Syllabus

Course Description

Course Title	Advanced topics on machine design
Course Code	47555
Course Title Additional	
Scientific-Disciplinary Sector	IIND-03/A
Language	English
Degree Course	Master in Industrial 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	Second semester
Course Year/s	1
CP	5
Teaching Hours	32
Lab Hours	12
Individual Study Hours	81
Planned Office Hours	
Contents Summary	The course aims to introduce the design mind-set and the main methods for the design of mechanical systems, to provide exposure to the practice of design through application and to encourage understanding of the broader implications of design. Students will learn, in the first module, fundamental concepts and methodologies for understanding and modelling mechanical systems. In the second module, the theory of numerical finite element methods is introduced. Emphasis is given to practical applications, especially considering the advantages achievable with the latest technologies.

Course Topics	PART 1: Material behavior and basic concepts 1. Principle of virtual work 2. Force Method for the solution of Hyperstatic Structures 3. Multi-axial fatigue criteria a. Critical plane concepts 4. Low cycle fatigue of materials a. Masing Hp. b. Ramberg-Osgood eq. c. Neuber Hp. d. Basquin-Coffin-Manson eq. e. Loading spectra PART 2: Machine Elements 5. Shafts and shaft components a. Interference fits (shaft-hub connection) b. Deflections 6. Gears a. Failure modes (bending - pitting - micro pitting - scuffing) b. Gear types (spur - helical - bevel - worm) c. Gear configurations (parallel axis, orthogonal axis, planetary) d. Synthetic factors (sizing) e. Strength calculation (ISO 6336) f. Gear stiffness (Deformation under load) g. Examples of gearboxes (motorcycle and car transmissions) 7. Bolted connections (screwed joints) a. Pretension b. Tearing c. Sheet yielding 8. Welded connections a. Pressure vessel.
Keywords	Machine elements
Recommended Prerequisites	Machine Design.
Propaedeutic Courses	
Teaching Format	The topics are presented by the professor by means of Power Point presentations or the blackboard. A selection of the material presented in class as well as online resources and useful material will be available in the OLE database/. Further deepening material will be supplied or recommended by

	the teacher.
Mandatory Attendance	Recommended
Specific Educational Objectives and Learning Outcomes	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 realize the technical drawing of the system. Communication skills: 5) Oral communication skills (technical language) Learning skills: 6) Ability to autonomously extend the knowledge acquired.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	- Formative assessment In class and exercises and activities (2,3,4) - Summative assessment The assessment of the course is: • Written exam 3/4 exercises • Oral Exam 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%).
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 reserve collections There is no single textbook that covers the entire course. The course material is collected from various sources that will be announced during the course. A selection of the material presented in class and useful material will be available in the course reserve collection database.
Supplementary Readings	R.S.KHURMI AND J.K. GUPTA, A Textbook of Machine Design, S Chand (ENG) Shigley's Mechanical Engineering Design, McGraw-Hill (ENG) G. NIEMANN, H. WINTER, Maschinenelemente, Springer (GER) P. HAEFELE, L. ISSLER, H. RUOSS, fertigkeitslehre – Grundlagen, Springer (GER) P. DAVOLI, M. FILIPPINI, C. GORLA, A. LO CONTE, Lezioni sugli organi di macchine, Politecnica (ITA) P. DAVOLI, A. BERNCASCONI, M. FILIPPINI, S. FOLETTI, Comportamento meccanico dei materiali, McGraw-Hill (ITA)
Further Information	
Sustainable Development Goals (SDGs)	Industry, innovation and infrastructure, Quality education