

**SYLLABUS**

# **Fundamentals of Rock Mechanics 7.5 credits T0014B**

**Introduktion till bergmekanik**

**Course syllabus admitted: Autumn 2023 Sp 1 - Present**

**DECISION DATE  
2021-02-17**

# Fundamentals of Rock Mechanics 7.5 credits T0014B

## Introduktion till bergmekanik

### First cycle, T0014B

Education level	Grade scale	Subject	Subject group (SCB)
First cycle	G U 3 4 5	Berg- och mineralteknik	Mining and Mineral Technology

## Entry requirements

In order to meet the general entry requirements for first cycle studies you must have successfully completed upper secondary education and documented skills in English language and B0002B Structural engineering or corresponding course

## Selection

The selection is based on 1-165 credits.

## Course Aim

After completing the course participants should be able to

1. calculate and evaluate the stress state of underground constructions in rock using analytical and empirical models and propose optimal geometry and orientation of underground constructions in rock
2. identify possible failure mechanisms and based on that select and apply appropriate failure criterion to analytically and empirically analyze and evaluate the stability of underground constructions in rock
3. calculate and evaluate the deformation and strain state of underground constructions in rock with analytical and empirical models
4. carry out field and laboratory experiments with proven analytical, empirical and numerical methods to evaluate rock and joint parameters as well as the quality of the rock mass
5. identify failure mechanisms for loaded bedrock based on simplified geological descriptions, and where possible, be able to calculate the safety factor
6. present and discuss in writing their analyzes, models, results and conclusions

## Contents

The main topics covered in the course are:

- Introduction - Course design, repetition of relevant content from previous courses in rock mechanics
- Practical test on rock mechanical pre-investigation - Rock mass classification, joint mapping, hemispherical projection, collection and analysis of field data, presentation of engineering work, presentation of field data, etc.
- Stresses - The stress state, Mohr's stress circles, Principal stresses, Primary stresses, Secondary stresses,
- Strength - mechanical properties of rock (intact and rock mass), failure mechanisms, failure criteria, test methods,
- Deformations - strain, Mohr's strain circles, modulus of elasticity,
- Slope stability - Circular shear fracture in slopes, safety factor
- Loaded bedrock - failure modes, strength calculations, safety factor

## Realization

Each course occasion's language and form is stated and appear on the course page on Luleå University of Technology's website.

This course includes teaching and learning activities such as:

- Lectures - They are a mix of several teaching/learning activities: (i) short theory review where the lecturer explains the most important theoretical aspects related to the course content and (ii) together solve and/or discuss typical rock mechanical problems and questions which gives you the opportunity to work in different ways with several aspects around empirical and analytical stability analyzes of different underground constructions in rock from a practical and theoretical point of view and train calculation procedures for problems related to these.
- Computer exercises - During these we work in computer rooms where we practice on various numerical applications and how they can be used to analyze joint data and the stability of underground structures in rock.
- Field exercise and laboratory work - Here you train in performing and evaluating joint and rock properties in the field and in the lab, as well as presenting the conducted work and results in writing.
- Assignments - You work together with other students and use your knowledge to solve various problems. You present your work in written reports. You train to use and apply empirical and analytical analyzes to motivate and suggest how an underground construction in rock should be made stable.
- Between lecture - You are expected to prepare for each lecture by working through the recommended material, recommended exercises and study questions so that you are ready to contribute and participate in the learning activities (problem solving, discussion, etc.) during the lectures, computer exercises, as well as the field and laboratory exercises.

## Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided.

The course is assessed through:

- Written tests - Consists of questions testing your theoretical knowledge and understanding of certain rock mechanics aspects related to the content of the course.
- Assignments - Consist of problems where you practice and apply your theoretical knowledge, understanding, and abilities as well as conducting analyses and explaining your results in writing.
- Field exercise and laboratory work - Through exercise in the field and in the lab and submission of a written solution for each part.
- Written exam - You solve problems like those encountered during the course (in lectures and assignments) to test your individual knowledge, understanding, skill and abilities. You are allowed to use the course compendium during the written exam.

Intended learning outcomes 1-3, 5-6 is assessed through a written exam. Grading scale G/U 3 4 5

Intended learning outcomes 4 and 6 is assessed through field exercise and laboratory work. Included in required assignment with the grading scale G U.

Intended learning outcomes 1-3, 5-6 is assessed through written tests and the assignments. Included in required assignment with the grading scale G U.

To be approved on the module required assignment, you must be approved on assignments, laboratory work and field exercises as well as approved on written tests.

## Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term "unauthorized aids" refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

## Transition terms

1000

## Course offered by

Department of Civil, Environmental and Natural Resources Engineering

## Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0002	Required assignment	U G#	4.5	Mandatory	A08	
0003	Written exam	G U 3 4 5	3	Mandatory	A14	

## Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

## Last revised

by Assistant Director of Undergraduate Studies Eva Gunneriusson, Department of Civil, Environmental and Natural Resources Engineering 2021-02-17

## Syllabus established

The plan is established by the Department of Civil and Environmental Engineering 2008-01-22 and is valid from H08.