

## Battery Systems

Batterisystem  
6 credits

Programme course

TSFS19

Valid from: 2026 Spring semester

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

## Course offered for

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