

## Project - Biomedical Engineering

Projekt i medicinsk teknik  
16 credits

Programme course

TBMT41

Valid from: 2022 Spring semester

<b>Determined by</b>	<b>Main field of study</b>	
Board of Studies for Electrical Engineering, Physics and Mathematics	Biomedical Engineering	
<b>Date determined</b>	<b>Course level</b>	<b>Progressive specialisation</b>
2021-09-01	First cycle	G2X
<b>Revised by</b>	<b>Disciplinary domain</b>	
	Technology	
<b>Revision date</b>	<b>Subject group</b>	
	Other Subjects within Technology	
<b>Offered first time</b>	<b>Offered for the last time</b>	
Spring semester 2013	Spring semester 2023	
<b>Department</b>	<b>Replaced by</b>	
Institutionen för medicinsk teknik	TBMT58	

## Course offered for

- Master of Science in Biomedical Engineering

## Entry requirements

For admission to the course, see tab Common rules, headline Commencing a degree project.

Basic knowledge in biomedical engineering, mathematics, physics, electronics, computer science and control engineering. The courses Anatomy and Physiology, Engineering project, Basic knowledge in programming - abstraction and modelling must be completed.

For students admitted 2018 and forward:

The project work requires basic knowledge in physics, mathematics, electronics, computer science, signals and systems and the project model LIPS. In addition, domain knowledge in biomedical engineering including deepend knowledge within some area. The courses Anatomy and Physiology, Engineering project, Introduction to Computer Programming, and Biomedical Engineering must be completed.

## Intended learning outcomes

After the project work the student in the main subject should be able to

- identify the needs of engineering solutions in medicine
- apply methodological knowledge, models and subject-specific knowledge in biomedical engineering
- use and synthesize knowledge from previous courses and to seek information outside the area of biomedical engineering which can be applied to new areas
- make engineering judgments with regard to the work of relevant scientific, social and ethical aspects
- show the ability to plan, implement and report a thesis work
- implement a project charter to a specification
- plan, document and execute a project according to a predetermined project model, with efficient use of material and human resources
- professionally present results orally and in writing within specified time and project frameworks
- critically examine and discuss the writing and orally presented work in the candidate's work
- reflect on a project work and suggest improvements
- actively contribute to well organized project teams
- describe and explain the ethical challenges related to the engineering profession and to technological development.
- apply basic normative ethical theories, principles and concepts to concrete cases and situations.

## Course content

Projects: The project may cover areas such as medicine, material science, construction theory, physics, optics, electronics, signals, systems and models etc. The customer initiates the projects. The project group follows the project model CDIO. Independent thesis work established in parallel to the project as a resource.

## Teaching and working methods

The course consists of lectures, seminars, project work, written and oral reporting. The project work is done in groups of 5-6 students. The project group will have a supervisor during the project and together with the domain experts in the field act as support. Each group is assigned to a specific project task and a teacher acting as a customer. The customer presents a specification of the project task to the project group. From this specification the group will make a project plan and perform a project work according to the project model LIPS. The work is well documented in a written report and presented orally to the customer. At the end of the course the work is also presented for the other students at a project conference. An independent thesis work is implemented in parallel with the project and this is provided to the project as a project resource.

The course runs the entire spring semester.

## Examination

UPG3	Presentation and Opposition	1,5 credits	U, G
UPG2	Ethics	1,5 credits	U, G
UPG1	Written Report	2 credits	U, G
PRA1	Project assignment	11 credits	U, G

Grades are given as 'Fail' or 'Pass'.

## Grades

Two grade scale, older version, U, G

## Other information

### Supplementary courses

Biomedical Engineering - Project Course

### About teaching and examination language

The teaching language is presented in the Overview tab for each course. The examination language relates to the teaching language as follows:

- If teaching language is “Swedish”, the course as a whole could be given in Swedish, or partly in English. Examination language is Swedish, but parts of the examination can be in English.
- If teaching language is “English”, the course as a whole is taught in English. Examination language is English.
- If teaching language is “Swedish/English”, the course as a whole will be taught in English if students without prior knowledge of the Swedish language participate. Examination language is Swedish or English depending on teaching language.

### Other

The course is conducted in a manner where both men's and women's experience and knowledge are made visible and developed.

The planning and implementation of a course should correspond to the course syllabus. The course evaluation should therefore be conducted with the course syllabus as a starting point.

If special circumstances prevail, the vice-chancellor may in a special decision specify the preconditions for temporary deviations from this course syllabus, and delegate the right to take such decisions.

## Common rules

Degree projects (included in Term 6 of study programmes in engineering)

### General provisions

All study programmes in engineering (with the exception of the programme in Industrial Engineering and Management – International and the programme in Applied Physics and Electrical Engineering – International) have since 2014 included an obligatory degree project. The project undertaken may also be included as part of the Bachelor of Science (Technology). During Term 6 of each programme, one or several special courses are given that constitute degree projects. The syllabuses of these courses contain course-specific provisions, which are supplemented with the general provisions given below.

### Aim

The degree project is to contribute to general and programme-specific objectives of the study programmes in engineering being achieved. Specific learning outcomes are given in the relevant course syllabus. In addition, the degree project has also the following learning outcomes, which are common to all degree project-based courses at LiTH:

- Knowledge of the subject  
After carrying out the degree project, the student is expected to master the following:
  - integrating in a systematic manner the knowledge gained during the period of study
  - applying methodological knowledge and subject-specific knowledge within the main subject area
  - assimilating the contents of relevant technical publications and relating the study to such contents.
- Personal and professional skills  
After carrying out the degree project, the student is expected to possess the following skills:
  - formulating research questions and limiting the same, within a specified time schedule
  - seeking and evaluating scientific literature.
- Working and communicating in a group  
After carrying out the degree project, the student is expected to possess the following skills:
  - planning, executing and presenting independent work in the form of a project carried out in a group
  - expressing oneself professionally, in writing and orally
  - critically examining and discussing independent work presented in speech and in writing.
- Engineering fundamentals

After carrying out the degree project, the student is expected to master the following:

- creating, analysing and/or evaluating technical solutions
- making assessments that consider relevant scientific, societal and ethical aspects.

### **Degree projects undertaken while studying abroad**

During study abroad, an individual plan is to be drawn up together with the faculty programme director to determine how the requirements for a degree project in engineering can be satisfied.

### **Commencing a degree project**

Before a student commences a degree project, the following requirements must be satisfied:

- The student must have a minimum of 90 credits obtained from courses from Terms 1-4 of the programme (courses taken voluntarily are not counted). This requirement must be satisfied before the end of the third week of study period 2 of the autumn term before the degree project is to be carried out.
- The student must have completed the subject-specific courses listed in the course syllabus for the relevant degree project course. This requirement must be satisfied before the end of the third week of study period 2 of the autumn term before the degree project is to be carried out.
- When assessing whether the requirements have been satisfied, individual decisions (such as those taken in association with admission to subsequent parts of the programme) are to be considered.

Registration for a degree project is carried out during the course registration period 1-10 October in the autumn before the degree project is to be undertaken.

### **Forms of examination**

The examiner for the degree project is responsible for ensuring that examination takes place as specified by the course syllabus, and, where appropriate, carries out the duties of an examiner for degree projects.

The written report of the degree project corresponds to a degree project for a bachelor's degree. This means that it is to be managed in an equivalent manner with respect to publication, unless special circumstances apply.

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.

In cases in which several students carry out a degree project together, the

contribution of each student is to be specified. The extent of the work for each student is to correspond to that of a degree project. 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.

## Course syllabus

A syllabus must be 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.

## Interruption in and deregistration from a course

The LiU decision, Guidelines concerning confirmation of participation in education (Dnr LiU-2020-02256), 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 or interrupting a course is carried out using a web-based form [Forms](#)

## Cancelled courses and changes to the course syllabus

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 Dean is to deliberate and decide whether a course is to be cancelled or changed from the course syllabus.

## Guidelines relating to examinations and examiners

For details, see Guidelines for education and examination for first-cycle and second-cycle education at Linköping University, Dnr LiU-2020-04501 (<http://styrdokument.liu.se/Regelsamling/VisaBeslut/917592>).

An examiner must be employed as a teacher at LiU according to the LiU Regulations for Appointments, Dnr LiU-2021-01204 (<https://styrdokument.liu.se/Regelsamling/VisaBeslut/622784>). For courses in second-cycle, the following teachers can be appointed as examiner: Professor (including Adjunct and Visiting Professor), Associate Professor (including Adjunct), Senior Lecturer (including Adjunct and Visiting Senior Lecturer), Research Fellow, or Postdoc. For courses in first-cycle, Assistant Lecturer (including Adjunct and Visiting Assistant Lecturer) can also be appointed as examiner in addition to those listed for second-cycle courses. In exceptional cases, a Part-time Lecturer can also be appointed as an examiner at both first- and



second cycle, see Delegation of authority for the Board of Faculty of Science and Engineering.

## Forms of examination

### Principles for examination

Written and oral examinations and digital and computer-based 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 faculty programme board.

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 January
- 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 in March 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 faculty programme board has decided are to be held in alternate years are held three times during the school year in which the course is given according to the principles stated above.

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.

When a course, or a written examination (TEN, DIT, DAT), is given for the last time, the regular examination and two re-examinations will be offered. Thereafter, examinations are phased out by offering three examinations during the following academic year at the same times as the examinations in any substitute course. If there is no substitute course, three examinations will be offered during re-examination periods during the following academic year. Other examination times are decided by the faculty programme board. In all cases above, the examination is also offered one more time during the academic year after the following, unless the faculty programme board decides otherwise. In total, 6 re-examinations are offered, of which 2 are regular re-examinations. In the examination registration system, the examinations given for the penultimate time and the last time are denoted.

If a course is given during several periods of the year (for programmes, or on different occasions for different programmes) the faculty programme board or

boards determine together the scheduling and frequency of re-examination occasions.

### **Retakes of other forms of examination**

Regulations concerning retakes of other forms of examination than written examinations and digital and computer-based examinations are given in the LiU guidelines for examinations and examiners, <http://stydokument.liu.se/Regelsamling/VisaBeslut/917592>.

### **Course closure**

For Decision on Routines for Administration of the Discontinuation of Educational Programs, Freestanding Courses and Courses in Programs, see DNR LiU-2021-04782. After a decision on closure and after the end of the discontinuation period, the students are referred to a replacement course (or similar) according to information in the course syllabus or programme syllabus. If a student has passed some part/parts of a closed program course but not all, and there is an at least partially replacing course, an assessment of crediting can be made. Any crediting of course components is made by the examiner.

### **Registration for examination**

In order to take an written, digital or computer-based examination, registration in advance is mandatory, see decision in the university's rule book <https://stydokument.liu.se/Regelsamling/VisaBeslut/622682>. An unregistered student can thus not be offered a place. The registration is done at the Student Portal or in the LiU-app during the registration period. The registration period opens 30 days before the date of the examination and closes 10 days before the date of the examination. Candidates are informed of the location of the examination by email, four days in advance.

### **Code of conduct for students during examinations**

Details are given in a decision in the university's rule book: <http://stydokument.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 digital and computer-based examinations in an attempt to achieve a higher grade. This is valid for all examination components with code "TEN", "DIT" and "DAT". The same right may not be exercised for other examination components, unless otherwise specified in the course syllabus.

A retake is not possible on courses that are included in an issued degree diploma.

### **Grades**

The grades that are preferably to be used are Fail (U), Pass (3), Pass not without distinction (4) and Pass with distinction (5).

- Grades U, 3, 4, 5 are to be awarded for courses that have written or digital

examinations.

- 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.
- Grades Fail (U) and Pass (G) are to be used for degree projects and other independent work.

### Examination components

The following examination components and associated module codes are used at the Faculty of Science and Engineering:

- Grades U, 3, 4, 5 are to be awarded for written examinations (TEN) and digital examinations (DIT).
- 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), digital preparatory written examination (DIK), oral examination (MUN), computer-based examination (DAT), home assignment (HEM), and assignment (UPG).
- 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 tutorial group (BAS) or examination item (MOM).
- Grades Fail (U) and Pass (G) are to be used for the examination components Opposition (OPPO) and Attendance at thesis presentation (AUSK) (i.e. part of the degree project).

In general, the following applies:

- Mandatory course components must be scored and given a module code.
- Examination components that are not scored, cannot be mandatory. Hence, it is voluntary to participate in these examinations, and the voluntariness must be clearly stated. Additionally, if there are any associated conditions to the examination component, these must be clearly stated as well.
- For courses with more than one examination component with grades U,3,4,5, it shall be clearly stated how the final grade is weighted.

For mandatory components, the following applies (in accordance with the LiU Guidelines for education and examination for first-cycle and second-cycle education at Linköping University,

<http://stydokument.liu.se/Regelsamling/VisaBeslut/917592>):

- If special circumstances prevail, and if it is possible with consideration of the nature of the compulsory component, the examiner may decide to replace the compulsory component with another equivalent component.

For possibilities to alternative forms of examinations, the following applies (in accordance with the LiU Guidelines for education and examination for first-cycle and second-cycle education at Linköping University,

<http://stydokument.liu.se/Regelsamling/VisaBeslut/917592>):

- If the LiU coordinator for students with disabilities has granted a student the right to an adapted examination for a written examination in an examination hall, the student has the right to it.
- If the coordinator has recommended for the student an adapted examination or alternative form of examination, the examiner may grant this if the examiner assesses that it is possible, based on consideration of the course objectives.
- An examiner may also decide that an adapted examination or alternative form of examination if the examiner assessed that special circumstances prevail, and the examiner assesses that it is possible while maintaining the objectives of the course.

### **Reporting of examination results**

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

### **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, such as degree projects, project reports, etc. (this is sometimes known as “self-plagiarism”).

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 [Cheating, deception and plagiarism](#)

### **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-](http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-)

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