Battery Systems

Batterisystem
6 credits

Programme course

TSFS19

Valid from: 2025 Spring semester

Determined by	**Main field of study**	
Board of Studies for Mechanical Engineering and Design	Electrical Engineering, Mechanical Engineering	
Date determined	**Course level**	**Progressive specialisation**
2024-08-28	Second cycle	A1N
Revised by	**Disciplinary domain**	
	Information missing	
Revision date	**Subject group**	
	Electrical Engineering	
Offered first time	**Offered for the last time**	
Spring semester 2025		
Department	**Replaced by**	
Institutionen för systemteknik		

Course offered for

- Master of Science in Energy - Environment - Management
- Master of Science in Mechanical Engineering
- Master's Programme in Mechanical Engineering
- Master of Science in Computer Science and Engineering
- Master of Science in Applied Physics and Electrical Engineering - International
- Master of Science in Applied Physics and Electrical Engineering

Prerequisites

Introductory courses in electricity, automatic control, mathematical programming, and probability theory.

Intended learning outcomes

An overarching goal is to be able to solve systems engineering problems for battery systems. After completing the course, the student should be able to:

- Describe and perform basic calculations for battery systems' construction, function, safety, and reliability.
- Mathematically model, parameterize, and simulate batteries.
- Implement and evaluate battery management system functions.

Course content

- Introduction of battery cells and battery systems.
- Physical principles of battery function, with a focus on Li-ion cells.
- Basic properties and characterization of battery cells.
- Standardized cell tests for performance evaluation.
- Mathematical modeling of cells with a focus on circuit-equivalent models.
- Parameterization of battery models for adaptation to measurement data.
- Simulation of battery models in typical operating conditions.
- Charging strategies.
- Fundamental functions of the battery management system (BMS).
- State-of-charge (SOC) estimation.
- Cell balancing.
- Aging phenomena, battery health, and sustainability.
- Voltage and power limitations.

Teaching and working methods

The course consists of lectures, lessons, laboratory work, and a written examination.

Examination

TEN1	Written Examination	4 credits	U, 3, 4, 5
LAB1	Laboratory Work	2 credits	U, G

Grades for examination modules are decided in accordance with the assessment criteria presented at the start of the course.

Grades

Four-grade scale, LiU, U, 3, 4, 5

Other information

About teaching and examination language

The teaching language is presented in the Overview tab for each course. The examination language relates to the teaching language as follows:

- If teaching language is “Swedish”, the course as a whole could be given in Swedish, or partly in English. Examination language is Swedish, but parts of the examination can be in English.
- If teaching language is “English”, the course as a whole is taught in English. Examination language is English.
- If teaching language is “Swedish/English”, the course as a whole will be taught in English if students without prior knowledge of the Swedish language participate. Examination language is Swedish or English depending on teaching language.

Other

The course is conducted in such a way that there are equal opportunities with regard to sex, transgender identity or expression, ethnicity, religion or other belief, disability, sexual orientation and age.

The planning and implementation of a course should correspond to the course syllabus. The course evaluation should therefore be conducted with the course syllabus as a starting point.

The course is campus-based at the location specified for the course, unless otherwise stated under “Teaching and working methods”. Please note, in a campus-based course occasional remote sessions could be included.