

Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Applied Mechanics and Technologies for Energy Efficiency
Code der Lehrveranstaltung	45531
Zusätzlicher Titel der	
Lehrveranstaltung	
Wissenschaftlich-	
disziplinärer Bereich	
Sprache	Englisch
Studiengang	Master in Energie-Ingenieurwissenschaften
Andere Studiengänge (gem. Lehrveranstaltung)	
Dozenten/Dozentinnen	Prof. Dr. Erwin Rauch,
	Erwin.Rauch@unibz.it
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	staff/person/17786
	Dott. Roberto Belotti,
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	https://www.unibz.it/en/faculties/engineering/academic-
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	Dott. Davide Don,
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	staff/person/49990
Wissensch.	
Mitarbeiter/Mitarbeiterin	
Semester	Erstes Semester
Studienjahr/e	2
KP	12
Vorlesungsstunden	68
Laboratoriumsstunden	48
Stunden für individuelles Studium	0



Vorgesehene Sprechzeiten	
Inhaltsangabe	Module 1 - Basic knowledge about the main features of power generation, storage, and distribution plants.
	Module 2 - The course aims to give guidelines for the functional design of automatic machines, in particular taking into account mechanical efficiency. Criteria and methods to analyze and choose mechanical devices, design motion laws and evaluate the best system to minimize energy dissipation in electromechanical systems will be addressed.
Themen der	Module 1:
Themen der Lehrveranstaltung	Basic knowledge about the main features of power generation, storage, and distribution plants. Examination of the production processes (both conventional and advanced) used to yield components and assemblies in the energy engineering field, including: a) gas power generation plants. b) solar power plants. c) eolic plants. d) tanks and pressure containers for energy storage. e) tube and piping for energy distribution. f) electric energy distribution. Module 2: Introduction: Introduction to functional design, classification of
	 basic concepts and definitions. Mechanical efficiency, performance, energy efficiency and energy savings in automatic machines. Direct/reverse energy flow and motor—load systems. be Mechanical components for transferring and transforming energy. Classification is based on function, working principle as well as performance and efficiency. coptimization is aimed at improving the quality of motion and efficiency. Energy storage systems and energy recovery. Classification (working principle and scope of use). Classification of motion laws implemented in automatic machines. An analysis of the main requirements in the design of motion law and its optimization.

Stichwörter	Mechanical elements of energy plants; tanks; tubes and piping; mechanical functional design; automatic machines
Empfohlono	
Empfohlene Voraussetzungen	Module 1: students should be familiar with the basic knowledge of mathematical analysis.
	Module 2: Some knowledge of electrical machines is preferred, e.g.
	the content of the course "Electric Power Conversion Equipment".
Propädeutische	
Lehrveranstaltungen	
Unterrichtsform	The course is based on hours of frontal lectures and hours
	dedicated to classroom and/or laboratory activities. The topics of
	the course are reported in the lecture notes provided by the
	professor, as well as in the textbooks of the bibliography. After
	each lecture, the corresponding pdf presentation will be posted in
	the Reserve Collection database. The professor can also provide
	additional material (e.g., research papers). The professor can be
	contacted by students for questions and clarifications by
	appointment.
Anwesenheitspflicht	Strongly recommended.
Spezifische Bildungsziele	- Module 1:
und erwartete	Knowledge and understanding:
Lernergebnisse	Students will
	1. acquire a knowledge about some important production
	processes used for the fabrication of the main mechanical
	assemblies and components in the energy industry.
	2. be able to identify the advantages and limitations of these
	industrial production processes.
	3. acquire a basic knowledge of the production process
	Applying Knowledge and understanding:
	4. Students will be able to select some manufacturing processes to
	be used in the energy industry.
	5. Students will have the ability to apply their knowledge to identify
	which are the main systems and issues of a production process.
	6. The exercises in the classroom, progress tests, conversations
	with the teacher, and the performance of specific tasks would
	allow us to assess and evaluate the student's ability to apply his
	knowledge and understanding of the topics covered during the
	course.

Making judgments:

Students will acquire an autonomy of judgment that will allow him 7. to select proper manufacturing processes for the fabrication of some mechanical assemblies and components in the energy

engineering field.

8. to examine objectively the results obtained from analytical processing, numerical simulations or experimental laboratory tests.

9. to make use of technical and scientific literature.

Communication skills:

- 10. Students will have the ability to structure and prepare scientific and technical documentation inherent to the selection of some manufacturing processes used in the energy engineering field.
- 11. students will have the ability to present, communicate, discuss and argue the topics covered in the course.

Learning skills:

- 12. The students will develop learning skills through the individual study of the topics dealt with in the lecturing and exercise hours. In addition, the analysis of different problems related to the fabrication of mechanical components for the energy engineering field will also be addressed by group discussions.
- 13. The students will have the opportunity to extend the knowledge of the topics of the course by consulting scientific literature, specialized texts, technical standards and international standards that the professor will provide during the course.

- Module 2:

The course aims to give guidelines for the functional design of automatic machines, in particular taking into account mechanical efficiency.

Criteria and methods to analyze and choose mechanical devices, design motion laws and evaluate the best system to minimize energy dissipation in electromechanical systems will be addressed.

- Knowledge and Understanding
- Identify the main components of transmission systems and sources of inefficiency

	Understand the basic principles of energy storage, recovery
	and redistribution systems.
	2. Applying knowledge and understanding
	Evaluate and select the proper transmission system considering
	mechanical and energy efficiency.
	3. Making judgments
	Select and design an effective motion law under different
	working conditions and targets.
	Choose a suitable combination of mechanical and electric
	components for energy transformation and transfer
	4. Communication skills
	Ability to structure and prepare scientific and technical
	documentation
	5. Learning skills
	Ability to independently build upon the knowledge acquired
	during the study course by reading and understanding scientific
	and technical documentation.
Spezifisches Bildungsziel	
und erwartete	
Lernergebnisse (zusätzliche	
Informationen)	
Art der Prüfung	- Module 1:
	- Formative assessment
	In class discussion about the topics covered during the course
	(ILOS assessed 1,2,3,6,12).
	- Summative assessment
	The assessment of the course is:
	Oral exam (ILOS assessed 4,5,7,8,11)
	The oral exam consists of 2 or 3 open-end questions to assess the
	knowledge and understanding of the topics of the course and the
	ability of the student to present, communicate, discuss and argue
	the basics of industrial plant systems and of some industrial
	processes used in the energy industry.
	Moreover, the student will should reflect on the characteristics of a
	production process and its limitations in terms of product quality,
	cost and so forth.
	- Module 2: - Formative assessment



	In-class exercises: continuosly in exercise courses; ILOs assessed: 1, 2, 3, 4, 5 Summative assessment Written exam: 3 h; ILOs assessed: 1, 2, 3, 4, 5.
Bewertungskriterien	- Module 1: The evaluation criterion of the oral exam is based on the knowledge of the topics of the course, the clarity of the response and the properties of language of the student (in relation to the language of the course), the pertinence and the relevance of the response, and the autonomy of judgment.
	- Module 2: The written examination will include both theoretical questions and numerical exercises to show the ability to solve problems handled on this course. Written examination: Theoretical knowledge (35%) Correctness of methods (30%) Correctness in solution (30%) Appropriate use of units (5%)
Pflichtliteratur	Module 1: There is no single textbook that covers the entire course. A collection of suggested readings from various sources will be announced during the course.
	Module 2: Slides provided to the students after each lecture and notes taken by students during lecture
Weiterführende Literatur	Module 1: Additional textbooks, lecture notes, research papers and readings may be provided by the professor.
	Module 2: A collection of suggested readings from various sources will be announced during the course. Such sources will be papers, manuals, technical notes, and excerpts from textbooks, including
	· Biagiotti, Luigi, and Claudio Melchiorri. Trajectory planning for automatic machines and robots. Springer Science & Business Media, 2008.
	Norton, Robert L. Kinematics and dynamics of machinery.



	McGraw Hill Higher Education, 2009. • Filizadeh, S. Electric Machines and Drives: Principles, control, modelling and simulation. CRC Press, 2013.
Weitere Informationen	
Ziele für nachhaltige Entwicklung (SDGs)	Bezahlbare und saubere Energie, Maßnahmen zum Klimaschutz, Nachhaltiger Konsum und Produktion, Industrie, Innovation und Infrastruktur

Kursmodul

Titel des Bestandteils der Lehrveranstaltung	Technologies and Production Processes for Energy Engineering
Code der Lehrveranstaltung	45531A
Wissenschaftlich-	ING-IND/16
disziplinärer Bereich	
Sprache	Englisch
Dozenten/Dozentinnen	Prof. Dr. Erwin Rauch, Erwin.Rauch@unibz.it https://www.unibz.it/en/faculties/engineering/academic- staff/person/17786 Dott. Davide Don, Davide.Don@unibz.it https://www.unibz.it/en/faculties/engineering/academic- staff/person/49990
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Erstes Semester
KP	6
Verantwortliche/r Dozent/in	
Vorlesungsstunden	36
Laboratoriumsstunden	24
Stunden für individuelles Studium	90
Vorgesehene Sprechzeiten	
Inhaltsangabe	



Themen der	Basic knowledge about the main features of power generation,
Lehrveranstaltung	storage, and distribution plants.
	Examination of the production processes (both conventional and
	advanced) used to yield components and assemblies in the energy
	engineering field, including:
	a) gas power generation plants.
	b) solar power plants.
	c) eolic plants.
	d) tanks and pressure containers for energy storage.
	e) tube and piping for energy distribution.
	f) electric energy distribution.
Unterrichtsform	The course is based on hours of frontal lectures and hours
	dedicated to classroom and/or laboratory activities.
	The topics of the course are reported in the lecture notes provided
	by the professor, as well as in the textbooks of the bibliography.
	After each lecture, the corresponding pdf presentation will be
	posted in the Reserve Collection database.
	The professor can also provide additional material (e.g., research
	papers).
	The professor can be contacted by students for questions and
	clarifications by appointment.
Pflichtliteratur	There is no single textbook that covers the entire course.
	A collection of suggested readings from various sources will be announced during the course.
Weiterführende Literatur	Additional textbooks, lecture notes, research papers and readings may be provided by the professor.

Kursmodul

Titel des Bestandteils der Lehrveranstaltung	Functional Mechanical Design for Energy Efficiency
Code der Lehrveranstaltung	45531B
Wissenschaftlich- disziplinärer Bereich	ING-IND/13
Sprache	Englisch
Dozenten/Dozentinnen	Dott. Roberto Belotti, Roberto.Belotti@unibz.it

	https://www.unibz.it/en/faculties/engineering/academic- staff/person/38331
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Erstes Semester
KP	6
Verantwortliche/r Dozent/in	
Vorlesungsstunden	32
Laboratoriumsstunden	24
Stunden für individuelles Studium	94
Vorgesehene Sprechzeiten	
Inhaltsangabe	The course aims to give guidelines for the functional design of automatic machines, in particular taking into account mechanical efficiency. Criteria and methods to analyze and choose mechanical devices, design motion laws and evaluate the best system to minimize energy dissipation in electromechanical systems will be addressed.
Themen der Lehrveranstaltung	 Introduction: 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. Direct/reverse energy flow and motor—load systems. Mechanical components for transferring and transforming energy. Classification is based on function, working principle as well as performance and efficiency. Optimization is aimed at improving the quality of motion and efficiency. Energy storage systems and energy recovery. Classification (working principle and scope of use). Classification of motion laws implemented in automatic machines. An analysis of the main requirements in the design of motion law and its optimization.
Unterrichtsform	Frontal lectures, hand-calculation exercises, computer-assisted exercises.
Pflichtliteratur	Slides provided to the students after each lecture and notes taken

	by students during lecture.
Weiterführende Literatur	 A collection of suggested readings from various sources will be announced during the course. Such sources will be papers, manuals, technical notes, and excerpts from textbooks, including Biagiotti, Luigi, and Claudio Melchiorri. <i>Trajectory planning for automatic machines and robots</i>. Springer Science & Business Media, 2008. Norton, Robert L. <i>Kinematics and dynamics of machinery</i>. McGraw Hill Higher Education, 2009. Filizadeh, S. <i>Electric Machines and Drives: Principles, control, modelling and simulation</i>. CRC Press, 2013.