Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	Mechanical Vibrations
Course code	47506
Scientific sector	ING-IND/13
Degree	Master in Industrial Mechanical Engineering – Major Mechanics and Automation
Semester	I
Year	II
Academic year	2019-2020
Credits	5 ECTS
Modular	No

Total lecturing hours	28
Total lab hours	10
Total exercise hours	8
Attendance	Recommended
Prerequisites	Fundamentals of mechanics and dynamics from bachelor degree studies of mechanical engineering
Course page	See Online Learning Environment ole.unibz.it

Specific educational objectives	Understanding and knowledge of the fundamentals for both the theoretical as well as the experimental sides of mechanical vibration. This includes the mathematical modeling of dynamical problems, the solving of these derived mathematical models and understanding of the results. Furthers, the students will gain practical experience of mechanical vibrations in laboratory.

Lecturer	Dr.-Ing. Erich Wehrle
Scientific sector of the lecturer	ING-IND/13
Teaching language	English
Office hours	See timetable online: www.unibz.it/en/timetable/ and by appointment
Teaching assistant (if any)	Dott. Ric. Ilaria Palomba
Office hours	See timetable online: www.unibz.it/en/timetable/ and by appointment
List of topics covered	Introduction, review and preliminaries: • Modeling of dynamic systems • Free-body diagrams • Statics of rigid bars • Analytical mechanics One-degree-of-freedom systems • Undamped free vibrations • Damped free vibrations • Forced vibrations

	• Shock • Transient responses Multiple-degree-of-freedom systems • Undamped free vibrations • Damped free vibrations • Forced vibrations • Shock • Transient responses Continuous systems • Approximation via the finite-element method • Vibrations of beams • Modes of beams Experimental vibration measurement • Measurement of vibrational responses • Introduction to laboratory equipment and software • Sensors including accelerometers, • Sampling and filtering • Set-up and carrying out dynamical experiments
Teaching format	Frontal lectures, hand-calculation exercises, computer exercises, laboratory exercises, group project

Learning outcomes	<u>Knowledge and understanding</u> 1. Knowledge and understanding of the fundamentals of mechanical vibrations. <u>Applying knowledge and understanding</u> 2. Applying knowledge and understanding to analyze dynamical components, structures and systems. <u>Making judgments</u> 3. The structural-mechanical design under consideration of dynamical considerations including vibrations requires understanding and ability to make judgments based on theory and experiments <u>Communication skills</u> 4. Communication skills to convey and transfer understanding of mechanical vibrations. 5. Communication skills to explain results of dynamical analysis and their consequences to structural-mechanical design <u>Ability to learn</u> 6. Learning skills to independently study the specific fields of mechanical vibrations for applications beyond this lecture.

Assessment

Formative assessment:

Form	Details	Learning outcomes assessed
In-class exercises	Continuously in exercise courses	1, 2, 3, 4, 5

Summative assessment:

Form	%	Details	Learning outcomes assessed
Written exam	75%	2 h	1, 2, 3, 4, 5
Group project	25%	In teams of 2–3 students, practical project based on laboratory experiments culminating in a written report (ca. 5 pages) and a presentation (ca. 15 min)	1, 2, 3, 4, 5, 6

Assessment language

English

Evaluation criteria and criteria for awarding marks

Written examination will include analytical and numerical examples to show ability to solve vibrational problems as well as knowledge-based questions to show understanding of the material.

Form	Evaluation criteria and weight
Written examination (75%)	Theoretical knowledge (35%) Correctness of methods (30%) Correctness in solution (30%) Appropriate use of units (5%)
Group project (25%)	Understanding of project goals (10%) Correctness of methods (30%) Correctness in results (30%) Communication of results (30%)

Required readings	Lecture slides and notes
Supplementary readings	Schmitz, T. L. and Smith, K. S. (2012) Mechanical vibrations, Springer. Rao, S.S. (2016) Mechanical vibrations , Pearson. Den Hartog, J. P. (1985) Mechanical Vibrations, Dover. Magnus, K., Popp, K., Sexto, W. (2013) Schwingungen: Physikalische Grundlagen und mathematische Behandlung von Schwingungen, Springer. Giovagnoni, M. (2009) Analisi delle vibrazioni nei sistemi meccanici, Edizioni Libreria Cortina.