Thin Film Optics and Polarized Light, 3.0 credits

Tunnfilmsoptik och polariserat ljus, 3.0 hp

Third-cycle education course

6FIFMA0

Department of Physics, Chemistry and Biology

Valid from: First half-year 2026

Approved by **Approved**

Registration number

Entry requirements

Entry requirement for studies on third-cycle education courses:

- second-cycle degree,
- 240 credits in required courses, including at least 60 second-cycle credits, or
- acquisition of equivalent knowledge in some other manner

Specific entry requirements for this course:
Bachelor level mathematics and physics. It is in particular recommended to have a good knowledge of electromagnetics, wave physics and optics

Specific information

The course is planned and carried out according to what is stated in this syllabus. Course evaluation, analysis and suggestions for improvement should be fed back to the Research and PhD studies Committee (FUN) by the course coordinator.

Learning outcomes

The aim of the course is to give in-depth knowledge of optics.
After successful examination the student should be able to ...

- reproduce, explain, analyze, and use physical concepts, relations, and methods related to materials optics especially for thin films.
- reproduce, explain, analyze, and use physical concepts, relations, and methods related to polarization optics in general and to ellipsometric experiments specifically.

Contents

The course aims to provide in-depth knowledge of several of the fields of optics with emphasis on ellipsometry. The purpose is also to disseminate knowledge in optics to prepare for industrial applications and to understand on an overall level the results of ongoing international optics research. The ambition is to describe the path from theory to application and at the same time provide models, methodology and tools that are practically useful. The studies include mathematical models for analysis to provide physical / mathematical tools that are useful for developing and describing the optical systems, methods and components that exist in different environments in society and that need further development. Basic theory is anchored in physics to provide an understanding of the optics relevant to current research. The course connects to real-world problems through application examples to show that it is a short step between academic studies and the knowledge, and methods used in industrial development and research. Theories and models are tested in laboratory work and calculation steps to illustrate their usefulness and limitations.
The course consists of
• Material optics:
-Band structure and Optical response
-Dispersion models
-Inhomogeneous materials
-Layered structures.
• Ellipsometry, including polarization optics:
-Polarized light
-Polarizing components
-Polarization methods
-Instrumentation
The lectures begin with brief repetitions of basic optics and then develop further into the more advanced concepts. The course also places great emphasis on the optical properties of materials and in many cases, the theory is supplemented with application examples.
In the course, many concepts are covered including:
Dispersion models, Band structure, the Kramers / Kronig relationships, polarizing materials, heterogeneous media, effective media concepts, Jones formalism, Stokes/Mueller formalism, spectrophotometry, polarimetry, ellipsometry.

Examination

Hand-in Problems and/or Group Assignments
Laboratory Work

Grading

Two-grade scale

Course literature

Arwin, Hans, (2021) *Thin Film Optics and Polarized Light* Caeruleus edition (7e).
ISBN:
Nordling, Carl, Österman, Jonny, (2020) *Physics handbook : for science and engineering*. Ninth edition (9e), Studentlitteratur Lund.
ISBN: 9789144128061