

## Syllabus

### Course description

<b>Course title</b>	Applied Energetics
<b>Course code</b>	45545
<b>Scientific sector</b>	ING-IND/10
<b>Degree</b>	Master Energy Engineering
<b>Semester</b>	I
<b>Year</b>	1
<b>Academic year</b>	2024/25
<b>Credits</b>	6
<b>Modular</b>	No

<b>Total lecturing hours</b>	36
<b>Total lab hours</b>	
<b>Total exercise hours</b>	24
<b>Attendance</b>	Not mandatory
<b>Prerequisites</b>	None
<b>Course page</b>	<a href="https://www.unibz.it/en/faculties/engineering/master-energy-engineering/course-offering/?academicYear=2024">https://www.unibz.it/en/faculties/engineering/master-energy-engineering/course-offering/?academicYear=2024</a>

<b>Specific educational objectives</b>	<p>This course covers the topics related to the fundamentals of thermodynamics (Zeroth and First Laws of Thermodynamics, Ideal gases), the Second law of Thermodynamics, Heat Transfer, Real Working Fluids, Mixtures and Moist Air, Thermodynamic Cycles without and with Phase Change, Heat Exchanger, Heat Pumps, Mass Transfer. Emphasis is laid on the deeper technical understanding of thermodynamic problems including the apparatus.</p>
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<b>Lecturers</b>	Prof. Ochs Fabian Ernst/Dr. Stefano Piazza
<b>Scientific sector of the lecturer</b>	ING-IND/10
<b>Teaching language</b>	English
<b>Office hours</b>	Appointment by email
<b>Teaching assistant (if any)</b>	
<b>Office hours</b>	
<b>List of topics covered</b>	<p>Repetition of basic thermodynamics concepts, Introduction EES/Matlab, Second Law, thermodynamic cycles, Heat Pump (basic thermodynamics), Psychrometrics, Introduction to Matlab/CoolProp, Mixtures, Mass Transfer.</p> <p>Heat transfer (conduction, convection, radiation), Heat exchanger, Combustion, heat pumps (applied thermodynamics, how components realize technically the thermodynamic process)</p>

<b>Teaching format</b>	Oral presentation and exercises
<b>Learning outcomes</b>	<p>The learning outcomes need to refer to the Dublin Descriptors:</p> <p><b>Knowledge and understanding</b>  Knowledge of basics of 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.</p> <p><b>Applying Knowledge and understanding</b>  Analyzing 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 white board and with computers.</p> <p><b>Making judgements</b>  Autonomous judgement will be enhanced by means of the knowledge of basic concepts and analytical approaches applied to thermodynamic systems.</p> <p><b>Communication skills</b>  The student will be able to discuss the learned knowledge with vocabulary and technical terms of the discipline.</p> <p><b>Ability to learn</b>  Capability of autonomous study of heat and mass transfer phenomena and mechanisms applied in thermal devices and systems.</p>
<b>Assessment</b>	Written examination
<b>Assessment language</b>	English
<b>Evaluation criteria and criteria for awarding marks</b>	The knowledge and the ability to apply knowledge will be assessed through written examination, aimed also at checking the ability to use the correct technical vocabulary and analyze thermodynamic and heat and mass transfer problems.
<b>Required readings</b>	Lecture book
<b>Supplementary readings</b>	<p>Müller, I., Müller, W. 2009, Fundamentals of Thermodynamics and Applications: With with Historical Annotations and Many Citations from Avogadro to Zermelo, Springer Verlag</p> <p>VDI Wärmeatlas, Springer Verlag</p> <p>Nellis, G., Klein, S., Heat Transfer, 2008 Cambridge</p>

	University Press	
	Baehr, H.D., Kabelac, St. 2005, Thermodynamik, Springer Verlag	
	P.K. Nag, 2005, Engineering Thermodynamics, Tata McGraw-Hill Education	