Faculty of Science

# FYSN35, Physics: Electronics for Physicists, 7.5 credits

*Fysik: Elektronik för fysiker, 7,5 högskolepoäng*

**Second Cycle / Avancerad nivå**

## Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2024-12-03. The syllabus comes into effect 2024-12-03 and is valid from the autumn semester 2025.

## General information

The course is an elective course in the second cycle for a degree of Bachelor of Science or Master of Science in Physics.

*Language of instruction:* English

| *Main field of study* | *Specialisation* |
|---|---|
| Physics | A1N, Second cycle, has only first-cycle course/s as entry requirements |

## Learning outcomes

Electronics play an essential role in the modern physicist's laboratory and experiments, as well as form a key foundation for our society. This course aims to equip students with the baseline skills to design and build circuits to acquire and filter signals and to control experiments and measurement systems. The course gives particular attention to communicating between designers with physics and engineering backgrounds.

### Knowledge and understanding

After completion of the course, the student should be able to:

- Explain and construct circuit blocks for signal handling (including collection, filtering, amplification, and data storage) and control (including state changes through feedback loops)
- Articulate the advantages and disadvantages of analogue and digital circuits
- Make arguments for designs combining analogue and digital circuits

- Be prepared to discuss the possibilities and limitations in modern electronic design.

### Competence and skills

After completion of the course, the student should be able to:

- Read and understand circuit diagrams and device data sheets
- Identify a circuit's intended function(s)
- Account for the operating windows and limits of components
- Design and construct building-block analogue and digital circuits
- Convert between analogue and digital signals
- Operate circuit characterization tools such as multimeters and oscilloscopes
- Use circuit simulator tools to explore circuit design choices

### Judgement and approach

After completion of the course, the student should be able to:

- Communicate and coordinate with electronics engineers to realize measurement systems
- Reflect on the role of electronics and digital technology in modern laboratories and in wider society
- Make circuit design choices based on both their scientific merit and environmental impact.

## Course content

The course covers the basic ingredients for electronics literacy, including voltage dividers, filtering, amplification, control circuits and digital-to-analog signal conversion with a focus on how signal processing and data acquisition occur in modern experiments, as well as studies of analog and digital signals with parallels to everyday electronics.

## Course design

The obligatory learning activities consists of:

- Classroom sessions mixing miniature lectures, problem solving, discussions, and hands-on circuit building activities;
- Workshop sessions devoted to problem solving and circuit building;
- An "open laboratory" period where students complete short electronics projects;
- A short project on everyday electronics.

Active attendance and participation is necessary for students to both pass and excel in the course. Students are expected to build circuits, make mistakes, reflect on their prototyping process, contribute to discussions, work in small groups, and complete both written and oral assignments.

This is a hands-on class with strong emphasis on learning by making mistakes and trying again. The practical activities (classroom and workshop, open lab) are evaluated through reflections of the student's circuit building experience that day. Emphasis is placed on figuring out what happened in the circuit, why it behaved that way, and making a new iteration.

## Assessment

Examination takes place throughout the course through written assignments. These include:

- Short, written reports and reflections submitted for classroom and workshop sessions summarizing and reacting to the day's activities;
- Hand-in assignments focused on simulation and problem solving;
- Laboratory reports on the Open Lab;
- Everyday electronics project, including written and oral components.

Students who do not pass a regular assessment will be offered another opportunity for assessment soon thereafter.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

## Grades

Grading scale includes the grades: Fail, Pass
A passing grade requires passed written assignments, approved laboratory reports, a passed everyday electronics project and a minimum of 80% attendance at sessions.

## Entry requirements

Access to the course requires 75 credits physics and 45 credits mathematics, or a Bachelor's degree in Physics or equivalent, as well as English 6/B.

## Further information

The course replaces FYSN25/FYSN15, Experimental Tools, 7.5 credits and cannot be included in a degree together with this course, or with FKFN05, Experimental Tools in Subatomic Physics, 7.5 credits.

The course is given by the Department of Physics, Lund University.