Syllabus

Descrizione corso

Titolo insegnamento	Electric Drives and Machines
Codice insegnamento	47558
Titolo aggiuntivo	
Settore Scientifico-Disciplinare	IIND-08/A
Lingua	Inglese
Corso di Studio	Corso di laurea magistrale in Ingegneria Industriale Meccanica
Altri Corsi di Studio (mutuati)	
Docenti	dott. ing. Stefano Nuzzo, Stefano.Nuzzo@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/43989
Assistente	
Semestre	Secondo semestre
Anno/i di corso	1
CFU	5
Ore didattica frontale	36
Ore di laboratorio	24
Ore di studio individuale	65
Ore di ricevimento previste	
Sintesi contenuti	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.
Argomenti dell'insegnamento	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 course covers the following topics: • 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 • 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.
Parole chiave	Machines, Drives, Control, Synchronous, Modelling
Prerequisiti	Electrotechnics
Insegnamenti propedeutici	
Modalità di insegnamento	The lectures will be in person, focusing for about 40 hours on theoretical aspects and for about 20 hours on practical exercises
Obbligo di frequenza	Not mandatory.
Obiettivi formativi specifici e risultati di apprendimento attesi	(1) Knowledge and understanding: Master the most important concepts about electro-mechanical 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:

	Ability to select the more adequate electric drive (and its components) for a certain application. (4) Communication skills: Acquisition of the 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.
Obiettivi formativi specifici e risultati di apprendimento attesi (ulteriori info.)	
Modalità di esame	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.
Criteri di valutazione	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.
Bibliografia obbligatoria	Lecture notes and documents for exercise will be available on Teams.

	There is no single textbook covering the entire course content. The material is collected from various sources.
Bibliografia facoltativa	1. Shaahin Filizadeh. Electric Machines and Drives: Principles, control, modelling and simulation. CRC Press. 2. E.Bassi, A.Bossi “Macchine e Azionamenti Elettrici” UTET, Milano ISBN: 88-7933-184-1 3. W. Bolton, "Mechatronics - electronic control systems in mechanical and electrical engineering", 4th ed., Pearson Educational, ISBN 978-0-13- 240763-2. 4. M. Rashid, "Power electronics", 3rd ed., Prentice-Hall, ISBN 0-13-122815- 3.
Altre informazioni	
Obiettivi di Sviluppo Sostenibile (SDGs)	Energia rinnovabile e accessibile