Faculty of Science

FYST52, Physics: Modern Neutron Science, 7.5 credits

Fysik: Modern neutronvetenskap, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2020-06-11 to be valid from 2020-06-11, spring semester 2021.

General Information

The course is an elective second cycle component of a Bachelor / Master of Science degree in physics.

Language of instruction: English

Main field of studies	*Depth of study relative to the degree requirements*
Physics	A1F, Second cycle, has second-cycle course/s as entry requirements

Learning outcomes

The course provides an introduction to modern neutron science. The main focus of the course will be on neutron scattering and how these methods can be applied to scientific questions, focusing on examples drawn from physics. This will be supplemented by information on neutron generation for use in experiments and information on neutron instrument design.

Knowledge and understanding

On completion of the course, the students shall be able to:

- Explain the neutron interaction with matter (including magnetic interactions)
- Describe how neutrons are generated for use in experiments
- Explain the basic principles of neutron instrument design

Competence and skills

On completion of the course, the students shall be able to:

- Calculate relevant material properties (absorption length, cross-section, accessible Bragg reflections)
- Identify the appropriate neutron instrument for a given physical problem
- Write a beamtime proposal
- Work in a self-organized group to analyse instrument design; this will require practice of time management, role delegation and group communication skills

Judgement and approach

On completion of the course, the students shall be able to:

- Critically evaluate experimental data from neutron scattering found in the literature
- Develop an experimental plan for a neutron scattering experiment
- Evaluate and assess detailed information about a neutron instrument with the aim of understanding how to use it
- Critically review a beamtime proposal and provide constructive feedback

Course content

Properties of the neutron:

- Broad overview of the main areas of neutron science
- The scattering formalism (elastic and inelastic)
- Neutron generation
- Instrument types and properties (including the European Spallation Source instruments)
- Fundamental physics studied using neutrons
- Controlling sample behaviour during experiments
- Strategies for handling data
- Neutron detection and neutron optics
- Proposal writing and review

Course design

Teaching consists of a series of lectures, complemented by example classes where the students will go through written exercises illustrating various aspects of the course. There will be a group exercise evaluating instrument design. The students will prepare beamtime proposals individually, provide individual commentary to a designated partner, and then participate in a mock review panel of the proposals. The teacher will provide additional detailed feedback on the proposals.

Assessment

The assessment will consist of three parts:

- Written examination (worth 4.5 hp)
- 2-page beamtime access proposal. The teacher assessment will comprise 0.5 hp and the remaining 0.5 hp will be awarded based on participation in the individual

commentary and the mock review panel.
- Group report on a neutron instrument design (worth 2 hp). The report will be assessed by the teacher and will form 80% of the credit here. The remaining 20% will be awarded based on peer assessment (guidance will be provided to the students).

Students who do not pass an 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.

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.
For a grade of Pass on the whole course, the student must have passed the three components specified above. For all components, an overall grade of 50% is required for a Pass.

For compilation of results to calculate the final grade for the whole course, a weighted mean is calculated using the percentages, where the credits for the components are used as weight. The limit for Pass with distinction is 80%.
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Entry requirements

To be admitted to the course, students must have 90 credits in Physics and Mathematics, including knowledge corresponding to FYSN17 Quantum Mechanics, 7.5 credits.

Subcourses in FYST52, Physics: Modern Neutron Science

Applies from V21

2101 Exam, 4,5 hp
Grading scale: Fail, Pass, Pass with distinction
2102 Individual project, 1,0 hp
Grading scale: Fail, Pass, Pass with distinction
2103 Group project, 2,0 hp
Grading scale: Fail, Pass, Pass with distinction