

**SYLLABUS**

# **Advanced Course on Topics in Material- and Experimental Physics 7.5 credits F7047T**

**Fördjupningskurs i material- och experimentell fysik**

**Course syllabus admitted: Autumn 2023 Sp 1 - Present**

**DECISION DATE  
2022-02-14**

# Advanced Course on Topics in Material- and Experimental Physics 7.5 credits F7047T

## Fördjupningskurs i material- och experimentell fysik

### Second cycle, F7047T

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	U G#	Fysik	Physics

## Entry requirements

The base and core courses in physics and mathematics corresponding to the first three grades in the degree program in Applied Physics and Electrical Engineering or equivalent from another university. This also includes the F7045T course on Solid State Physics and, where appropriate, the F7008T course on atomic and molecular physics, or equivalent.

## Selection

The selection is based on 30-285 credits

## Course Aim

The aim of the course is to provide the opportunity for specialization in physics, with emphasis on experimental physics, with additional elements, not included in the regular courses. The course proposes the study of advanced books or scholarly articles, possibly supplemented by experiments, from experiment design to experiment realization, data analysis and conclusions. The course will also further develop the students' presentation skills and will give an introduction to research in experimental physics.

The student should be on its own, he will discuss with the examiner and, in good time before the start of the course, he will express his interest to investigate one of the areas described below, assembling an overall plan for the work. The precise content depends on the current specialization. The student will take responsibility for his/her own development with teachers who will provide feedback and support for students' professional development.

The topic of the course will fall within one of the main areas of materials and surface physics, nanomaterials and high-pressure physics, synthesis and characterization of nanomaterials or advanced measurement methods.

Some examples of the areas (not limited to), in which the project can be proposed:

- Preparation and characterization of nanostructured materials;
- Techniques for thin film coating through chemical and/or physical vapor deposition;
- Self-organization of nanomaterials;
- Synthesis of nanostructured materials at high pressure;
- Material behavior / properties at extremely high (up to 1 mbar (1 million atmospheres)) pressure;
- Advanced characterization methods: confocal Raman / fluorescence microscopy, high-pressure spectroscopy, scanning probe microscopy, pico-newton force spectroscopy, FT-Raman, etc.;
- Spectroscopy of single molecules or functionalized nanotubes;
- Nanomaterials: carbon nanotubes, graphene, fullerenes, nanoparticles, nanowires and quantum dots;
- Carbon nanotube -based composites;
- Nanomaterials for solar cells;
- Interaction between nanoparticles;
- Physical measurements and characterization in biophysics and biomimetics;
- Methods of measurement and development of metrics / characterization methods, such as development and testing saturations in the diamond anvil (diamond anvil cell) at extremely high pressure;
- Quasi 1D nanostructures for sensors and solar cells, quantum dots and nanowires for solar cells.

After completing the course, the student should:

- Have delved deeply into his/her field;
- Have developed his/her independence (supported by the teachers), assimilating new material at the advanced level, demonstrating to be an independent player in his/her research topic;
- Be able to integrate, generalize and combine previously acquired knowledge in the field;
- Be able to work with the original scientific journals: study, analyze and compile information about the latest developments in the areas of interest;
- Have acquired a deep understanding of the experimental methods and be able to apply the in-depth knowledge through experiments in concrete examples or in a project;
- Be able to acquire research findings in the research topic and has received an introduction to research in experimental physics.
- Have further developed his/her presentation skills.

## Contents

The detailed contents of the course are specified by the examiner, or a supervisor appointed by the examiner, together with the student(s) in a written course description each time the course is given. The content has to be approved by the examiner and by the supervisor. The exact content will be controlled by the current topic / projects.

## Realization

Each course occasion's language and form is stated and appear on the course page on Luleå University of Technology's website.

The work will be carried out independently, but with the help of tutors. The tutors will provide support and guidance to the student's own acquisition of knowledge and skills. Regular meetings will be planned with the supervisor, in which the student / students will present their progress, will discuss the possible issues and will set their own work. Within the framework of the course, oral presentations are planned to all the attendees in the course, then the student/students will receive feedback on their oral presentation. At the end of the course, the project will be presented both in oral and written form, as a report of the activities carried out and the results obtained during the course. Discrepancies may occur between the oral and written presentation.

## Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided. The project work will be presented as oral presentations, written reporting, and final oral presentation at at LTU.

## Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term "unauthorized aids" refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

## Course offered by

Department of Engineering Sciences and Mathematics

## Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0001	Advanced assignment	U G#	7.5	Mandatory	A15	

## Last revised

by Niklas Lehto, Programme Director 2022-02-14

## Syllabus established

by Mats Näsström 2015-02-12