



CIVL 376 Introduction to Rock Mechanics [3-1-0:3] Spring 2010

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Time and Venue:

Lecture Sessions: Tues, Thur 15:00-16:20 Rm 4475

Tutorial Session: Mon. 10:30-11:20 Rm 3588

Course Description

This course introduces basic concepts of rock mechanics applied to geotechnical engineering. Students will learn rocks classification, basic mechanical properties of rocks and discontinuities, rock strength and failure criteria, stress-strain analysis in rocks, stability analysis of rock slopes, underground openings and rock foundations.

Prerequisites: CIVL270 and CIVL372

Course Outlines

1. Index properties of rock
 - 1.1 Geological classification of rocks
 - 1.2 Index properties of rock system
 - 1.3 Rock mass classification for engineering purpose
2. Stress, strain and elasticity
 - 2.1 Scalar, vector and tensor
 - 2.2 Stress tensor
 - 2.3 Principal stress and principal invariants
 - 2.4 Octahedral stress
 - 2.5 Surface traction
 - 2.6 Transformation of stress tensor (2D)
 - 2.7 Mohr circle in three dimensions
 - 2.8 Strain
 - 2.9 Elasticity
3. Intact rock strength and failure criteria
 - 3.1 Laboratory strength test
 - 3.2 Stress-strain behavior in compression
 - 3.3 Mohr-Coulomb failure criterion
 - 3.4 Empirical failure criteria for intact rock
4. Discontinuities and rock mass
 - 4.1 Tests on discontinuities
 - 4.2 Shear strength of joint surface
 - 4.3 Properties of rock mass
 - 4.4 Stereonet analysis of planar discontinuities
5. Rock slope engineering
 - 5.1 Plane failure



- 5.2 Wedge failure
- 5.3 Toppling failure
- 6. Underground engineering
 - 6.1 Initial stress in rock mass
 - 6.2 Openings in rock – elastic solutions
 - 6.3 Techniques for measurement of in-situ stresses
 - 6.4 Effect of planes of weakness on elastic stress distribution
 - 6.5 Opening in horizontally layered rock
 - 6.6 Opening in rock with inclined layers
 - 6.7 Elastic-plastic behavior around tunnels
 - 6.8 Tunnel support system
 - 6.9 Rock reinforcement – rock bolt
- 7. Rock foundation
 - 7.1 Types of rock foundations
 - 7.2 Allowable bearing pressure in design codes
 - 7.3 Elastic solutions of foundation under loads
 - 7.4 Failure modes of footing on rocks
 - 7.5 Allowable bearing pressure on footings on rocks
 - 7.6 Deep foundation in rocks

Course Grading

- Homework and Quiz: 30% (no late submission)
- Midterm Exam: 30%
- Final Exam: 40%

References

- [1] CIVL376 Course Notes (can be purchased via University bookstore)
- [2] R.E.Goodman, **Introduction to Rock Mechanics** (2nd Edition). John Wiley & Sons, 1989. [Online version available through HKUST library](#)
- [3] E. Hoek, **Practical Rock Engineering**, 2007.
<http://www.rocscience.com/hoek/PracticalRockEngineering.asp>
- [4] B. H. G. Brady and E. T. Brown. **Rock Mechanics for Underground Mining**, third edition, Springer. [Online version available through HKUST library](#)
- [5] E. Hoek and J.W. Bray. **Rock Slope Engineering**, 3rd Edition, Spon Press, 1981
- [6] D. C. Wyllie, C. Mah, E. Hoek. **Rock Slope Engineering: Civil and Mining**, 4th Ed. Taylor & Francis, 2004. [Online version available through HKUST library](#)
- [7] J.P. Harrison and J.A. Hudson, **Engineering Rock Mechanics, An introduction to The Principle**, Elsevier Science, 2000. [Online version available through HKUST library](#)