

SYLLABUS

Quantum Mechanics and Solid State Physics 7.5 credits F0053T

Fasta tillståndets fysik och kvantmekanik

Course syllabus admitted: Autumn 2023 Sp 1 - Present

**DECISION DATE
2023-01-16**

Quantum Mechanics and Solid State Physics 7.5 credits F0053T

Fasta tillståndets fysik och kvantmekanik

First cycle, F0053T

Education level	Grade scale	Subject	Subject group (SCB)
First cycle	G U 3 4 5	Fysik	Physics

Entry requirements

In order to meet the general entry requirements for first cycle studies you must have successfully completed upper secondary education and documented skills in English language and F0004T Physics 1, F0005T Physics 2, F0006T Physics 3, M0018M Linear analysis

Selection

The selection is based on 1-165 credits.

Course Aim

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

- explain basic quantum mechanical concepts and theories
- solve quantum mechanical problems as, potential barrier, tunneling, particle in box, harmonic oscillator, hydrogen atom.
- explain the basic concepts that are used to describe the structure and physical properties of crystalline substances,
- use physical models to perform calculations of the properties of solids,
- analyze and discuss measurement data based on theoretical models,
- summarize, present and communicate results from experiments,
- give an overview of an application related to the physical phenomena treated in the course

Contents

The Schrödinger equation, the foundations of quantum mechanics, completeness, operators, tunneling, particle in a box, the harmonic oscillator, the hydrogen atom, spin. Crystal structures and interatomic forces. Scattering theory and descriptions of various experimental techniques employed in structure analysis. The electrical, thermal and optical properties of metals semiconductors and insulators. Heat capacity on the basis of the models of Einstein and Debye. The quantization of the energy of elastic waves in terms of phonons. Lattice waves and the Brillouin zone. Thermal conductivity. The success and failure of the free electron model in accounting for observed metallic properties. The Hall effect and cyclotron resonance. The electronic contribution to heat capacity and thermal conductivity. Energy bands in solids. The nearly free electron model, band structure and band gaps. Semiconductor theory.

Realization

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

During the course, course participants work to develop their theoretical knowledge of quantum mechanics and solid state physics. The students' active participation is central to the study result. The course offers lectures that introduce and explain parts of the content. The course also includes compulsory assignments, seminars, and laboratory work.

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 examination takes place through compulsory assignments, seminars, and written presentation of laboratory work.

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.

Remarks

This course cannot be part of the degree together with the courses F7006T, F0019T, F0047T.

Overlap

The course F0053T is equal to F0019T

Course offered by

Department of Engineering Sciences and Mathematics

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0002	Laboratory work	U G#	1	Mandatory	A15	
0004	Seminars	U G#	1	Mandatory	S23	
0005	Compulsory assignments	G U 3 4 5	5.5	Mandatory	S23	

Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

Last revised

by Mats Näsström, Head of Undergraduate Education 2023-01-16

Syllabus established

by Mats Näsström 2015-02-12