

# Soil Mechanics

Programme course

8 credits

Geoteknik

TNBI90

Valid from: 2019 Spring semester

**Determined by**  
Board of Studies for Mechanical  
Engineering and Design

**Date determined**  
2018-08-31

## Main field of study

Civil Engineering

## Course level

First cycle

## Advancement level

G1X

## Course offered for

- Bachelor of Science in Civil Engineering

## Examination

|      |                     |           |            |
|------|---------------------|-----------|------------|
| TEN1 | Written Examination | 5 credits | U, 3, 4, 5 |
| UPG1 | Project Work        | 3 credits | U, G       |

## Grades

Four-grade scale, LiU, U, 3, 4, 5

## Department

Institutionen för teknik och naturvetenskap

## Director of Studies or equivalent

Dag Haugum

## Examiner

Anders Jägryd

## Education components

Preliminary scheduled hours: 0 h

Recommended self-study hours: 213 h

## Course literature

### Other

Sällfors, Göran: Geoteknik, Chalmers;  
Jägryd, Anders: Kurskompendium i Geoteknik

## Common rules

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

### **Degree projects for Bachelor of Science in Engineering, Bachelor of Science (Technology), Bachelor of Science, Bachelor of Arts, and Bachelor without prefix**

General provisions for the degree project are given here. The appropriate board of studies can provide further, programme-specific regulations, which are given in the programme syllabus and/or the course syllabus for 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](http://www.lith.liu.se/examensarbete/examensarbete?l=sv).

#### **General provisions**

To be awarded the degree of Bachelor of Science in Engineering, Bachelor of Science (Technology), Bachelor of Science, Bachelor of Arts or Bachelor without prefix it is required that the student has completed a degree project and achieved the Pass grade for it. 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](http://www.lith.liu.se/examensarbete/examensarbete?l=sv). Links to the course syllabuses are found under the heading "Utbildningar" ("Högskoleingenjörsutbildning" or "Kandidatutbildning").

#### **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, for example, a company, government agency, or other organisation in Sweden or abroad, that an examiner has assessed to be competent to manage a degree project that satisfies the requirements
- 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 report (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 LiTH regulations.

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 report is to be published during the grading procedure, unless special circumstances prevent this. If any part of the report 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](http://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](http://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 degree 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, postdoc, assistant lecturer (including guest and adjunct teachers) or is to have been appointed docent at LiU. The examiner must also have the expertise required to examine degree projects within the relevant main subject area, and be appointed by 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
- be responsible that the supervisor or supervisors carry out their duties
- approve the work for presentation
- before the presentation, check that the student has registered for the degree project
- before the presentation, check that the proposed opponent satisfies the conditions for commencement of the degree project and has attended two report 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).

In cases in which a degree project is carried out jointly by two students with different main subject areas, one examiner in each main subject area must be appointed, where this is necessary.

### **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 report
- 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 host 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
- planned literature foundation
- a preliminary statement of the research question, against the background of the literature foundation

- a preliminary description of the approach to be taken
- a schedule for the execution of the degree project, including suggested date for the presentation.

### **Reporting**

Both oral and written reports of the degree project are to be made, in Swedish or English. The board of studies may permit other languages to be used.

The oral report is to take place at a public presentation. The written report is to be in the form of a professionally produced degree project report. The presentation and report 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 other students' report 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 report have been made, 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 degree.

### **Degree project report**

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 report 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 report is to demonstrate good mastery of the literature in the field, and include an abstract. Reports 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 working days of the oral presentation. Deviations from this limit may be granted by the examiner. If final versions of the required documents are not submitted as stipulated, the examiner may determine that the presentation is to be repeated.

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

### **Opposition**

An oral opposition is to be carried out either before or after the student presents his or her own report. 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 two report presentations as a member of the audience. Acting as an opponent during the report 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 report and related, formal aspects of style, and comment on the oral presentation technique
- illuminate the strengths and weaknesses of the report.

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 report replies to and comments on the criticism raised by the opponent.

One week before the presentation, the opponent is to submit 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 reports as described in the 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 licentiate 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 report. The 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](http://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 12 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 a 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. Examples are:

- international students for whom special circumstances apply
- other students for whom all other components of the degree have been satisfied, the degree project report 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 report 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 report 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.