

MINING ENGINEERING 323 **Introduction to Rock Mechanics**

Spring/Summer Semester 2026

Lectures will be held on Tuesdays and Thursdays from 11:00 to 12:20 am in NREF 2-090
Laboratory: Tuesday 2:00 to 3:50 pm in NREF L2-011 or in the Caterpillar Computer Lab

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Catalogue Description Rock mass ratings, empirical failure criteria; slope and high wall stability; field stresses; design of underground openings, pillars, and roof beams; principles of roof-bolt design; surface subsidence.

Topics

- 1 Concept of stress in rock materials.
- 2 Deformation of rocks.
- 3 Understand the measurement and use of rock properties for the intact rock, rock mass and rock joints, including compressive strength, tensile strength, E , ν , c , ϕ and others.
- 4 Describe and classify rock masses using RQD
- 5 Bieniawski's Rock Mass Rating System.
- 6 Barton-Lunde Q system.
- 7 Hoek-Brown Failure Criterion.
- 8 Stereonets for mining applications.
- 9 Estimate the strength and deformability of intact rock, rock mass and rock joints to predict the mechanical behaviour of each.
- 10 Analyze and design rock slopes and waste slopes in surface mines.
- 11 Design pillars for support around underground openings.
- 12 Use beam theory to analyze roof spans of underground openings.
- 13 Estimate required rock support to maintain safe and stable underground openings.
- 14 Estimate the magnitude and effects of surface subsidence over underground openings.

Textbook

Coursepack will be available on eclass.

Suggested Textbooks

- 1) Hudson, J.A., Harrison, J. P., "Engineering Rock Mechanics: an Introduction to the Principles" 1997, Pergamon, pages 444.
- 2) Hoek, E, 2000, "Practical Rock Engineering",
<http://www.rocscience.com/hoek/PracticalRockEngineering.asp>

<u>Grading</u>	Mid-term exam	25%
	Final Exam	45%
	Homework	15%
	Lab Reports	15%
	TOTAL	100%

References:

1. Bieniawski, Z. T., 1989, Engineering rock mass classification. New York: Wiley.
1. Barton, N.R., Lien, R. and Lunde, J. 1974. Engineering classification of rock masses for the design of tunnel support. *Rock Mech.* 6 (4), 189-239.
2. Brady, B.H.G. and Brown, E.T., Rock Mechanics for Underground, 1st or 2nd Edition, Published by Chapman & Hall
3. Hoek, E., Kaiser, P.K., Bawden, W.F. 1995. *Support of Underground Excavations in Hard Rock*. A.A. Balkema, P.O. Box 1675, 3000 BR Rotterdam, Netherlands.
4. International Society for Rock Mechanics. 1981. *Rock characterization, testing and monitoring - ISRM suggested methods*. Oxford: Pergamon.
5. Grimstad, E. and Barton, N. 1993. Updating the Q-System for NMT. *Proc. int. symp. on sprayed concrete - modern use of wet mix sprayed concrete for underground support*, Fagernes, (eds Kompen, Opsahl and Berg). Oslo: Norwegian Concrete Assn.

General Policies Statement

- 1) Classes will begin promptly at the assigned time. Please be on time for classes and laboratories.
- 2) Please wait 10 minutes beyond the regular start time if extraordinary circumstances prevent me from arriving at class on time.
- 3) Regular attendance at lectures is expected. You must attend class regularly if you want to obtain my help outside of class.
- 4) No make-up exams will be given unless you have a valid medical reason certified by a doctor.
- 5) If anyone has any special needs due to participation in sports etc., please make the necessary arrangements with me IN ADVANCE.

Homework Assignments

- 1) On average, one homework assignment will be due every second week.
- 2) Assignments are usually due in class in one week.
- 3) A late penalty of 20% is applied to all late homework assignments.
- 4) Assignments will not be accepted after one month after the due date.
- 5) Examination questions will be similar in scope and difficulty to the homework assignments.
- 6) MOST IMPORTANT, handwritten assignments are to be submitted NEATLY on engineering paper.

Lab Schedule – Introduction to Rock Mechanics – Min E 323

Spring/Summer 2020

The videos of Laboratory experiments are posted on YouTube, and the links are available on eclass. The laboratory procedures are explained in posted on eclass PowerPoint presentations. And the laboratory with the Rock Science Software will be explained during online laboratories.

Lab No.	Lab Title	Web Links
1	Point Load Test	www.youtube.com/watch?v=KbkzyHJ4TSI
2	Slake Durability Test	www.youtube.com/watch?v=y_b-35fCcc
3	Brazilian Tensile Test and Modulus of Rapture	www.youtube.com/watch?v=7X7zo5hy-q0
4	UCS and determination of Elastic Modulus	www.youtube.com/watch?v=yjAXo3fpze0
5	Triaxial Strength Test	www.youtube.com/watch?v=yjAXo3fpze0
6	Shear Strength Test	See Handout
7	Dips	NA
8	Unwedge	NA
9	Phase2	NA

An example of the laboratory report format expected from each student will be provided during the first laboratory. The lab reports are due one week after the day of the laboratory.

Important Dates:

- Assignments and Lab reports are due one week after posting the assignment.
- Midterm Examination 11:00–12:20 am – June 9, 2016.
- Final Examination to be established once the date is posted on Beartracks.
- All exams are open-book exams