Master's Programme in Computer Science

120 credits

Masterprogram i Computer Science

6MICS

Valid from: 2019 Spring semester

Determined by
Board of Studies for Computer Science and Media Technology

Date determined

Purpose

The Master's Programme in Computer Science aims to educate specialists who will be able to work at the forefront of modern software and computer systems technology in a variety of application areas. The programme also aims at ensuring that the students are well prepared for a career in research or continued studies towards a doctoral degree.

Computer science is one of the most dynamic and expansive fields of science. For the individual scholar or the professional in the field this means that, as well as having a good understanding of the theoretical and technical foundations of the field, one needs to be able to apply the technology to new challenging problems and integrate it with other technologies.

Aim

The Master's Programme in Computer Science offers the opportunity for advanced study in computer science and engineering and allows for flexible planning of specialization areas. Having covered core computer science courses, the students will be able to focus their studies on areas such as artificial intelligence, databases and data-mining, internet computing, embedded systems, information security, design and programming computer games, language technology, human-computer interaction, theoretical computer science or design and implementation of computer languages.
The following learning outcomes will serve as measurable goals towards the implementation of the general aim of the program. These objectives are formulated in terms of capacities competences of the students who successfully complete the program.

- A Computer Science master will be able to understand and apply mathematical concepts which are necessary for modelling various kinds of computational problems. He/She will have an understanding of both software and hardware issues.
- A Computer Science master will be a competent programmer who is familiar with a variety of programming languages and tools and is able to creatively apply his/her knowledge and skills to modelling and developing software solutions which contribute towards applications in a wide variety of application domains.
- The Computer Science master will be able to work as a team member and effectively cooperate with other specialists and contribute towards the solution of complex technical problems.
- The Computer Science master will be qualified to take a leading role in a software design and development team, evaluate and compare solutions, and decision making. He/She will be able to further deepen his/her knowledge and contribute to the development of the area.
- The Computer Science master will be a good communicator who will be able to present coherent technical and scientific results both orally and in writing.
- Students who successfully complete the programme will have a good understanding of the impact of computers in society, ethical issues relevant to the field, as well as the responsibilities of the computer science professionals.
- Although computer science enjoys a relatively stable scientific foundation, the field is still dynamic and expansive. An important aspect of educational programs in the field is to prepare the students for a lifelong learning in the field.

Content

The programme is based on fundamental mathematical, theoretical, and technical knowledge acquired by the student during his/her undergraduate education. This basic knowledge should cover programming in various languages and paradigms, algorithms, databases, system software, operating systems and mathematical knowledge which should include discrete mathematics, logic and statistics.
The Master's Programme in Computer Science is both theoretical and applied. A number of courses will provide the student with the broad view and understanding needed in order to master the general area. At the same time, a proper selection of courses allows for further specialisation.
Communication skills, presentation techniques (both oral and written), as well as team work, are emphasized during the whole program.
Each year the programme board decides what courses will be given and included in the programme. This is found in the curriculum. For each course there is a course syllabus, describing the learning outcomes, organisation, examination and the classification of the advancement level and to what subject area the course belongs. The course advancement level and subject area are important in fulfilling the requirements for the Master's degree.

Education profiles

The specialisation areas are visible in the curriculum. If a specialisation requirement is fulfilled the specialisation will be included in the Degree Certificate.

Specialisation areas in the programme include:

- Artificial Intelligence and Data Mining
- Visualization and Computer Graphics
- Computer Networks, Distributed Systems and Security
- Embedded Systems
- Programming and Software Methods

In order to meet the specialization requirement, 42hp of the elective courses in the degree must be within the specialization.

Entry requirements

- A bachelor's degree with a major in computer science, information technology, software engineering, computer engineering, alternatively, a bachelor's degree with a minor in computer science or related subject area, with a minimum of 60 ECTS credits in computer-related subjects (e.g. programming, data structures, databases, software engineering, computer hardware, computer networks). The Bachelor's degree (equivalent to a Swedish Kandidatexamen) shall be from an internationally recognised university.
- At least 24 ECTS credits in mathematics/applied mathematics and/or application of mathematics relevant for the programme including courses in discrete mathematics, linear algebra and calculus.
- English corresponding to the level of English in Swedish upper secondary education (English 6/B). This is normally attested by means of an internationally recognised test.

Selection for the January application round is based on merit rating (grade tariff) at three levels. If necessary, applicants within the same merit group will be selected by lot.

- Group 1: High
- Group 2: Good
- Group 3: Low

Degree thesis

The thesis encompasses independent work corresponding to 30 ECTS credits. The students are encouraged to carry out their thesis work in their specialisation area. The thesis should be written and presented in English. The thesis work should be supervised by a faculty member within computer science and engineering.

Degree requirements

The programme is designed to give the Master's Degree "Teknologie masterexamen i datavetenskap" translated to "Master of Science (2 years) with a major in Computer Science".

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 of Computer Science.
    - a 30 ECTS credits Master's Thesis in the major subject of Computer Science.
- a Master's thesis presented and passed as per Linköping Institute of Technology degree regulations.
- One of the following courses must be completed and approved:
    - TDDE18 Programming C++
    - TDDD38 Advanced C++
- One of the following courses must be completed and approved:
    - TDDD89 Scientific Method
    - TNM107 Scientific Method

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.

About the Degree
Students who have studied advanced courses in computer science prior to the Master's programme can either transfer some of their credits to the programme or be allowed to substitute compulsory courses in the programme with other courses. Transferring credits is only applicable to earlier courses that have not been included in other degrees.

Degree in Swedish

Teknologie masterexamen i Datavetenskap, 120 hp

Degree in English

Master of Science in Computer Science, 120 credits

Specific information

Graduate Level Courses
Certain PhD courses can be taken by master students. These course selections are subject to formal decision by the executive committee of the Programme Board.

Entrance requirements
See general rules and regulations for master programmes at LiTH.

Common rules

See also common rules

Curriculum

Semester 1 (Autumn 2019)

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDDE32	Professionalism in Computer Science	6*	G2F	4	C
TDDD38	Advanced Programming in C++	6*	A1N	2	C/E
TDDE18	Programming C++	6*	G2F	2	C/E
TDDC17	Artificial Intelligence	6	G2F	3	E
TDTS06	Computer Networks	6	G2F	1	E
TDTS08	Advanced Computer Architecture	6	A1N	2	E
Period 2					
TAMS11	Probability and Statistics, first course	6	G2F	4	C
TDDE32	Professionalism in Computer Science	6*	G2F	3	C
TDDD38	Advanced Programming in C++	6*	A1N	-	C/E
TDDE18	Programming C++	6*	G2F	1	C/E
TDDD07	Real Time Systems	6	A1N	4	E
TDDD37	Database Technology	6	G2F	1	E
TDDE01	Machine Learning	6	A1N	1	E
TSIT02	Computer Security	6	G2F	2	E

Specialisation: AI and Data Mining

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDDC17	Artificial Intelligence	6	G2F	3	E
Period 2					
TDDE01	Machine Learning	6	A1N	1	E

Specialisation: Computer Networks, Distributed Systems and Security

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDTS06	Computer Networks	6	G2F	1	E
Period 2					
TSIT02	Computer Security	6	G2F	2	E

Specialisation: Embedded Systems

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDTS08	Advanced Computer Architecture	6	A1N	2	E
Period 2					
TDDD07	Real Time Systems	6	A1N	4	E

Specialisation: Visualization and Computer Graphics

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDDC17	Artificial Intelligence	6	G2F	3	E

Semester 2 (Spring 2020)

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TATA54	Number Theory	6*	G2F	3	E
TATA64	Graph Theory	6*	A1N	2	E
TBMI26	Neural Networks and Learning Systems	6	A1N	2	E
TDDB68	Concurrent Programming and Operating Systems	6	G2X	3	E
TDDD17	Information Security, Second Course	6*	A1X	4	E
TDDD20	Design and Analysis of Algorithms	6	A1N	3	E
TDDD25	Distributed Systems	6	A1N	2	E
TDDD38	Advanced Programming in C++	6*	A1N	2	E
TDDD41	Data Mining - Clustering and Association Analysis	6	A1N	3	E

Course code	Course name	Credits	Level	Timetable module	ECV
TDDD97	Web Programming	6	G2F	3	E
TDDE05	AI Robotics	6*	A1N	4	E
TDDE09	Natural Language Processing	6	A1F	2	E
TDTS07	System Design and Methodology	6	A1N	1	E
TDTS21	Advanced Networking	6*	A1N	1	E
TNM048	Information Visualisation	6	A1X	3	E
TNM061	3-D Computer Graphics	6*	G2X	1	E
TSBK35	Audio and Image Compression	6	A1X	4	E
Period 2					
TAOP24	Optimization, Advanced Course	6	G2F	1	E
TATA54	Number Theory	6*	G2F	1	E
TATA64	Graph Theory	6*	A1N	2	E
TDDC78	Programming of Parallel Computers - Methods and Tools	6	A1X	3	E
TDDD14	Formal Languages and Automata Theory	6	G2F	2	E
TDDD17	Information Security, Second Course	6*	A1X	4	E
TDDD27	Advanced Web Programming	6	A1N	3	E
TDDD38	Advanced Programming in C++	6*	A1N	-	E
TDDD48	Automated Planning	6	A1N	1	E
TDDE05	AI Robotics	6*	A1N	4	E
TDDE07	Bayesian Learning	6	A1F	2	E
TDDE31	Big Data Analytics	6	A1F	3	E
TDDE41	Software Architectures	6	A1N	1	E
TDTS21	Advanced Networking	6*	A1N	1	E
TNM061	3-D Computer Graphics	6*	G2X	4	E
TNM079	Modelling and Animation	6	A1X	2	E
TNM096	Artificial Intelligence - Principles and Techniques	6	G2X	1	E
TNM098	Advanced Visual Data Analysis	6	A1X	4	E

Specialisation: AI and Data Mining

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TBMI26	Neural Networks and Learning Systems	6	A1N	2	E
TDDD41	Data Mining - Clustering and Association Analysis	6	A1N	3	E
TDDE05	AI Robotics	6*	A1N	4	E
TDDE09	Natural Language Processing	6	A1F	2	E
Period 2					
TDDD48	Automated Planning	6	A1N	1	E
TDDE05	AI Robotics	6*	A1N	4	E
TDDE07	Bayesian Learning	6	A1F	2	E
TDDE31	Big Data Analytics	6	A1F	3	E
TNM096	Artificial Intelligence - Principles and Techniques	6	G2X	1	E

Specialisation: Computer Networks, Distributed Systems and Security

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDDD17	Information Security, Second Course	6*	A1X	4	E
TDDD25	Distributed Systems	6	A1N	2	E
TDTS21	Advanced Networking	6*	A1N	1	E
Period 2					
TDDD17	Information Security, Second Course	6*	A1X	4	E
TDTS21	Advanced Networking	6*	A1N	1	E

Specialisation: Embedded Systems

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDDB68	Concurrent Programming and Operating Systems	6	G2X	3	E
TDDD25	Distributed Systems	6	A1N	2	E
TDTS07	System Design and Methodology	6	A1N	1	E
Period 2					
TDDC78	Programming of Parallel Computers - Methods and Tools	6	A1X	3	E

Specialisation: Programming and Software Methods

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDDB68	Concurrent Programming and Operating Systems	6	G2X	3	E
TDDD25	Distributed Systems	6	A1N	2	E
TDDD38	Advanced Programming in C++	6*	A1N	2	E
TDDD97	Web Programming	6	G2F	3	E
Period 2					
TDDC78	Programming of Parallel Computers - Methods and Tools	6	A1X	3	E
TDDD27	Advanced Web Programming	6	A1N	3	E
TDDD38	Advanced Programming in C++	6*	A1N	-	E
TDDE41	Software Architectures	6	A1N	1	E

Specialisation: Visualization and Computer Graphics

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TNM048	Information Visualisation	6	A1X	3	E
TNM061	3-D Computer Graphics	6*	G2X	1	E
TSBK35	Audio and Image Compression	6	A1X	4	E
Period 2					
TDDD27	Advanced Web Programming	6	A1N	3	E
TNM061	3-D Computer Graphics	6*	G2X	4	E
TNM079	Modelling and Animation	6	A1X	2	E
TNM096	Artificial Intelligence - Principles and Techniques	6	G2X	1	E
TNM098	Advanced Visual Data Analysis	6	A1X	4	E

Semester 3 (Autumn 2020)

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TAMS22	Probability Theory and Bayesian Networks	6*	A1X	4	E
TATA55	Abstract Algebra	6*	G2F	3	E
TBMI19	Medical Information Systems	6*	A1N	2	E
TDDC34	Technical, Economic and Societal Evaluation of IT-products	6	A1X	3	E
TDDC88	Software Engineering	12*	A1N	1	E
TDDD04	Software Testing	6	A1N	2	E
TDDD08	Logic Programming	6	A1N	4	E
TDDD23	Design and Programming of Computer Games	6	A1N	2	E
TDDD38	Advanced Programming in C++	6*	A1N	2	E
TDDD43	Advanced Data Models and Databases	6*	A1N	2	E
TDDE19	Advanced Project Course - AI and Machine Learning	6*	A1F	4	E
TDDE21	Advanced Project Course: Secure Distributed and Embedded Systems	6*	A1F	4	E
TDDE45	Software Design and Construction	6	A1N	4	E
TDTS06	Computer Networks	6	G2F	1	E

Course code	Course name	Credits	Level	Timetable module	ECV
TNCG15	Advanced Global Illumination and Rendering	6	A1X	4	E
TNM067	Scientific Visualization	6	A1X	3	E
TNM095	Artificial Intelligence for Interactive Media	6	A1X	2	E
TSIN01	Information Networks	6	A1X	3	E
TSIT03	Cryptology	6	A1X	2	E
TSKS12	Modern Channel Coding, Inference and Learning	6	A1N	1	E
TSTE86	Digital Integrated Circuits	6	A1N	2	E
Period 2					
TDDD89	Scientific Method	6	A1F	3	C/E
TNM107	Scientific Method	6	A1X	3	C/E
TAMS22	Probability Theory and Bayesian Networks	6*	A1X	4	E
TATA55	Abstract Algebra	6*	G2F	3	E
TBMI19	Medical Information Systems	6*	A1N	3	E
TDDB44	Compiler Construction	6	A1X	1	E
TDDC88	Software Engineering	12*	A1N	1	E
TDDC90	Software Security	6	A1N	1	E
TDDD38	Advanced Programming in C++	6*	A1N	-	E
TDDD43	Advanced Data Models and Databases	6*	A1N	2	E
TDDD56	Multicore and GPU Programming	6	A1N	2	E
TDDE13	Multi Agent Systems	6	A1N	1	E
TDDE16	Text Mining	6	A1F	2	E
TDDE19	Advanced Project Course - AI and Machine Learning	6*	A1F	4	E
TDDE21	Advanced Project Course: Secure Distributed and Embedded Systems	6*	A1F	4	E
TNM084	Procedural Methods for Images	6	A1X	4	E
TNM086	Virtual Reality Techniques	6	A1X	2	E
TSEA26	Design of Embedded DSP Processor	6	A1X	2	E
TSIN02	Internetworking	6	A1N	1	E

Specialisation: AI and Data Mining

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDDD08	Logic Programming	6	A1N	4	E
TDDD23	Design and Programming of Computer Games	6	A1N	2	E
TDDD43	Advanced Data Models and Databases	6*	A1N	2	E
TDDE19	Advanced Project Course - AI and Machine Learning	6*	A1F	4	E
Period 2					
TDDD43	Advanced Data Models and Databases	6*	A1N	2	E
TDDE13	Multi Agent Systems	6	A1N	1	E
TDDE16	Text Mining	6	A1F	2	E
TDDE19	Advanced Project Course - AI and Machine Learning	6*	A1F	4	E

Specialisation: Computer Networks, Distributed Systems and Security

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDDE21	Advanced Project Course: Secure Distributed and Embedded Systems	6*	A1F	4	E
TDTS06	Computer Networks	6	G2F	1	E
TSIN01	Information Networks	6	A1X	3	E
TSIT03	Cryptology	6	A1X	2	E
Period 2					
TDDC90	Software Security	6	A1N	1	E
TDDE21	Advanced Project Course: Secure Distributed and Embedded Systems	6*	A1F	4	E
TSIN02	Internetworking	6	A1N	1	E

Specialisation: Embedded Systems

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDDE21	Advanced Project Course: Secure Distributed and Embedded Systems	6*	A1F	4	E
TSTE86	Digital Integrated Circuits	6	A1N	2	E
Period 2					
TDDD56	Multicore and GPU Programming	6	A1N	2	E
TDDE21	Advanced Project Course: Secure Distributed and Embedded Systems	6*	A1F	4	E
TSEA26	Design of Embedded DSP Processor	6	A1X	2	E

Specialisation: Programming and Software Methods

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDDC88	Software Engineering	12*	A1N	1	E
TDDD04	Software Testing	6	A1N	2	E
TDDD08	Logic Programming	6	A1N	4	E
TDDE45	Software Design and Construction	6	A1N	4	E
Period 2					
TDDB44	Compiler Construction	6	A1X	1	E
TDDC88	Software Engineering	12*	A1N	1	E
TDDC90	Software Security	6	A1N	1	E
TDDD56	Multicore and GPU Programming	6	A1N	2	E

Specialisation: Visualization and Computer Graphics

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TNCG15	Advanced Global Illumination and Rendering	6	A1X	4	E
TNM067	Scientific Visualization	6	A1X	3	E
TNM095	Artificial Intelligence for Interactive Media	6	A1X	2	E
Period 2					
TNM084	Procedural Methods for Images	6	A1X	4	E
TNM086	Virtual Reality Techniques	6	A1X	2	E

Semester 4 (Spring 2021)

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

Common rules

Structure and organisation of study programmes

The contents and design of the programmes are to be continuously revised such that new knowledge is integrated into courses and specialisations. Within one programme, several study specialisations or profiles may be available. The identities of the study specialisations or profiles and the regulations governing how these may be selected are given in the syllabus and curriculum for the particular field of study and programmes.

The structure and organisation of the programmes are to follow specified criteria that are summarised in the syllabus for each programme.

- The syllabus defines the aims of the study programme.
- The curriculum, which constitutes one part of the syllabus for the field of study, gives details of the terms in which the various courses have been timetabled, and their scheduling through the academic year.
- The course syllabus specifies, among other things, the aim and contents of the course, and the prior knowledge that a student must have in order to be able to benefit from the course.

Qualification requirements

The qualification requirements specified in the Higher Education Ordinance 2007 apply to students admitted after 1 July 2007. A student who has completed components of a programme after 1 July 2007 has the right to be assessed with respect to the qualification requirements specified by the Higher Education Ordinance 2007. In addition, local regulations laid down by the faculty boards and university board apply, see http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva/Examina.

Higher Education Act Chapter 1, Section 8:

First-cycle courses and study programmes are to develop:

- the ability to make independent and critical assessments
- the ability to identify, formulate and solve problems autonomously, and
- the preparedness to deal with changes in working life.

In addition to knowledge and skills in their field of study, students shall develop the ability to:

- gather and interpret information at a scholarly level
- stay abreast of the development of knowledge, and
- communicate their knowledge to others, including those who lack specialist knowledge in the field.

Qualifications within a study programme

Qualification requirements that are specific to a study programme are given in the syllabus for that programme.

Matriculation and postponement of matriculation

A person who has been accepted for a study programme is to start their studies (matriculate) in the term that is specified in the decision about admission. The date and location of the compulsory matriculation procedure will be communicated to those admitted to the first term of the programme.

At any one admission occasion, it is possible to be admitted to only one place on a study programme. A student who has been granted a place on a study programme and who is offered and accepts a place on another study programme during a supplementary round of admission will lose the place offered for the first study programme.

Regulations concerning postponement of matriculation have been laid down in the admission regulations for Linköping University, http://styrdokument.liu.se/Regelsamling/VisaBeslut/622645.

A person who has been granted postponement must present to the admitting authority, before the term in which the studies are to be started and before the date of application, a renewed registration for the programme and a copy of the decision granting postponement.

Admission to a later part of a programme

Admission to a part of a study programme is used here to refer to admission with the purpose of completing the programme and taking a degree. Admission to a later part of a programme may take place only if sufficient resources and space on the programme are available. Furthermore, the applicant must satisfy the entry requirements for the relevant term of the programme, as specified in http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva/Tekniska_fakulteten.

Interruption in studies

Notification of an interruption in studies is to be made through the Student Portal. If such a notification is not made and if the student does not register for the first term during which the interruption is to take place, the interruption will be considered to be a withdrawal. An interruption in studies must cover a complete term, and notification of interruptions can be given for a maximum of two consecutive terms. Notification of resumption of studies is to take place at the term registration for the term that follows the interruption. If the student does not register at the term registration, this will be regarded as withdrawal from studies.

A student who is taking an interruption in studies may during this period retake examinations if he or she has re-registered for the most recent study term of the programme. A student who wishes to take another course during the interruption in studies must apply for this separately. The student is responsible that

registration for courses is carried out at the correct times in preparation for the resumption of studies.

Withdrawal from a study programme

A student who wishes to withdraw from a study programme must notify the study guidance counsellor. A student who leaves the studies without giving notification of an interruption in study and who fails to register for the immediately subsequent term is considered to have withdrawn. A student who has withdrawn may return to the study programme if a vacancy is available that is not required for students returning after an interruption in study, and not required for students who are changing their location of study and/or study programme.

Courses within a study programme

The curriculum for the various years of a study programme specify which courses are compulsory (o), elective (v) and voluntary (f). If a student wishes to study a different combination than the one specified in the curriculum, an application must be made to the board of studies.

Voluntary courses

The course specified as voluntary (labelled with "f") in the programme syllabus are assessed solely as voluntary courses, and credits from these may not contribute to the requirements for a degree.

Courses from another study programme

Courses that are elective courses in another study programme may be included as elective courses in a degree, if the board of studies so decides. If such a decision is not taken, such courses are regarded as voluntary courses.

When selecting a course from another programme, the admission requirements specified in the course syllabus must be satisfied.

Admission is granted to the extent that resources allow, provided that places are available on the course.

Students taking a master's programme in engineering

Students taking a master's programme in engineering can take courses given in Term 7 and later terms of the programme from all engineering master's programmes. Admission to courses at advanced level requires the possession of at least 150 credits within the programme to which the student has been admitted.

Students taking a Bachelor of Science (Engineering)

Student taking Bachelor of Science (Engineering) degrees may take courses specified in the programme syllabuses of all Bachelor of Science (Engineering) programmes.

Students taking a Bachelor of Science

Student taking Bachelor of Science degrees may take courses specified in the programme syllabuses of all Bachelor of Science programmes.

Third-cycle courses

The credits from third-cycle courses may be included as elective courses in a degree, if the board of studies so decides. If such a decision is not taken, such courses are regarded as voluntary courses.

Students taking a master's programme in engineering

It is possible for students taking master's programmes in engineering to take certain third-cycle courses. It is, however, required in this case that the student has achieved master's level (i.e. year 4 or 5 of the study programme). Information can be obtained from the relevant director of advanced studies.

Students on Master's programmes

It is possible for students taking master's programmes to take certain third-cycle courses. Information can be obtained from the relevant director of advanced studies.

Registration for programme courses

Registration for courses that are given as part of a study programme must be made during the specified period, which has been preliminarily set to 1-10 April for the autumn term, and 1-10 October for the spring term. Information about course registration is published on a webpage, sent to students by email, and disseminated at scheduled information meetings.

Registration for programme courses as single-subject courses

Admission to a programme course as a single-subject subject course may take place only if sufficient resources and space on the course are available. Furthermore, the applicant must satisfy the entry requirements for the relevant course.

In the event of a scarcity of resources, the board of LiTH can decide to limit the possibilities of taking courses that are part of a programme as freestanding courses.

Timetabling

Courses are timetabled after a decision has been made concerning the assignment of the course to a timetable module. A central timetable is not drawn up for courses with fewer than five participants. Most project courses do not have a central timetable.

Study planning

Students who require support in planning their continued studies can contact the study guidance counsellor of the programme. Study planning involves the student and the study guidance counsellor together drawing up an individual plan for studies during the subsequent term. The individual plan may allow the student to deviate from the general curriculum.

Completed first-cycle courses are a precondition for successful studies at more advanced levels. For this reason, study planning is based on giving priority to courses from earlier years of study that have not been completed. If further capacity is available, new courses may be taken.

Study planning takes place on a regular basis if the student:

- does not satisfy the requirements for progression to later terms. In order for a student to be able to participate in courses from later years in such cases, a decision of exemption is required.
- does not satisfy the requirements for starting a degree project.

Other situations in which study planning may be required:

- A student has fallen behind during the early part of a study programme and has failed to complete several courses.
- A student has not satisfied the entry requirements for a degree project before term 6 of an engineering degree.
- A student has applied for admission to a later part of a programme.
- Studies have been carried out abroad.
- A study programme is to be resumed after an interruption.

In these cases the study guidance counsellor supports the student in planning the continued studies, also in situations in which the student can register for the relevant courses without the need for a special decision for the continued studies.

Part of education abroad

Students can exchange study at LiTH for study at an institute of higher education abroad, and/or work on a degree project abroad.

In the event that study (courses) at LiTH are exchanged for study abroad, the relevant board of studies (faculty programme director) is responsible for a decision about an individual study plan, which is to be drawn up in advance, and about the final course approval and its inclusion in the qualification requirements. For this reason, students who plan to participate in an exchange should contact the faculty programme director (or equivalent) at the Dean's Office of the Institute of Technology.

Regulations for entry requirements, ranking and nomination for study abroad through LiTH's exchange agreements and for the compulsory study abroad period within Ii (Industrial Engineering and Management – International) and Yi (Applied Physics and Electrical Engineering – International) can be found at:

http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva/Tekniska_fakulteten.

Course syllabus

A syllabus has been established for each course. The syllabus specifies the aim and contents of the course, and the prior knowledge that a student must have in order to be able to benefit from the course.

Timetabling

Courses are timetabled after a decision has been made for this course concerning its assignment to a timetable module. A central timetable is not drawn up for courses with fewer than five participants. Most project courses do not have a central timetable.

Interrupting a course

The vice-chancellor's decision concerning regulations for registration, deregistration and reporting results (Dnr LiU-2015-01241) states that interruptions in study are to be recorded in Ladok. Thus, all students who do not participate in a course for which they have registered must record the interruption, such that the registration on the course can be removed. Deregistration from a course is carried out using a web-based form: www.lith.liu.se/for-studenter/kurskomplettering?l=sv.

Cancelled courses

Courses with few participants (fewer than 10) may be cancelled or organised in a manner that differs from that stated in the course syllabus. The board of studies is to deliberate and decide whether a course is to be cancelled or changed from the course syllabus.

Regulations relating to examinations and examiners

Details are given in a decision in the university's rule book: http://styrdokument.liu.se/Regelsamling/VisaBeslut/622678.

Forms of examination

Examination

Written and oral examinations are held at least three times a year: once immediately after the end of the course, once in August, and once (usually) in one of the re-examination periods. Examinations held at other times are to follow a decision of the board of studies.

Principles for examination scheduling for courses that follow the study periods:

- courses given in VT1 are examined for the first time in March, with re-examination in June and August
- courses given in VT2 are examined for the first time in May, with re-examination in August and October
- courses given in HT1 are examined for the first time in October, with re-examination in January and August
- courses given in HT2 are examined for the first time in January, with re-examination at Easter and in August.

The examination schedule is based on the structure of timetable modules, but there may be deviations from this, mainly in the case of courses that are studied and examined for several programmes and in lower grades (i.e. 1 and 2).

- Examinations for courses that the board of studies has decided are to be held in alternate years are held only three times during the year in which the course is given.
- Examinations for courses that are cancelled or rescheduled such that they are not given in one or several years are held three times during the year that immediately follows the course, with examination scheduling that corresponds to the scheduling that was in force before the course was cancelled or rescheduled.
- If teaching is no longer given for a course, three examination occurrences are held during the immediately subsequent year, while examinations are at the same time held for any replacement course that is given, or alternatively in association with other re-examination opportunities. Furthermore, an examination is held on one further occasion during the next subsequent year, unless the board of studies determines otherwise.
- If a course is given during several periods of the year (for programmes, or on different occasions for different programmes) the board or boards of studies determine together the scheduling and frequency of re-examination occasions.

Registration for examination

In order to take an examination, a student must register in advance at the Student Portal during the registration period, which opens 30 days before the date of the examination and closes 10 days before it. Candidates are informed of the location of the examination by email, four days in advance. Students who have not registered for an examination run the risk of being refused admittance to the examination, if space is not available.

Symbols used in the examination registration system:

** denotes that the examination is being given for the penultimate time.

* denotes that the examination is being given for the last time.

Code of conduct for students during examinations

Details are given in a decision in the university's rule book: http://styrdokument.liu.se/Regelsamling/VisaBeslut/622682.

Retakes for higher grade

Students at the Institute of Technology at LiU have the right to retake written examinations and computer-based examinations in an attempt to achieve a higher grade. This is valid for all examination components with code “TEN” and "DAT". The same right may not be exercised for other examination components, unless otherwise specified in the course syllabus.

Retakes of other forms of examination

Regulations concerning retakes of other forms of examination than written examinations and computer-based examinations are given in the LiU regulations for examinations and examiners,
http://styrdokument.liu.se/Regelsamling/VisaBeslut/622678.

Plagiarism

For examinations that involve the writing of reports, in cases in which it can be assumed that the student has had access to other sources (such as during project work, writing essays, etc.), the material submitted must be prepared in accordance with principles for acceptable practice when referring to sources (references or quotations for which the source is specified) when the text, images, ideas, data, etc. of other people are used. It is also to be made clear whether the author has reused his or her own text, images, ideas, data, etc. from previous examinations.

A failure to specify such sources may be regarded as attempted deception during examination.

Attempts to cheat

In the event of a suspected attempt by a student to cheat during an examination, or when study performance is to be assessed as specified in Chapter 10 of the Higher Education Ordinance, the examiner is to report this to the disciplinary board of the university. Possible consequences for the student are suspension from study and a formal warning. More information is available at https://www.student.liu.se/studenttjanster/lagar-regler-rattigheter?l=sv.

Grades

The grades that are preferably to be used are Fail (U), Pass (3), Pass not without distinction (4) and Pass with distinction (5). Courses under the auspices of the faculty board of the Faculty of Science and Engineering (Institute of Technology) are to be given special attention in this regard.

1. Grades U, 3, 4, 5 are to be awarded for courses that have written examinations.
2. Grades Fail (U) and Pass (G) may be awarded for courses with a large degree of practical components such as laboratory work, project work and group work.

Examination components

1. Grades U, 3, 4, 5 are to be awarded for written examinations (TEN).

2. Grades Fail (U) and Pass (G) are to be used for undergraduate projects and other independent work.
3. Examination components for which the grades Fail (U) and Pass (G) may be awarded are laboratory work (LAB), project work (PRA), preparatory written examination (KTR), oral examination (MUN), computer-based examination (DAT), home assignment (HEM), and assignment (UPG).
4. Students receive grades either Fail (U) or Pass (G) for other examination components in which the examination criteria are satisfied principally through active attendance such as other examination (ANN), tutorial group (BAS) or examination item (MOM).

The examination results for a student are reported at the relevant department.

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.

Degree project for Master's Degree in Engineering 300 credits, Master of Science (Two years), Master of Philosophy (Two years), Master of Science (One year), and master's degrees without prefix

General provisions for the degree project are given here. A specific board of studies may have supplementary regulations that are specific for a study programme. These are specified, where relevant, in the syllabus for the field of education and/or the degree project. Information and links to course syllabuses, registration, reflection documents, etc. can be found at www.lith.liu.se/examensarbete/examensarbete?l=sv.

General provisions

To be awarded a Master's Degree in Engineering 300 credits, Master of Science (Two years), Master of Philosophy (Two years), Master of Science (One year), or master's degree without prefix a student must carry out an approved degree project. The components of the degree project are described in the relevant course syllabus.

Aim

The aim of the degree project is described in the relevant course syllabus,

www.lith.liu.se/examensarbete/examensarbete?l=sv. Links to respective course syllabus can be found under the heading "Utbildningarna" (Civilingenjörsutbildning (i.e. Master of Science in Engineering) or Masterutbildning (i.e. Master of Science)).

Extent

Requirements for the extent of the degree project for each type of degree are given in the syllabus of the study programme.

Locations for a degree project

The work is carried out in the form of:

- an internal degree project located at one of the participating departments at LiU
- an external degree project located at a company, government agency, or other organisation in Sweden or abroad, that an examiner has assessed is able to manage a degree project that satisfies the requirements, or
- a degree project within an exchange agreement in association with study abroad, whereby all study results are to be credited to the student by the relevant board of studies.

The main subject areas that are permitted within each study programme are described in the programme syllabus. Any individual subjects that may be relevant to the main subject area are to be determined by the relevant board of studies.

The examiner for a degree project within a certain subject area are determined by the board of studies that is responsible for general degrees within the main subject area. An up-to-date list is given at http://www.lith.liu.se/examensarbete/examensarbete?l=sv.

Degree projects within agreements relating to study abroad

During study abroad that takes place within the framework of an agreement, the provisions of the host institute relating to degree projects are applied. The student is to consult the board of studies and together ensure that the proposed degree project is carried out in a main subject area that is permitted within the study programme. Approved main subject areas for degree projects are specified in the syllabus for the relevant programme.

A certificate confirming that the degree project has been approved and a copy of the degree project thesis (in PDF format) are to be submitted to the relevant board of studies.

Selection of degree project

A degree project is to be selected in consultation with an examiner, who is also responsible that the specialisation, extent and level of the project satisfy the requirements specified in the course syllabus.

In cases in which issues relating to work-related copyright, patenting or remuneration may arise, provisions governing these should be established in

advance. A student working on a degree project may sign a confidentiality agreement in order to obtain access to confidential information necessary for the degree project. The supervisor and examiner, however, determine whether they are prepared to sign a confidentiality agreement, and thus the confidential information must not normally be of such nature that it is necessary to supervise or grade the work. The complete degree project thesis is to be published during the grading procedure, unless special circumstances prevent this. If any part of the thesis should not be published, this must be approved in advance by the examiner and the relevant head of department. Note that final decisions relating to confidentiality are taken by an administrative court.

Commencement of a degree project

Requirements that must be satisfied before a degree project can be started are given in the currently valid course syllabus, which can be obtained at www.lith.liu.se/examensarbete/examensarbete?l=sv.

Notification of a degree project is to be carried out when the degree project starts, at www.lith.liu.se/for-studenter/anmalan-till-exjobb?l=sv. Registration of the degree project is to take place before work commences, after the student has registered for the term.

Before the start of the degree project, the examiner is to ensure that the student satisfies the conditions for commencement of the degree project within the relevant main subject area. Support in this can be obtained from the study guidance counsellor, who checks the general requirements for starting the degree project.

The student is also to notify the relevant department of the start of the degree project.

Degree projects in collaboration with another student

In cases in which two students carry out a degree project together, the contribution of each student is to be specified. The extent of the work is to correspond to the extent of two individual projects. The examiner is to ensure that each student has contributed in a satisfactory manner to the work, and that each student satisfies the requirements for achieving a Pass grade for the degree project.

Degree projects carried out in collaboration between more than two students are not permitted.

Examiners

The examiner is to be employed at LiU as professor, associate professor, senior lecturer, research fellow, lecturer, research assistant, or postdoc (including guest and adjunct teachers), or is to have been appointed docent at LiU. He or she must have the expertise required to examine the degree project within the relevant main subject area, and must be appointed by the the board of studies. The examiner is to:

- ensure before the start of the degree project that the student satisfies the conditions for commencement of the degree project within the relevant main subject area. The study guidance counsellor is to check whether the commencement criteria are satisfied and inform the examiner of this
- check whether special admission requirements (where relevant) are satisfied, for example that the student can demonstrate a certain degree of in-depth knowledge within the field relevant for the degree project
- determine the specialisation and principal work of the degree project, based on an assessment of whether the degree project will result in the learning outcomes of the course syllabus being satisfied
- pass/fail the planning report
- pass/fail the mid-way assessment
- be responsible that the supervisor or supervisors carry out their duties
- before the presentation, check that the student has registered for the degree project
- approve the work for presentation
- before the presentation, check that the proposed opponent satisfies the conditions for commencement of the degree project and has attended three thesis presentations
- pass/fail the presentation and the opposition to it
- approve a concluding reflection document
- ensure that a degree project that has been passed satisfies the learning outcomes of the course syllabus and other requirements, and award a grade to the degree project (either G = Pass, or U = Fail).

Supervisors

A student working on a degree project is to have access to an internal supervisor at the department at which the degree project has been registered. The internal supervisor is to have a degree that corresponds at least to the level of the degree project to be supervised. The internal supervisor may, in exceptional circumstances, be the same individual as the examiner. A decision of whether to allow this in a particular case is to be made by the relevant board of studies before the degree project is started.

The supervisor is to ensure that the student obtains help with:

- expert support in general questions related to methods, specialist knowledge of the subject, and writing the thesis
- problem formulation, and setting the limits of the work
- scheduling and planning work, and selection of appropriate methods.

If the degree project is being carried out outside of LiTH, an external supervisor from the commissioner is to be appointed.

Planning report

During the first weeks of the degree project, the student is to draw up a planning report that contains:

- a preliminary title of the degree project

- a preliminary statement of the research question, against the background of a literature search
- a preliminary description of the approach to be taken
- planned literature foundation
- a schedule for the execution of the degree project, including suggested dates for the mid-way assessment and presentation.

Formulation of the research question is to be bounded, realistic and viewed from a perspective of societal or commercial benefit. The term “societal” is to be understood here to include universities and university colleges.

Mid-way assessment

Approximately half-way through the degree project, the student is to describe to the examiner at a mid-way assessment how the work is progressing relative to the planning report. The supervisor should also participate. The form of the mid-way assessment may be anything from an oral presentation to a public seminar. The conclusion of the mid-way assessment may be one of three possibilities:

1. The work has been carried out essentially as planned, and can continue as planned. The mid-way assessment has been passed.
2. The work has been carried out with certain deviations from the planning report. It is, however, believed that it will be possible to complete the work with minor adjustments to the formulation of the research question, approach and/or schedule. The mid-way assessment has been passed.
3. The work has deviated from the planning report in a significant manner, and there is a risk that a Pass grade cannot be given. The mid-way assessment has been failed. A new planning report must be drawn up and a new mid-way assessment carried out.

Reporting

Both oral and written reports of the degree project are to be made, in Swedish or English. For the international Master's programmes, both the oral and written examination should be made in English. The board of studies can allow the reporting to be carried out in another language than Swedish or English.

The oral presentation is to take place in public, unless there are special grounds that this should not be done. The written report is to be in the form of a professionally produced degree project thesis. The presentation and thesis are to follow the instructions given below.

Presentation

The oral presentation is to take place when the examiner considers that the work has been completed and is ready to be presented. The presentation is to take place at LiTH at a time when other students can attend. This means that the presentation can take place on a date that the student has agreed with the examiner, normally between the re-examination period in August and midsummer, and after the student has attended three thesis presentations.

The oral presentation is to describe the background to the problem that has been

studied, describe the methods used, and present the results and conclusions. The presentation is to be at a level suitable for everyone present, not just for specialists. After the oral presentation, the student is to counter any criticism that the opponent may raise, and allow other participants to pose questions. The presentation and the opposition are to be approved by the examiner. When any required adjustments of the thesis have been made, the reflection document has been approved, and the student has functioned as an opponent for another degree project, the degree project is reported as a passed course and the credits can be used to satisfy the requirements for a qualification.

Degree project thesis

The written degree project report is to be professionally written and comprehensive, and it is to demonstrate a scientific approach. The report must be prepared in accordance with principles for acceptable practice when referring to sources (references or quotations for which the source is specified) when the text, images, ideas, data, etc., of other people are used. It is also to be made clear whether the author has reused his or her own text, images, ideas, data, etc. from previous examinations, such as undergraduate work, project reports, etc. (This is sometimes known as “self-plagiarism”.) A failure to specify such sources may be regarded as attempted deception during examination.

The contents are to be easy to understand, and the way in which material is presented is important. It must describe the background to the project and the formulation of the research question. The choice of approach is to be clearly explained, and the thesis should make clear the coupling between the results and the conclusions. Commonly accepted scientific methods are to be used for processing the results. The discussion is to be comprehensive, and demonstrate that the student masters analytical thought processes. The thesis is to demonstrate good mastery of the literature in the field, and include an abstract. Theses that are principally written in Swedish should contain a summary in English. A publication-ready manuscript and a reflection document covering the work undertaken are to be submitted to the examiner within 10 days after the oral presentation. The examiner may grant an exemption from this requirement. If final versions of the required documents are not submitted as stipulated, the examiner may determine that the presentation is to be rescheduled.

The Faculty of Science and Engineering (Institute of Technology) at Linköping University recommends that degree project theses be published.

Opposition

An oral opposition is to be carried out either before or after the student presents his or her thesis. The opponent must satisfy the same requirements for the number and level of credits gained as those of the student’s degree project. The opponent must also have attended three thesis presentations as a member of the audience. Acting as an opponent during the thesis presentation of another student is subject to points-based assessment as described in the course syllabus.

The opponent is to:

- discuss and comment on the selection of methods, results and (where relevant) data processing, conclusions, possible alternative solutions and conclusions, and the management of literature
- comment on the general arrangement of the degree project thesis and related, formal aspects of style, and comment on the oral presentation technique
- illuminate the strengths and weaknesses of the thesis.

The duration of the opposition should be approximately the same as that of the presentation, and it is to include a discussion in which the student presenting the thesis replies to and comments on the criticism raised by the opponent.

Unless otherwise agreed, at least one week before the presentation the opponent is to present in writing to the examiner the important issues that will be discussed, and the structure of the opposition that will be taken. The opponent and the examiner discuss the structure that the opponent has drawn up.

In a normal case, the number of opponents will be the same as the number of respondents. In exceptional cases, the examiner may decide that this is not to be the case.

Attendance at presentations

A student is to attend presentations of degree project theses as described in the course syllabus. The presentations attended must be at the same level or a higher level than the degree project of the student.

It is advantageous that one of the presentations attended is a licenciate degree seminar or a doctoral disputation. The student is responsible for ensuring that a certification of attendance at the presentation is obtained and passed to the departmental administrator for registration in Ladok. Attendance at such presentations is a component of the degree work that is subject to points-based assessment.

The occasions on which a student attends presentations are to be completed before the student presents the degree project thesis. The course syllabus for the degree project describes the scheduling of the attendance at presentations.

Reflection document

A document reflecting on the work that has been carried out is to be submitted to the examiner within 10 working days of the oral presentation. Instructions for preparing a reflection document can be reached through www.lith.liu.se/examensarbete/examensarbete?l=sv.

Grades

The degree project is graded as either Pass or Fail. In order for a student to obtain a pass grade for the degree project, all components must be completed and be awarded a pass grade.

Right to obtain supervision

It is expected that the student complete and pass a degree project within specified time limits. The department is required to provide supervision for a maximum of 18 months after the student has registered the degree project in Ladok. The examiner may grant additional supervision after this period in special cases. If the examiner determines that supervision is to be ended, the degree project is to be awarded a Fail grade.

If the degree project is awarded a Fail grade for the reason described above or for any other reason, the student is to be directed towards carrying out a further degree project.

Quality assurance

The relevant board of studies has overall responsibility for the quality of study programmes. This responsibility covers also degree projects. Quality assurance is to be carried out as determined by the faculty board.

Exemptions

If special circumstances apply, a board of studies may grant exemptions from the regulations specified above. The oral opposition, for example, may be replaced by an extensive written opposition, if the board of studies approves this

- for international students for whom special circumstances apply
- for other students for whom all other components of the qualification have been satisfied, the degree project thesis has been submitted, and special circumstances apply.

Written opposition may be carried out in one of the following ways:

- The student presents a written opposition to a degree project thesis that has been written by another student, whose examiner subsequently examines the opposition.
- The student's examiner requests that the student prepare a written opposition to a degree project thesis that has previously been examined by an examiner.

If written opposition is used, it is not necessary that the student prepare an introductory statement describing the structure.

The board of studies must approve that opposition may take place in written form, before it is carried out.