UNIVERSITY OF GOTHENBURG

DEPARTMENT OF PHYSICS

FYM350 Functional energy materials, 7.5 credits

Funktionella material för energitillämpningar, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Physics on 2020-05-04 and was last revised on 2023-05-08 to be valid from 2024-01-15, spring semester of 2024.

Field of education: Science 100%
Department: Department of Physics

Position in the educational system

The course is elective within the master program in physics.

The course can be part of the following programmes: 1) Complex Adaptive Systems, Master's Programme (N2CAS) and 2) Physics, Master's Programme (N2PHY)

Main field of studies	*Specialization*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Entry requirements

A Bachelor's degree in physics or equivalent, including solid state physics, solid state chemistry or materials science.

Applicants must prove their knowledge of English: English 6/English B from Swedish Upper Secondary School or the equivalent level of an internationally recognized test, for example TOEFL, IELTS.

Learning outcomes

Aim: To get insight into how fundamental physical properties of materials enable functionality in modern energy technologies, such as batteries, solar cells, fuel cells, supercapacitors, catalysts, hydrogen storage, thermoelectrica etc. By applying

knowledge on physical models of structure and processes in materials at different levels the student should be acquainted with rational development of new materials and technologies and connect to e.g. performance, lifetime, sustainability and environmental impact, and cost.

Learning outcomes (after completion of the course the student should be able to)

account for the role of materials science for the development of sustainable energy technologies.
give an overview of state-of-the-art functional materials in energy technology, such as solar cells, batteries, fuel cells, hydrogen storage, thermoelectric materials
explain how functionality is linked to materials composition, structure and morphology, dimensionality/nanoscale
assess new technologies and research results with respect to requirements on the materials' properties as set by the demands of the final functional device, such as efficiency, weight, thermodynamic stability, lifetime and cost.
devise strategies for the development of new materials with better performance.

Course content

Materials science is crucial for the development of new technologies. In this course the student will learn how materials development has laid the ground for modern energy technology and how it in the future can be a cornerstone in a sustainable energy system. Further, the course will give an overview of the opportunities and limitations of which specific material properties, and based on them functions, might contribute with to the future energy systems.

Conceptually, the course is based on the relation between fundamental materials properties and the performance of a device. The course content covers a general introduction to the materials challenges related to the design and development of next-generation energy technologies, and an in-depth analysis of materials in batteries, solar cells, fuel cells, hydrogen storage, thermoelectric materials.

Form of teaching

The course build on a series of lectures and a compulsory project work/case study.

Language of instruction: English

Assessment

Examination includes a written exam and examination of the project work by an oral/poster presentation and a written project report. Passed grade is required on both

parts and the final course grade is weighted by 67 % on the written exam and 33 % on the project part.

A student who has taken two exams in a course or part of a course without obtaining a pass grade is entitled to the nomination of another examiner. The student needs to contact the department for a new examiner, preferably in writing, and this should be approved by the department unless there are special reasons to the contrary (Chapter 6 Section 22 of the Higher Education Ordinance).

If a student has received a recommendation from the University of Gothenburg for special educational support, where it is compatible with the learning outcomes of the course and provided that no unreasonable resources are required, the examiner may decide to allow the student to sit an adjusted exam or alternative form of assessment.

In the event that a course has ceased or undergone major changes, students are to be guaranteed at least three examination sessions (including the ordinary examination session) over a period of at least one year, but no more than two years, after the course has ceased/been changed. The same applies to placements and professional placements (VFU), although this is restricted to just one additional examination session.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

Course evaluation

The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.