Syllabus

Course Description

Course Title	Fundamentals of Machine Design
Course Code	42178
Course Title Additional	
Scientific-Disciplinary Sector	IIND-03/A
Language	German
Degree Course	Bachelor in Industrial and Mechanical Engineering
Other Degree Courses (Loaned)	
Lecturers	Prof. Franco Concli, Franco.Concli@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/34279
Teaching Assistant	
Semester	First semester
Course Year/s	3
CP	6
Teaching Hours	36
Lab Hours	24
Individual Study Hours	90
Planned Office Hours	18
Contents Summary	The course aims to provide the tools and methods used in structural safe design of components present in any mechanical system. - Equilibrium of complex structures - Stresses and strains, stress intensification (Kt) - Material characterization - Constitutive law - Traction test - Von Mises equivalent stress - Fatigue - Wöhler diagram, Multiaxial fatigue criteria.
Course Topics	- Fundamentals of machine component design: general concepts about machine element damaging and failure.

	- Stress and strain field definitions: tensors and Mohr's circle description. Elastic constitutive relations: Hooke's Laws. Elasto-plastic behavior of ductile materials under simple loading conditions. - Static mechanical behavior of materials and their assessment through the tensile test. - Static design criteria: definition of equivalent, limit and admissible stresses. Meaning and use of the safety factor. Failure criteria for ductile and brittle materials. Comparison among the principal failure criteria. - High-Cycle fatigue criteria: General description of cyclic loading and fatigue damage. Laboratory tests for materials fatigue assessment. Factors that affect fatigue behavior of materials and machine elements. Fatigue curves. Fatigue failure theories and design criteria. - Cumulative damage: Palmgreen-Miner, Coffin-Manson damage rules. - Exercises on actual design case studies.
Keywords	Machine Elements
Recommended Prerequisites	
Propaedeutic Courses	
Teaching Format	Frontal lectures, exercises (Exercises, case studies and computer lab), excursions.
Mandatory Attendance	Required.
Specific Educational Objectives and Learning Outcomes	Criteria for strength assessment are addressed, under static and time-varying loading conditions. The most common and widely used mechanical components are then analyzed. Modern software for structural design and analysis is introduced and used, to address some actual case studies. Intended Learning Outcomes (ILO): By the end of the course, students should be able to: Knowledge and understanding 1. Handle the analysis methods used in structural design of mechanical systems. Applying knowledge and understanding 2. Know how to face a new project of a mechanical system starting from its functional design.

	Making judgements 3. Identify the critical zones and the corresponding stress states of all components of a mechanical system, under service loading conditions. 4. Choose the geometry and materials able to satisfy the requirements of each component in terms of strength, deformation, fatigue life, and so on and realizing the technical drawing of the system. Communication skills 5. Oral communication skills (technical language) Ability to learn 6. Ability to autonomously extend the knowledge acquired during the study course by reading and understanding.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	- Summative assessment: 50% written exam, exercises: 3/4 exercises (2.5 hours); ILOS assessed: 2, 3, 4; 50% oral exam, theory: open-ended questions - Theoretical knowledge (40%) - Ability to provide examples/applications of the theoretical concepts (30%) - Ability to establish relationships between topics (20%) - Mastery of language (also with respect to teaching language) (10%) ILOs assessed: 1, 5, 6.
Evaluation Criteria	The final mark will be obtained combining the evaluations of the final written test and of the oral examination.
Required Readings	Lecture notes and documents for exercise will be available on the OLE.
Supplementary Readings	ISSLER L., RUOß H: HÄFELE P., Festigkeitslehre – Grundlagen, Springer (GER) BERNASCONI A., FILIPPINI M., GIGLIO M., LO CONTE A., PETRONE G., SANGIRARDI M., Fondamenti di costruzione di macchine, McGraw-Hill (ITA)

	+ DAVOLI P., VERGANI L., BERETTA S., GUAGLIANO M., BARAGETTI S., Costruzione di macchine 1, McGraw-Hill (ITA) Shigley's Mechanical Engineering Design, McGraw-Hill (ENG)
Further Information	
Sustainable Development Goals (SDGs)	Industry, innovation and infrastructure, Quality education