

Syllabus

Descrizione corso

Titolo insegnamento	Electrochemical energy storage and conversion
Codice insegnamento	45534
Titolo aggiuntivo	
Settore Scientifico-Disciplinare	ING-IND/23
Lingua	Inglese
Corso di Studio	Corso di laurea magistrale in Ingegneria energetica
Altri Corsi di Studio (mutuati)	
Docenti	dott. Narges Ataollahi, Narges.Ataollahi@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/46627
Assistente	
Semestre	Secondo semestre
Anno/i di corso	2
CFU	6
Ore didattica frontale	60
Ore di laboratorio	0
Ore di studio individuale	90
Ore di ricevimento previste	
Sintesi contenuti	To equip students with a comprehensive understanding of the scientific and engineering principles behind modern electrochemical systems used for energy storage and conversion. Through lectures and laboratory work, students will develop theoretical and practical competencies in the design, analysis, and assessment of technologies such as batteries, fuel cells, electrolyzers and supercapacitors. The course prepares students to apply this knowledge in both research and industrial contexts, with a focus on solving real-world energy challenges using electrochemical solutions.

Argomenti dell'insegnamento	This course covers the principles of electrochemical energy production, storage, and conversion. Main topics include: (i) the study of equivalent circuits, (ii) thermodynamics, (iii) reaction kinetics, (iv) transport phenomena, (v) hydrogen production and use; (vi) applications to batteries, fuel cells, electrolyzers and supercapacitors.
Parole chiave	Electrochemical Energy Applications, Batteries, Fuel cells, Electrolyzers, Hydrogen
Prerequisiti	General chemistry- Physics: thermodynamics.
Insegnamenti propedeutici	
Modalità di insegnamento	Frontal lectures and Laboratory.
Obbligo di frequenza	Laboratory lessons are mandatory.
Obiettivi formativi specifici e risultati di apprendimento attesi	<p>Knowledge and understanding: profound and detailed scientific knowledge and understanding of the principles of equilibrium and non-equilibrium electrochemistry</p> <p>Applying Knowledge and understanding: profound and detailed scientific knowledge of the main electrochemical energy conversion and storage methods</p> <p>Making judgments: skills and problem-solving capacity to analyze problems of electrochemical energy conversion and storage</p> <p>Communication skills: ability to structure and prepare scientific and technical documentation describing project activities</p> <p>Learning skills: ability to independently keep up to date with developments in the most important areas of electrochemical energy conversion and storage.</p>
Obiettivi formativi specifici e risultati di apprendimento attesi (ulteriori info.)	
Modalità di esame	Evaluation of written reports on lab experiments and oral examinations. The examination consists of either an oral test, or the discussion of a report written by the student on a topic which may be either freely chosen or chosen in agreement with the course lecturer. An alternative method for the exam is building an electrochemical device with given specifications (e.g. A zinc-carbon

	battery which provides a given amount of power for a given time) and discussion of the procedures used and the problems found.
Criteri di valutazione	Showing a sufficient knowledge of the topic and the ability to answer related questions.
Bibliografia obbligatoria	<p>One of the following books:</p> <p>Electrochemical Engineering, Thomas F. Fuller and John N. Harb.</p> <p>Water Electrolysis for Hydrogen Production, Pasquale Cavaliere</p> <p>Fundamentals of Electrochemistry, Bagotsky</p> <p>Electrochemistry for material science - Plieth</p> <p>Hydrogen Storage Technology Materials and Applications, ed. Lennie Klebanof</p> <p>Electrochemical Power Sources (Batteries, Fuel Cells and Supercapacitors, ed V.S Bagotsky, A.M Skundin, Y.M Volfkovich</p>
Bibliografia facoltativa	Other files dedicated to specific topics will be indicated or given during the course.
Altre informazioni	<p>Connections with other courses</p> <p>This course is connected with the course Advanced Materials for Energy Engineering (140487), which extends several topics introduced here, with a particular focus on the materials and devices used in energy conversion and storage systems. It's a natural continuation and highly recommended for students who want to explore more about device fabrication and material performance.</p> <p>Professional applications of the covered topics</p> <p>The topics covered are highly relevant for careers in the energy field, particularly in companies and research centers focused on batteries, fuel cells, electrolyzers, and supercapacitors. Students will gain both theoretical knowledge and practical skills useful for R&D, system design, and evaluating electrochemical devices. These are key areas in today's shift towards sustainable energy, like electric mobility, portable electronics, grid storage, and green hydrogen.</p>
Obiettivi di Sviluppo Sostenibile (SDGs)	Energia rinnovabile e accessibile, Lotta contro il cambiamento climatico, Utilizzo responsabile delle risorse, Innovazione e

	infrastrutture
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