Faculty of Science

FYSN15, Physics: Experimental tools, 7.5 credits

Fysik: Experimentella verktyg, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2007-03-01 to be valid from 2007-07-01, autumn semester 2007.

General Information

The course is an elective module for second-cycle studies for a scientific candidate or Master's degree (120 credits).

Language of instruction: English

Main field of studies	*Depth of study relative to the degree requirements*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The aims of the course are that the student should acquire the following knowledge and skills:

Knowledge and understanding

- describe thoroughly the function of accelerators and radiation sources.
- explain deciding properties of the beams with which reactions are created.
- account for signal processing from sensor to storing of digital data.
- understand the function of analog and digital electronics
- account for different ways to present a measurement result
- explain statistical methods for evaluation of measurement results and confidence levels

Be able to carry out:

- connect up and analyse simple analog and digital circuits
- work with digital oscilloscope and logic analysator
- fit a function to data points and quantify the results with chi2 test.
- decide if a result can be explained as random
- include several independent sources of errors in error analysis

Be oriented about:

- account for accelerators and sources of light in a future perspective
- be familiar with possibilities and limitations in modern electronic design
- be familiar with digital electronics in modern society in general

Ability to communicate:

- cooperate with electronics engineers for realisation of measurement system
- reflect on the role of the electronics and the digital technology in the modern society.
- assess if a result is reasonable and significant

Course content

The student should learn, understand and use important tools and technologies that are used in experimental natural sciences in general and physics experiments in particular and be orientated about future perspectives for the infrastructure of exerimental physics. The aim of the electronics part is understanding of how signal processing and data collection take place in modern experiments. The similarity with modern electronics and digital technology in the society are striking and everyday examples are highlighted. The student obtains knowledge to communicate the modern electronics with experts and the surrounding society. Statistics and the presentations have scientific and social relevance.

The function of accelerators and radiation sources are studied at excursions to research departments that show and explain the infrastructure in use.

The major aim of the electronics part is to describe how data is collected from analog electronic processing of electric signals from a sensor/detector via digitisation to collection and storing of data in real time. Basic analog and digital electronics constitutes the basis but also advanced modern solutions, like application specific integrated circuits and programmable digital electronics as well as standard instrumentation in a laboratory environment are concerned. The experimental chain of electronics is put in relation to modern, digital home electronics by elaborated examples. Practical parts in analog and digital electronics are included.

Statistics and the data handling contain basic statistics and probability theory.

Binomial-, normal- and poisson distributions are studied. The concept of confidence level is introduced.

Principles of presentation of measurement result are gone through. Function fitting with chi2 test and principles of parametrisation of data are studied. Error estimation and presentation of statistical and systematic errors are carried out. Acquired knowledge is applied on simulated data in a computer exercise.

Course design

The teaching consists of lectures, laboratory sessions and group work and study visits. Participation in laboratory sessions and group work and thereby integrated other teaching is compulsory.

Assessment

Examination takes place with orally and in writing presented written assignments during the course and with written laboratory session reports and reports from practical exercises

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
A Pass grade requires approved laboratory reports, passed written assignments and active participation in compulsory parts.
The final grade is determined by combining the results of the different parts of the examination.

Entry requirements

For admission to the course is required:

English B

FYSA31 Physics 3: Modern physics 30 credits or the equivalent. Exemption can be given left students with good prior knowledge in other scientific subject.

Further information

This course may not be included together with FYS400 in a higher education qualification, if it has been included as module in FYS400.

Subcourses in FYSN15, Physics: Experimental tools

Applies from H07

0701 Experimental Tools, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction