

Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Electric Power Conversion Equipment
Code der Lehrveranstaltung	45511
Zusätzlicher Titel der	
Lehrveranstaltung	
Wissenschaftlich-	ING-IND/32
disziplinärer Bereich	
Sprache	Englisch
Studiengang	Master in Energie-Ingenieurwissenschaften
Andere Studiengänge (gem.	LM-33 Industrial Mechanical Engineering (code: 47558)
Lehrveranstaltung)	
Dozenten/Dozentinnen	
Wissensch.	
Mitarbeiter/Mitarbeiterin	
Semester	Zweites Semester
Studienjahr/e	1
KP	6
Vorlesungsstunden	36
Laboratoriumsstunden	24
Stunden für individuelles	90
Studium	
Vorgesehene Sprechzeiten	
Inhaltsangabe	The course discusses the theoretical basis and the practical
	applications of electrical energy conversion (electrical-to-electrical
	and electro mechanical), with a special focus on electrical
	machines and their control. The main conversion topologies are
	introduced and studied. Practical aspects and applications will be
	considered, highlighting the advantages achievable with state of
	the art technologies.
Themen der	The course covers the following topics:
Lehrveranstaltung	Recalling electrical engineering, including electric and magnetic



	circuits, principles and main laws.
	Introduction to motion control, motor-load dynamic, motion
	trajectories, overview of components of an electric drive.
	Electro-mechanical conversion, actuators, rotating electrical
	machines, main terminology and industrial standards
	DC motor: operating principles, main features and
	construction, mechanical characteristics, exercises.
	DC motor control: recalling control theory, including Laplace
	transforms, block schemes, nested loops, current and speed loops,
	choice of PI parameters, exercises
	Static conversion using power electronics: generalities, H
	bridge, 2- and 3- levels modulation, current ripple.
	Matlab-Simulink: implementation of DC motor control block
	scheme
	Brushless synchronous motors: operating principles, main
	features, DC vs. AC brushless motors
	AC brushless motor control: a-ß and d-q transforms (Park and
	Clark transforms), operating limits, maximum-torque-per-ampere
	(MTPA) and maximum-torque-per-voltage (MTPV) strategies.
Stichwörter	
Empfohlene	Electrotechnics.
Voraussetzungen	
Propädeutische	
Lehrveranstaltungen	
Unterrichtsform	Frontal lectures, exercises in lab.
Anwesenheitspflicht	Not mandatory.
Spezifische Bildungsziele	(1) Knowledge and understanding:
und erwartete	Master the most important concepts about electro-mechanical
Lernergebnisse	energy conversion, static conversion, and electrical machines and
	drives for different applications.
	(2) Applying knowledge and understanding:
	Verification of the requirements of an electric drive and
	understanding of real world operations of electric drives in different
	application fields.
	(3) Making judgments:
	The ability to select the more adequate electric drive (and its
	The ability to select the more adequate electric drive (and its



	components) for a certain application.
	 (4) Communication skills: Acquisition of field-related technical terminology. Ability to describe the state of the art of the technology adopted in energy conversion systems. Ability to present the acquired knowledge and competences with a proper language (5) Learning skills:
	Improvement in the ability to autonomously extend 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	 Formative assessment: In class with written exercises and using Simulink (assessment of ILOs 1, 2, 5). Summative assessment: The assessment of the course consists of two parts: Written examination on basic electric circuits, La Place transforms, DC motor, AC brushless motors. Eventual oral examination: assessed through questions relative to theoretical aspects. All ILOs except the number 5 are assessed in the summative assessment.
Bewertungskriterien	The Final grade will take into account both the marks obtained in the two parts of the overall assessment. The following aspects will be considering in the evaluation: Written examination: clarity and correctness of answers, ability to summarize and evaluate results, presentation quality Oral examination: clarity and correctness of answers with proper language, ability to summarize and evaluate results, presentation quality, problem solving ability, skills in critical thinking.
Pflichtliteratur	Lecture notes and documents for exercise will be available on

	Teams and the reserve collections. There is no single textbook covering the entire course content. The material is collected from various sources.
Weiterführende Literatur	 Shaahin Filizadeh. Electric Machines and Drives: Principles, control, modelling and simulation. CRC Press. E.Bassi, A.Bossi "Macchine e Azionamenti Elettrici" UTET, Milano ISBN: 88-7933-184-1 W. Bolton, "Mechatronics - electronic control systems in mechanical and electrical engineering", 4th ed., Pearson Educational, ISBN 978-0-13- 240763-2. M. Rashid, "Power electronics", 3rd ed., Prentice-Hall, ISBN 0-13-122815- 3
Weitere Informationen	
Ziele für nachhaltige Entwicklung (SDGs)	Industrie, Innovation und Infrastruktur, Bezahlbare und saubere Energie