Syllabus

Course Description

Course Title	Mechanics of Machinery
Course Code	42137
Course Title Additional	
Scientific-Disciplinary Sector	ING-IND/13
Language	Italian
Degree Course	Bachelor in Industrial and Mechanical Engineering
Other Degree Courses (Loaned)	
Lecturers	Prof. Andrea Giusti, Andrea.Giusti@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/47728
Teaching Assistant	
Semester	First semester
Course Year/s	3
CP	10
Teaching Hours	60
Lab Hours	36
Individual Study Hours	154
Planned Office Hours	24
Contents Summary	- Mechanisms, degrees of freedom, kinematic pairs, kinematic scheme of a mechanism. - Kinematic analysis of (planar) mechanisms: position, velocity, acceleration - Static and dynamic analysis of (planar) mechanisms. Lagrange's equations. - One degree of freedom mechanisms in periodic regime - Mechanical transmissions and components (kinematics and transmitted forces/torques) - Flexible power transmission elements (belts, ropes and chains) - Fundamentals of mechanical vibrations

Course Topics	Introduction and fundamentals. Basic concepts and definitions for the study of mechanisms. Degrees of freedom, kinematic pairs and structure equation. Kinematic analysis of planar mechanisms. Kinematic analysis of position, velocity and acceleration (by base and dyads mechanisms). Singular configurations. Introduction to 3D kinematics. Examples. Static and dynamic analysis of planar mechanisms. Recalls on Newtonian and Lagrangian approach. Newtonian and Lagrangian methods for the static analysis of planar mechanisms. Application examples. D'Alembert's principle. Equation of dynamic equilibrium for mechanisms. Lagrange's equation. Inertia reduced to the free coordinate. One degree of freedom mechanisms in periodic regime. Flywheel design, balancing of a slider-crank mechanism. Application examples. Transmission gears and other mechanical components. Description of the most common elements of machines (kinematics and exchanged and transmitted forces). Wheels. Gears. Toothed gears. Ordinary and epicyclic gearings. Screws and their applications. Flexible elements: Belts and chains. Overview of: joints, clutches, brakes. Comparison of different drives. Fundamentals of mechanical vibrations. Introduction to mechanical vibrations. Vibrations of one degree of freedom systems. Undamped and damped harmonic oscillators. Free and forced vibrations.
Keywords	Mechanisms, Mechanical Systems, Kinematics, Statics, Dynamics
Recommended Prerequisites	Mechanics of Structures.
Propaedeutic Courses	
Teaching Format	The topics are presented by the professor by means of Power Point presentations or the blackboard. Practical parts and lab activities/exercises (e.g., Matlab, WorkingModel, Simscape Multibody or MSC Adams) are planned. A selection of the material presented in class and useful material will be available in the course reserve collection database.
Mandatory Attendance	Attendance is not compulsory.
Specific Educational	The course belongs to the type "caratterizzanti" – areas:

Objectives and Learning Outcomes	mechanics and automation. It aims at teaching both scientific foundations and practical methods. The course aims at introducing the basis for understanding the principles of the applied mechanics. Students will learn, in the first part of the course, fundamental concepts and methodologies for the kinematic and dynamic study of mechanisms; in the second part of the course, they will acquire knowledge and competences on properties and characteristics of the main machine components, and on mechanical vibrations. Knowledge and understanding 1. Knowledge and understanding of applied mechanics fundamentals 2. Knowledge and understanding of the main mechanical components and their applications Applying knowledge and understanding 3. Ability to formulate the equilibrium conditions for a mechanical system 4. Ability to apply the learned principles in the study of planar mechanisms 5. Ability to apply the learned principles to design mechanical components and transmissions from a kinematic point of view Making judgements 6. Making judgments for choosing the suitable mechanical component or kinematic solution Communication skills 7. Ability to present the acquired knowledge and competences with a proper language Learning skills 8. Ability to autonomously extend the knowledge acquired during the study course.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	- Summative assessment. Written exam with exercises and questions: 60% written exam, exercises: 2 exercises (100 minuti); ILOs assessed 1 - 8; 40% written exam, theory: 4 open questions (80 minuti); ILOs

	assessed: 1,2,4,6,7. - Optional midterm test on the first part of the course, consisting of questions and an exercise: 60% optional midterm written test:1 exercise (50 minutes); ILOs assessed: 1 - 5, 8; 40% optional midterm written test, theory: 2 questions. (40 minutes); ILOs assessed: 1-3, 8. The result of the optional midterm test, if sufficient (>=18/30), may be considered, for the entire academic year, as the grade for the first part of the course content. In this case, the final written exam result will be computed as the arithmetic mean of the optional midterm test result and the written exam result for the second part of the course.
Evaluation Criteria	Theoretical knowledge (35%) Correctness of methods (35%) Correctness in solution (30%)
Required Readings	Notes from the lectures Handouts provided by the lecturer. Subject Librarian: David Gebhardi, David.Gebhardi@unibz.it and Ilaria Miceli, Ilaria.Miceli@unibz.it
Supplementary Readings	M. Callegari, P. Fanghella, F. Pellicano, Meccanica applicata alle macchine, Ed. Utet Università. M. Giovagnoni, A. Rossi, Una introduzione allo studio dei meccanismi, Ed. Cortina, Padova G. Jacazio, S. Pastorelli, “Meccanica applicata alle macchine”, Ed. Levrotto e Bella, Torino
Further Information	Software used (possible): Matlab, WorkingModel, Simscape Multibody or MSC Adams.
Sustainable Development Goals (SDGs)	Industry, innovation and infrastructure, Decent work and economic growth