon, J. Slavič

Lectures: 30h | Tutorials: 10h | Labs: 20h | Project: 65h |

| Lang.: 

Objectives

The objective of this course is to provide students with advanced knowledge of mechanical vibrations and system dynamics, with an emphasis on analytical modelling, physical interpretation of dynamic phenomena, and practical engineering applications. The course aims to deepen the understanding of dynamic response of single- and multi-degree-of-freedom systems subjected to various types of excitation. Special attention is given to experimental methods, vibration testing, and modern optical measurement techniques.

The course will cover:

- Fundamental principles of analytical statics and dynamics
- Dynamic response of systems under periodic and impulsive excitation
- Dynamics of systems with multiple degrees of freedom
- Vibrations of continuous systems
- Practical and experimental aspects of higher dynamics

Programme

- Fundamentals of analytical statics and dynamics: Introduction to analytical modelling and dynamic behaviour of mechanical systems.
- Dynamic response of systems to external excitation: Analysis of system response to periodic and impulsive loading.
- Dynamics of multi-degree-of-freedom systems: Modelling and analysis of mechanical systems with multiple degrees of freedom.
- Vibrations of continuous mechanical systems: Study of vibrations in strings, shafts, and beams.
- Advanced and experimental topics in dynamics: Engineering applications, optical vibration measurement techniques, and nonlinear dynamics.

Prerequisites

To successfully complete this course, students should have:

- Good knowledge of engineering mechanics
- Basic knowledge of dynamics and vibrations
- Basic knowledge of differential equations and linear algebra

Learning outcomes

After attending this course, the student will:

- Understand and analytically model mechanical vibration problems
- Analyse the dynamic response of systems subjected to different types of excitation
- Model and interpret the behaviour of multi-degree-of-freedom systems
- Analyse vibrations of continuous systems such as strings, shafts, and beams
- Understand experimental and optical methods for vibration measurement
- Apply advanced dynamic concepts to practical engineering problem

Assessment

- Written examinations (mid-term tests and final exam)*
- Laboratory work and reports

Literature

- Rao, S. S., *Mechanical Vibrations*, 6th ed., Pearson, 2019.
- Thomson, W. T., Dahleh, M. D., *Theory of Vibration with Applications*, Pearson, 1997.
- Meirovitch, L., *Methods of Analytical Dynamics*, Dover Publications, 2010.