Syllabus

Course Description

Course Title	Dynamics of Mechanical Systems
Course Code	47561
Course Title Additional	
Scientific-Disciplinary Sector	IIND-02/A
Language	English
Degree Course	Master in Industrial Mechanical Engineering
Other Degree Courses (Loaned)	
Lecturers	dr. Veit Gufler, Veit.Gufler@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/38756
Teaching Assistant	
Semester	Second semester
Course Year/s	1
CP	5
Teaching Hours	28
Lab Hours	18
Individual Study Hours	79
Planned Office Hours	15
Contents Summary	- Introduction and fundamentals of mechanical vibrations - Free and forced vibration of single degree-of-freedom systems - Free and forced vibration of multiple degree-of-freedom systems - Numerical and experimental methods in vibration analysis
Course Topics	The course provides a comprehensive introduction to the theory and analysis of mechanical vibrations. It begins with the fundamental concepts of kinematics, dynamics and the modeling of vibrating mechanical systems. The free and forced vibration response of single degree-of-freedom systems is studied in detail, including undamped and damped vibration, resonance, harmonic

	excitation, vibration isolation and the formulation of equations of motion using energy-based methods. The course then extends these concepts to multiple degree-of-freedom systems, covering free and forced vibration, modal analysis and an introduction to the dynamic behavior of continuous systems. In addition, numerical methods for vibration analysis are introduced and applied to practical engineering problems. The course concludes with an overview of experimental vibration analysis, including measurement techniques and experimental modal analysis for the identification and characterization of dynamic system properties.
Keywords	Dynamic systems, mechanical vibrations, frequency response, resonance, modal analysis
Recommended Prerequisites	
Propaedeutic Courses	Fundamentals of mechanics and mathematics learned in bachelor's degree studies of mechanical engineering.
Teaching Format	Frontal lectures, hand calculation exercises, computer exercises, laboratory exercises.
Mandatory Attendance	Not mandatory but strongly recommended.
Specific Educational Objectives and Learning Outcomes	Knowledge and Understanding: - Fundamentals of mechanical vibrations and dynamic system behavior - Free and forced vibration of single and multiple degree-of-freedom systems - Fundamentals of numerical and experimental vibration analysis Applying Knowledge and Understanding: - Analysis and evaluation of the dynamic behavior of mechanical systems - Application of analytical, numerical and experimental methods for vibration analysis Making Judgements: - Selection of appropriate analytical, numerical and experimental methods - Interpretation and assessment of numerical and experimental results Communication Skills:

	- Analysis and discussion of technical documentation - Discussion of technical problems and solution concepts Learning Skills: - Independent deepening of course content through the use of scientific and technical literature - Familiarization with advanced methods in vibration analysis
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	The assessment is based on a written examination consisting of numerical exercises accounting for 60 % of the final grade and theoretical questions accounting for 40 %.
Evaluation Criteria	The assessment criteria for the numerical exercises are the correctness of the solution procedure and the results. The assessment criteria for the theoretical questions are based on knowledge of the course topics, the clarity and relevance of the answers, command of the language of instruction, and the ability to exercise independent judgment. The weighting of each numerical exercise and theoretical question is specified in the written examination.
Required Readings	• Notes taken during lecture • Lecture slides
Supplementary Readings	• S. G. Kelly. Mechanical vibrations: Theory and applications. San Diego: Cognella, 2022 • T. L. Schmitz and K. S. Smith. Mechanical vibrations: Modeling and measurement. Cham: Springer, 2021. https://doi.org/10.1007/978-3-030-52344-2
Further Information	
Sustainable Development Goals (SDGs)	Quality education, Industry, innovation and infrastructure, Affordable and clean energy