Syllabus

Course Description

Course Title	Applied Energetics
Course Code	45545
Course Title Additional	
Scientific-Disciplinary Sector	IIND-07/A
Language	English
Degree Course	Master in Energy Engineering
Other Degree Courses (Loaned)	
Lecturers	Dr. Ing. Fabian Ernst Ochs, FabianErnst.Ochs@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/32732 dr. Stefano Piazzi, Stefano.Piazzi@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/38511
Teaching Assistant	
Semester	First semester
Course Year/s	1
CP	6
Teaching Hours	36
Lab Hours	24
Individual Study Hours	90
Planned Office Hours	
Contents Summary	The Applied Energetics course is a core teaching in the context of the Master in Energy Engineering and, specifically, it deals with the fundamentals of applied engineering thermodynamics and heat transfer and energy resources and systems. The course consists of two parts. The first part covers topics related to the fundamentals of

	thermodynamics (First and Second Law of Thermodynamics), Heat Transfer, Real Working Fluids, Psychrometrics, Heat Exchanger, Thermodynamic Cycles/ Heat Pumps. Based on the deepened understanding of the concepts of thermodynamics and heat transfer, students are introduced to numerical concepts. The second part introduces the main energy resources, the global energy mix, different energy scenarios and energy market having a look at the most reliable bibliographic sources for retrieving these data. Nuclear energy systems are then thoroughly presented. In the last part of the course, an overview on different techniques for analyzing energy systems and specifically nuclear power plant is proposed, considering the economical (different energy economics indicator), the environmental (LCA analysis) and the technical (exergy analysis) point of view, combined with the heat and mass transfer analysis presented in the first part of the course.
Course Topics	The first part of the course will cover the following topics: • Repetition of basic thermodynamics concepts, First and, Second Law, material properties • Heat transfer (conduction, convection, radiation) • Mass transfer • Components of energy systems (heat exchanger, cooling tower, heat pumps) The second part of the course is intended to give the students an overview of the different energy systems with a focus nuclear energy and different analysis techniques. The following topics will be covered: • Energy resources and scenarios • Energy market • Nuclear energy systems • Economic analysis of energy systems • Environmental analysis of energy systems • Exergy analysis of energy systems
Keywords	Thermodynamics; Heat transfer; Mass transfer; Energy resources; Energy systems
Recommended Prerequisites	None.
Propaedeutic Courses	
Teaching Format	The course consists of lectures in which the topics are presented

	by the professor. There are also classes (exercises) that will give practical examples of the application of theoretical topics. Course topics will be presented on the blackboard and using electronic slides. Teaching material and additional materials will be provided by the Professor during the semester.
Mandatory Attendance	Not mandatory.
Specific Educational Objectives and Learning Outcomes	Intended Learning Outcomes (ILO): Knowledge and understanding: Students should acquire the knowledge and the understanding of: 1. Applied thermodynamics and heat and mass transfer, with/without phase change. Knowledge of key factors for different thermal devices and systems, in particular, heat exchangers and heat pumps. 2. Energy resources and energy systems 3. Energy systems analysis Applying Knowledge and understanding: 4. The ability to analyze the technical approach to thermodynamic problems of different appliances (space heating surfaces, heat pumps …). The exercise part provides instruction on the calculation methods for thermodynamic problems as well as the calculation of various explicit examples on the whiteboard and with computers. 5. The ability to analyze energy systems from different perspectives. Making judgements: 6. Autonomous judgement will be enhanced by means of the knowledge of basic concepts and analytical approaches applied to thermodynamic systems. Communication skills: 7. the ability to correctly and properly present the concepts acquired in the course both in written and oral form 8. the ability to use the proper technical terms to describe the topics covered during the course Ability to learn:

	9. Capability of autonomous study of heat and mass transfer phenomena and mechanisms applied in thermal devices and systems.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	The student is asked to produce project work on the design of an energy system presented during the course; this part of the assessment evaluates the ability of the student to apply the topics of the course in actual contexts, the comprehension of the theoretical concepts and the ability to make judgments. - Summative assessment: 100% project work presentation: presentation and discussion (30 minutes); ILOs assessed: 1,3,4,5,6,7,8,9.
Evaluation Criteria	Students regularly enrolled in the 1st year of the Master in Energy Engineering are eligible for the attendance of the lessons and the exam. Other exceptional cases have to be discussed with the Professor. The project work will be presented in front of the class at the end of the course and will be evaluated according to different criteria: • difficulty of the chosen solution • details of the analysis • communication skills and master of the technical language
Required Readings	Slides of the course.
Supplementary Readings	Müller, I., Müller, W. 2009, Fundamentals of Thermodynamics and Applications: With with Historical Annotations and Many Citations from Avogadro to Zermelo, Springer Verlag VDI Wärmeatlas, Springer Verlag Nellis, G., Klein, S., Heat Transfer, 2008 Cambridge University Press

	Baehr, H.D., Kabelac, St. 2005, Thermodynamik, Springer Verlag P.K. Nag, 2005, Engineering Thermodynamics, Tata McGraw-Hill Education
Further Information	
Sustainable Development Goals (SDGs)	Affordable and clean energy, Climate action, Sustainable cities and communities, Industry, innovation and infrastructure