LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Modern neutronvetenskap
Modern Neutron Science

EXTQ55, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED N
Date of Decision: 2023-04-17

General Information

Elective for: F4, F4-axn, MNAV2, N4
Language of instruction: The course will be given in English

Aim

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.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- 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

Competences and skills
For a passing grade the student must

- 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
For a passing grade the student must

- 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

Contents

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.

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

Examination details

Grading scale: UV - (U,G,VG) - (Fail, Pass, Pass with Distinction)
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). 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.

Parts
Code: 0123. **Name:** Written Exam.

Credits: 4,5. **Grading scale:** UV. **Assessment:** Written exam **Contents:** Written exam

Code: 0223. **Name:** Individual Project.

Credits: 1. **Grading scale:** UV. **Assessment:** 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. **Contents:** 2-page beamtime access proposal.

Code: 0323. **Name:** Group Project.

Credits: 2. **Grading scale:** UV. **Assessment:** Assessment of written group report (worth 2 hp). **Contents:** Written group report on a neutron instrument design.

Admission

Assumed prior knowledge: FMFN01 / FYSN17 Quantum Mechanics, Advanced Course 1

The number of participants is limited to: No

Reading list

Contact and other information

Course coordinator: Elizabeth Blackburn, elizabeth.blackburn@sljus.lu.se

Course homepage: https://canvas.education.lu.se

Further information: The course is given by the Faculty of Science and does not follow the study period structure.