

Constitutive Laws in Geomechanics

Subject area: Civil Engineering/Architecture

University:	Technion
Level:	MA all years, PhD
Teaching mode:	hybrid: some students participate online, other students attend real-life
Instructor(s):	Prof. Assaf Klar

Short description

This course covers the fundamentals of constitutive laws for the representation of geomaterials, as well as the use of plasticity methods (upper and lower bounds) for prediction of the stability of geotechnical structures (foundations, tunnels, slopes, etc.).

Full description

This course covers the fundamentals of constitutive laws for the representation of geomaterials, as well as the use of plasticity methods (upper and lower bounds) for prediction of the stability of geotechnical structures (foundations, tunnels, slopes, etc.).

The primary objective of this course is to provide students with a general background in soil/rock plasticity as an introduction to the broad area of inelastic response of geomaterials, as well as to provide the framework in which constitutive models are formulated and executed in numerical simulations. In addition the course provides the details of the upper and lower bound approaches used in classical stability analyses of geotechnical problems.

Students who complete the course will be capable of understanding theoretical information provided in documentation (manuals) of advanced geotechnical finite element software.

They will also be able to formulate and write user defined constitutive laws for direct use in the software.

The upper and lower bound methods, taught within the course, can assist in evaluating the instability conditions of various geotechnical problems using back-of-the-envelope calculations, and are important tools for the geotechnical engineer.

Learning outcomes

A student who has met the objectives of the course will be able to:

- Understand how the general stress-strain response of the soil is represented mathematically.
- Understand how constitutive laws are implemented numerically.
- Learn about various frameworks to represent the nonlinear response under monotonic and cyclic loading.

- Predict stress strain response under given strain path and stress path conditions (drained and undrained).
- Calibrate parameters for various constitutive models.
- Understand the advantages and limitations of each constitutive framework and models, with respect to specific geotechnical problems.
- Predict the capacity for various geotechnical problems using limit analysis.
- Utilize the mobilized strength design approach.

General information

Contact hours per week: The course will be given as a concentrated course in the first 3 weeks of January 2023. Students are obligated to 39 contact hours.

Total workload: 100 (in student hours for the whole course)

ECTS credits: 5

Language: English

Course start date: 02 January 2023

Course end date: 20 January 2023

Add. info about start date:

Weekly teaching day/time:

Time zone: CET +1 (Estonia, Israel)

Further information: Please note that Technion does not work with ECTS. The amount of ECTS which you see in the description is meant to give an indication of the intensity of the course. However, the transcript of records will not be listing ECTS.

Prerequisites: Geomechanics, Basic Soil Mechanics.

Activities and methods: Lectures, Self-study, Exercises

Presence on campus:

Final examination

Form: written

Date:

Location/format: online

Re-sit possibility: yes

Transcript available: on request

Add. info/requirements:

Registration

To register for this course, follow the registration requirements of your **home university** as specified here: www.euroteq.eu/courses-registration.

Administration

Number of places:

Minimum participants: 4

Internal course code: 19427

Contact: Bat-el Almogy, academic@int.technion.ac.il

This course is part of the EuroTeQ Engineering University joint course catalogue 2022/2023. This is a collaborative activity of the partner universities DTU, L'X, TU/e, TalTech, CTU, TUM as well as Technion. Students from these universities can participate in the offered courses. It is the responsibility of the student to check if you fulfil the requirements to participate in a specific course. Students are also advised to check with their home institution how to get recognition of the ECTS credits gained in courses of the EuroTeQ course catalogue. For further information about EuroTeQ Engineering University, visit www.euroteq.eu or get in touch with the above-mentioned point of contact.