Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	Applied Mechanics and Technologies for Energy Efficiency
Course code	47509
Scientific sector	Ing-Ind/13
Degree	Master in Industrial and Mechanical Engineering LM-33
Semester	I
Year	1
Academic year	2017/2018
Credits	5
Modular	Yes

Total lecturing hours	28
Total lab hours	
Total exercise hours	18
Attendance	
Prerequisites	students should be familiar with the basic knowledges of solid mechanics and mathematical analysis.
Course page	https://www.unibz.it/en/faculties/sciencetechnology/master-industrial-mechanical-engineering/

Specific educational objectives	The course aims at giving the guidelines for the functional design of automatic machines, in particular taking into account mechanical and energetic efficiency. Criteria and methods to analyze and choose mechanical devices, design motion laws and to evaluate the best system to minimize the energy consumption in electromechanical systems will be addressed.

Lecturer	Roberto Belotti
Scientific sector of the lecturer	ING-IND/13
Teaching language	English
Office hours	By appointment
Teaching assistant *(if any)*	Davide D'Amico
Office hours	
List of topics covered	• Introduction: The functional design. Introduction to functional design, classification of the mechanisms and motion systems. • Basic concepts and definitions. Mechanical efficiency, performance, energy efficiency and energy savings in automatic machines. Retrograde motion and motor-load systems. • Energy storage systems and energy recovery. Classification (working principle and scope of use). • Mechanical components for transfer and

	transformation of energy. Classification based on function, working principle and performance/efficiency. • Transmissions, articulated mechanisms and mechanisms for machine tools and assembly lines. • Transmissions, gears and brakes for renewable energy systems (e.g. wind). • Optimization aimed at improving the quality of motion and efficiency. • Motion planning and optimization. Classification and choice. • Motion laws implemented in automatic machines: analysis of the main requirements in the design of a motion law (e.g. acceleration, velocity, vibration, torque limits) and optimization (e.g. modified laws, polynomial, minimum time, jerk, energy). • Motion planning and optimization for renewable energy systems (e.g. tracking, guidance, active and passive systems).
Teaching format	Frontal lectures, exercises, labs
Learning outcomes	**Knowledge and Understanding** • Identify the main components and sources of inefficiency in motor-transmission-load systems • Understand the basic principles of the main energy storage, recovery and redistribution systems; **Applying knowledge and understanding** • Evaluate and select, from the mechanical and energy efficiency point of view, the proper transmission system; **Making judgments** • Select and design an effective motion law under different working conditions and targets; • Choose suitable and proper mechanical components for energy transformation and transfer **Communication skills** • Ability to structure and prepare scientific and technical documentation **Learning skills** • Ability to autonomously extend the knowledge acquired during the study course by reading and understanding scientific and technical documentation.
Assessment	Written exam and written project work
Assessment language	English
Evaluation criteria and criteria for awarding marks	The final grade is the written exam grade, augmented or diminished by at most 3 points, according to the project work evaluation. N.B. The written exam grade must be ≥18 anyway.
Required readings	Lecture/Course notes
Supplementary readings	