Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	Electrochemical Energy Storage and Conversion
Course code	45534
Scientific sector	ING-IND/23 "Applied Physical Chemistry"
Degree	Master Energy Engineering
Semester	2
Year	2
Academic year	2025/2026
Credits	6
Modular	no

Total lecturing hours	60
Total lab hours	
Total exercise hours	
Attendance	Laboratory lessons are mandatory
Prerequisites	General chemistry- Physics: thermodynamics
Course page	https://www.unibz.it/en/faculties/engineering/master-energy-engineering/

Specific educational objectives	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.
Lecturer	Prof. Ataollahi Narges
Scientific sector of the lecturer	ING-IND/23
Teaching language	English
Office hours	By appointment
Teaching assistant *(if any)*	-
Office hours	-
List of topics covered	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.
Teaching format	Frontal lectures and Laboratory

Learning outcomes	**Knowledge and understanding:** profound and detailed scientific knowledge and understanding of the principles of equilibrium and non-equilibrium electrochemistry **Applying Knowledge and understanding:** profound and detailed scientific knowledge of the main electrochemical energy conversion and storage methods **Making judgments:** skills and problem-solving capacity to analyze problems of electrochemical energy conversion and storage **Communication skills:** ability to structure and prepare scientific and technical documentation describing project activities **Learning skills:** ability to independently keep up to date with developments in the most important areas of electrochemical energy conversion and storage
Assessment	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.
Assessment language	English
Evaluation criteria and criteria for awarding marks	Showing a sufficient knowledge of the topic and the ability to answer related questions
Required readings	One of the following books: Electrochemical Engineering, Thomas F. Fuller and John N. Harb. Water Electrolysis for Hydrogen Production, Pasquale Cavaliere Fundamentals of Electrochemistry, Bagotsky Electrochemistry for material science - Plieth Hydrogen Storage Technology Materials and Applications, ed. Lennie Klebanof Electrochemical Power Sources (Batteries, Fuel Cells and Supercapacitors, ed V.S Bagotsky, A.M Skundin,Y.M Volfkovich
Supplementary readings	Other files dedicated to specific topics will be indicated or given during the course.