

GEO-E1020 Geotechnics

Preliminary Course plan 2023, changes are possible.

1. **Basic information** (name of the course, teaching period, teachers)

Geotechnics, period I

Teachers: Leena Korkiala-Tanttu (LKT), Henry Gustavsson (HG), Monica Löfman (ML), Anoosheh Iravanian (AI) and Samuel Chavez Romero (SCR). We are expecting to have more than 30 both Finnish and international students. The background of the students is versatile.

The course is an intensive course, where interactive work with peers carries an important role. We organize contact lectures and exercise sessions. The attendance during the contact lecture sessions is highly recommended. The compulsory parts are: introduction lecture, visit to Honkasuo, Ossinlampi demonstration, flipped classroom presentation of your group, tests, exercises and final presentation.

The aim is to work actively during the sessions where you have opportunities to ask questions and discuss the topics at hand. The group work and exercises take quite much time. Therefore, you have to be prepared to spend time also outside the sessions and exercises (see point 8). We have prefixed groups so that students from different backgrounds are mixed. The groups can choose their own working tools and methods.

2. **Course connections**

In the Master programme this course is one of the six common courses and the first one of them. It provides the basic knowledge of geotechnics. This course is prerequisite for Foundation Engineering and Ground Improvement course.

Prerequisites: The basics of Geomechanics and geotechnics. For Aalto students “Geologia ja Geomekaniikka” together with “Kiinteän aineen mekaniikka” and “Georakentaminen ja kaivannaistuotanto” from the bachelor programme or similar. You should know at least soil types and basics of structural mechanics (what are force, pressure, moment,...). If this basic knowledge is partial or missing, we strongly suggest you to complete supplementary studies.

3. **Amount of ECTS**

5 cr

4. **Learning outcomes** (including also skills such as group working, presentation skills etc.)

After the course student:

- Understands the most important concepts and theories of soil mechanics
- Knows the most common design and analysis methods and tools of geotechnics
- Creates skills to use these methods and tools in simple geotechnical problems
- Knows the engineering properties and basic behavior of soil.
- Knows the most common foundation construction methods
- Creates professional identity as an expert and developer of the field
- Improves project and group working skills in a design group as well as enhances communication skills

- Learns to present group work and her/his results and to defend them.
- Learns to evaluate other's work
- Learns to know other Geoengineering students

5. Content

The course includes the most common theories of soil mechanics, including stress distribution, settlement and stability calculations, seepage and the most common site investigation methods, foundation techniques of buildings and structures. The general question for the course is: "What has to be taken into account when geotechnical design is done in Honkasuo area?" Theme questions are:

- Theme 1: "What is the right foundation method for our building site?"
- Theme 2: "What issues have to be taken into account when the infrastructure around your building is designed?" and "How do Finnish climate conditions and climate change affect the construction of buildings and streets?"

PRELIMINARY TIMETABLE and content: the sessions are mainly from 12:15-14:00. Yellow sessions are compulsory.

Week	Date	Room	Theme	Topic
1	Mo 4.9	R5		Introduction, intro to geotechnics, grouping, assignment of FC1, ML
	Th 7.9	Honkasuo	1	Visit to Honkasuo by bus 12:15-14:00
	Fr 8.9	R5	1	Foundation methods, assignment of FC2, LKT
2	Mo 11.9	R5	1	FC1 Bearing capacity, Assignment of FC3, ML
	Th 14.9	U344	1	Bearing capacity, exercise
	Fr 15.9	R5	1	FC2 Site investigations, assignment of FC4, LKT
3	Mo 18.9	R5	1	FC3 Stresses in ground, assignment of FC5, ML
	We 20.9	Ossinlampi		SITE INVESTIGATION DEMO + laboratory demonstration 10-14
	Th 21.9	U344	1	Site investigations and bearing capacity in Honkasuo, exercise
4	Fr 22.9	K216	1	Summary of theme 1, Test 1 12-14
	Mo 25.9	R5	1	FC4 settlements, assignment of FC6, ML
	Th 28.9	U344	2	Settlement, exercise
	Fr 29.9	R5	2	FC5 Stability, assignment of FC7, AI
	Fr 29.9	R5	1	14.15-15:00 Feedback discussion of Test 1, LKT
5	Mo 2.10	R5	2	FC6 Earth pressure, assignment of FC 8, ML
	Th 5.10	U344	2	Stability, exercise
	Fr 6.10	R5	2	FC7 Seepage, AI
6	Mo 9.10	R5	2	FC8 Seasonal changes and conditions in Finland, ML
	Th 12.10	U344	2	Earth pressure, exercise
	Fr 13.10	K216	2	Summary of theme 2: Test 2 12-14
7	Tu 17.10 12-15	R5, R266		Final presentation session Feedback discussion of the course. Self-assessment of group work.

Flipped classroom: The flipped classroom (FC) technique is used in the sessions; each group prepares material for one session (FC presentation) based on the preliminary information given in the previous session and in My Courses. The presentation is part of the group work. The FC presentation will take about 15 minutes. The presentations will be graded by teachers too. Therefore, the groups should check in advance that the content of the presentation is in balance and it looks like one single presentation. Note that all members of the group should take part in presentation. The other groups will explore the theme in advance to ponder, how this aspect should be taken into account in their block area. Based on the exploration, the other groups prepare 3 – 4 questions, which have to be loaded to MC about 3 hours before FC session. After the presentation, there is a short discussion based on the prepared questions. **Each group should be prepared to ask one question either based on their prepared questions or something which is not clear to them. The personal exercises** (design calculations) will be done based on this and information given during the exercises.

Group work is done in groups of about 4-5 students. The topic for the group work is geotechnical design for the new Honkasuo residential area in Helsinki. Each group will focus on one block with its unique set of buildings and ground conditions. Each group suggests what kind of things have to be taken into account in the geotechnical design of their block. The question of the group work (for the whole course) is **“What kind of things have to be taken into account when geotechnical design is done in Honkasuo for our own block area?”** The soil investigations are in general level. Besides the professional identity creation, another aim of the group work is that students share their knowledge and get to know each other. This improves their group work and communication skills, too. Each group will collect together all the answers to **the final presentation session**. Most of these exercises require design calculations, and these *exercises are done as each student’s personal work*. It is also important to learn to document each own’s design process and calculations. Some part of the group work is presented in final presentation session. The final presentation is compiled from the results of each member’s personal exercises in your block. The results are evaluated with a peer-reviewing system and evaluation of the teachers.

Personal calculation exercises have to be returned each Monday. The exercises are done individually to show that all the students understand the fundamentals. All the exercises have to be returned as accepted before you can pass the course. Example calculations are available in MC. You will get feedback already on next Wednesday.

Grouping will be done on Mo 4.9. A photo of each student will be collected, and the photos of the group members will be distributed to all students in the course. To be able to make the groups, we need some information of your earlier studies and experiences of geotechnics etc. We also need information of how many will participate to Honkasuo trip 7.9. and Ossinlampi site investigation demo 21.9. These sessions are compulsory for all students. In MyCourses you should **upload Assignment_0: Questionnaire and your photo before the course starts (DL 1.9.)**

TIMETABLE and content of sessions for each group (G1...G8):

Date	Action	G1	G2	G3	G4	G5	G6	G7	G8
Mo 4.9	Grouping	x	x	x	x	x	x	x	x
Mo 4.9	Assignment for 1 st FC	X							
Fr 8.9	Assignment for 2 nd FC		X						
Mo 11.9	1 st FC	X							
Mo 11.9	Assignment for 3 rd FC			X					
Fr 15.9	2 nd FC		X						
Fr 15.9	Assignment for 4 th FC				X				
Mo 18.9	3 rd FC			X					
Mo 18.9	Assignment for 5 th FC					X			
Mo 25.9	4 th FC				X				
Mo 25.9	Assignment for 6 th FC						X		
Fr 29.9	Assignment for 7 th FC							X	
Fr 29.9	5 th FC					X			
Mo 2.10	6 th FC						X		
Mo 2.10	Assignment for 8 th FC								X
Fr 6.10	7 th FC							X	
Mo 9.10	8 th FC								X

Other events/assignments	
Mo 4.9	Grouping
Th 7.9	Visit to Honkasuo area
We 20.9	Site investigation demo at Ossinlampi
Fr 22.9	Test 1
Fr 13.10	Test 2
Tu 17.10	Final presentation session and Feedback discussion

FC =Flipped classroom

6. Assessment: methods, criteria, scale

The course grade consists of **group work** 40 %, **personal tests** (20% / each) and **personal exercises** 20%. Scaling is 0 - 5. The scaling of **group work (40%)** is based on peer-reviewing of final presentations (20%) and of flipped classroom presentations (20%). The grade of group work is calculated from these and lecturers' evaluations. Based on the self- and peer-assessment inside group the grade can vary inside one group ± 2 grade. Final presentation session can be compared to the exam of the course that is why it is held in evaluation week. Note the basic level of group work grade is 3 meaning that it fulfils the basic criteria. If there are merits or faults the grade is adjusted accordingly.

The deadline to submit ALL group work material in MyCourses-pages is 17th October.

7. Teaching methods

Sessions, exercises, group work, personal tasks, flipped classrooms and homework.

8. Course workload for students

Total	133 h	
Attending sessions and personal exercises	36 h	6 h/week
Preparing of flipped classroom and session material	24 h	
Preparation for the personal tests	20 h	
Group work	24 h	4h/week
Final poster session and feedback	3 h	
Personal homeworks (part of group work and exercises)	26 h	

9. Materials used during the course

Session slides and materials, professional handbooks, exercise materials, regulations and standards.

Additional reading:

Craig’s Soil Mechanics, edition 7:

[Craig's Soil Mechanics, Seventh edition \(tafreshu.ac.ir\)](http://www.tafreshu.ac.ir)

In youtube you can find excellent videos of Soil mechanics by John Burland For example

<https://www.youtube.com/watch?v=-wtLX5eISR4>

Additionally Verruijt’s Soil Mechanics includes some examples

<http://geo.verruijt.net/software/SoilMechBook2012.pdf>

<http://geo.verruijt.net/>

There are ready made examples in My Courses.

The students will get a Finnish-English geotechnical dictionary, which they can use during the course and afterwards. Sanakirja (<https://www.sanakirja.org/>) is also very useful and lexicon from <http://www.issmge.org/en/resources/lexicon>.

10. Evaluation of teaching and exercises

There will be a separate feedback session on the 17th October. **Additionally, everyone is supposed to use the Aalto Webropol feedback system!**

MORE INFORMATION

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