Materials Science and Nanotechnology, Master's Programme

120 credits

Materials Science and Nanotechnology, masterprogram

6MMSN

Valid from: 2017 Spring semester

Determined by
Faculty Board of Institute of Technology

Date determined
2017-01-25

Purpose

The Master's Programme in Materials Science and Nanotechnology educates specialists in the area of physics of novel materials. The Materials Physics and Nanotechnology masters are prepared for university or industry careers in materials related research and development

The programme is supported by a number of internationally known research divisions at the Department of Physics, Chemistry and Biology (IFM). The applications and importance of advanced materials in today's technology are best exemplified by highly purified semiconductor crystals, which are the basis of the "electronic age". Future applications in electronics and photonics will include nanoscaled physics, molecular electronics, non-linear optics etc.

The master's programme in Materials Science and Nanotechnology covers a wide range of materials including materials used in semiconductor technology, optoelectronics, biotechnical applications (biocompatibility), chemical and bio-sensors, mechanical applications such as hardness and elasticity etc.

Aim

A Master of Science in Materials Science and Nanotechnology should in

Knowledge and reasoning in mathematics, natural sciences and engineering

- be well-qualified in solid state physics and the applications of analytical methods in materials science, and depending of the profile selected Electronic Materials and Devices, Surface Science, Computational Physics or Organic Electronics.

Personal and professional skills and attributes

- be able to formulate, to model and to solve problems in various fields of Physics using experimental and/or computational tools
- be skilled in the effective use of modern analytic equipments for solving problems concerning novel materials

Interpersonal skills: teamwork and communication

- be capable of the teamwork and active collaboration within the group by sharing the tasks and responsibilities
- be able to initialize, to plan, to carry out and to evaluate scientific or engineering projects
- be able to communicate and to give presentations in English, orally and in writing

Conceiving, designing, implementing, and operating systems in the enterprise and social context

- be able to utilize the theoretical and experimental knowledge acquired to the specific problems arising in industry, academic institutions and research and development laboratories

Teaching and working methods

The programme comprises four semesters. The first autumn semester consists to a larger part of compulsory courses while the two following semesters contains mainly elective courses. The fourth semester is assigned to the Master's thesis project. .

The student can chose courses among essentially four elective profiles:

- Electronic Materials and Devices
- Surface and Nano Sciences
- Computational Physics
- Organic Electronics and Sensors

The autumn semester is aimed at giving the master's students a broad knowledge of modern theoretical and experimental methodology used in studies of the physical properties of materials. The courses during the two following semesters are studied in close contact with the research groups at the IFM. Finally, a 30 ECTS credits Master's Thesis in the major subject must be completed. One semester of full-time study corresponds to 30 ECTS credits.

Programme Contents

The syllabus for the programme may vary from year to year, but the main structure remains. The programme consists of four mandatory courses and a set of elective courses all given in English. See the the curriculum for course details. The total number of course credits has to reach a minimum of 90 ECTS credits.

There are certain possibilities for students to exchange courses (for example if a student in previous studies has taken a course that corresponds to a course within the program) or add courses after consulting the programme director, and decision in the Programme Board.

Entry requirements

- Bachelor's degree in physics, applied physics, materials science, electronics engineering or equivalent.
- 20 ECTS credits mathematics/applied mathematics and/or application of mathematics relevant for the programme including courses in calculus, linear algebra, vector calculus, Fourier transforms and differential equations
- 20 ECTS credits in physics including courses in mechanics, wave physics, modern physics, electromagnetism and thermal and statistical physics
- English corresponding to the level of English in Swedish upper secondary education (English 6/B)

Degree thesis

The thesis should be based on the high quality scientific content and carried out in close contact with the research groups involved in the programme and in the area of the profile chosen by the students. Without special permission a thesis work may be performed in the following subject areas:

- Applied Optics
- Applied Sensor Science
- Biosensors and Bioelectronics
- Biomolecular and Organic electronics
- Biotechnology
- Complex Materials and Devices
- Functional Electronic Materials
- Molecular Physics
- Molecular Surface Physics and Nano Science
- Nanostructured Materials
- Plasma and Coatings Physics
- Semiconductor materials
- Surface Physics and Chemistry
- Surface and Semiconductor Physics
- Theory and modelling
- Thin Film Physics

Degree requirements

The programme is designed to give one of the Master's Degrees "Teknologie masterexamen i teknisk fysik" or "Naturvetenskaplig masterexamen i fysik" translated to "Master of Science (Two Years) with a major in Applied Physics" and Master of Science (Two Years) with a major in Physics", respectively.

The requirements are the following:

- a Bachelor's degree as specified in the entrance requirements.
- course requirements for a total of 120 ECTS credits from courses from the curriculum of the programme, or after special decision from the programme board, and thesis work.
- passed the requirements for all compulsory courses.
- courses on advancement level A (advanced) 90 ECTS credits including:
    - at least 30 ECTS credits courses from the major subject Physics/Applied Physics
    - a 30 ECTS credits Master's Thesis in the major subject Physics/Applied Physics
- at least 45 ECTS credits from courses in mathematics or applications of mathematics from the Bachelor level (basic) or Master level (advanced), see list of specific courses
- a Master's thesis presented and passed as per Linköping Institute of Technology degree regulations.

Courses overlapping each other regarding contents are not allowed to be included in the degree. Courses used for the Bachelor's degree can never be included in the Master's degree.

Degree in Swedish

Master of Science (120 credits) with a major in Applied Physics or Master of Science (120 credits) with a major in Physics

Degree in English

Master of Science (two years) with a major in Applied Physics or Master of Science (two years) with a major in Physics

Specific information

Graduate Level Courses

Certain PhD courses can be taken by master students. Please contact the directors of graduate studies:

- Department of Physics, Chemistry and Biology, forskarstudierektor@ifm.liu.se
- Department of Electrical Engineering, forskarstudierektor@isy.liu.se
- Department of Computer and Information Science, forskarstudierektor@ida.liu.se
- Department of Mathematics, forskarstudierektor@mai.liu.se
- Department of Biomedical Engineering, forskarstudierektor@imt.liu.se

In order to include graduate course in the degree the student must apply to the Board of Studies

Common rules

See also common rules

Curriculum

Semester 1 (Autumn 2017)

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TFFM08	Experimental Physics	6*	A1X	1	C
TFYA43	Nanotechnology	6	G2X	3	C
TFYA77	Fundamentals in Materials Science	6	A1X	2	C
Period 2					
TFFM08	Experimental Physics	6*	A1X	1	C
TFFY70	Physics of Condensed Matter part I	6	A1X	2	C
TFYA20	Surface Physics	6	A1X	4	C

Semester 2 (Spring 2018)

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TFFM40	Analytical Methods in Materials Science	6*	A1X	1	C
TFYA25	Physics of Condensed Matter part II	6	A1X	2	C
THEN24	Communication, Ethics and Sustainable Development	6*	G1X	-	C
TFYA04	Materials Optics	6	A1X	4	E
TFYA21	Physical Metallurgy	6	A1X	3	E
TFYA36	Chaos and Non-Linear Phenomena	6*	A1X	3	E
TFYY67	Classical Electrodynamics	6	A1X	1	E
TNE103	Organic Electronics 1	6	A1X	4	E
Period 2					
TFFM40	Analytical Methods in Materials Science	6*	A1X	1	C
THEN24	Communication, Ethics and Sustainable Development	6*	G1X	-	C
TFMT19	Chemical Sensor Systems	6	A1X	4	E
TFYA19	Quantum Computers	6	A1X	4	E
TFYA36	Chaos and Non-Linear Phenomena	6*	A1X	2	E
TFYA38	Optoelectronics	6	A1X	3	E
TFYA41	Thin Film Physics	6	A1X	2	E
TNE093	Solar Cell Technology	6	A1X	3	E

Semester 3 (Autumn 2018)

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TFFY54	Quantum Mechanics	6	A1X	2	E
TFYA17	Advanced Project Work in Applied Physics	6*	A1X	-	E
TFYA40	Analytical Mechanics	6	A1X	2	E
TFYA50	Project course in Computational Physics CDIO	12*	A1X	4	E
TFYA88	Additive Manufacturing: Tools, Materials and Methods	6	A1X	3	E
TFYA91	Quantum Structures: Photonics and Transport	6	A1X	1	E
TFYA92	Project Course in Applied Physics, CDIO	12*	A1X	4	E
Period 2					
TFYA17	Advanced Project Work in Applied Physics	6*	A1X	-	E
TFYA28	Quantum Dynamics	6	A1X	1	E
TFYA39	Semiconductor Technology	6	A1X	3	E
TFYA50	Project course in Computational Physics CDIO	12*	A1X	4	E
TFYA90	Computational Physics	6	A1X	4	E
TFYA92	Project Course in Applied Physics, CDIO	12*	A1X	4	E
TFYY54	Nano Physics	6	A1X	3	E

Semester 4 (Spring 2019)

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TQXX30	Degree project - Master's Thesis	30*	A1X	-	C
Period 2					
TQXX30	Degree project - Master's Thesis	30*	A1X	-	C

ECV = Elective / Compulsory /Voluntary
*The course is divided into several semesters and/or periods