# GEOL 4360/6360 Introduction to Geomechanics
# Spring Semester 2016

| ***WEEK*** *STARTING* | ***TUESDAY*** | ***THURSDAY*** |
|---|---|---|
| ***1*** 1/11 | *Rock Mass Concept* | *Rock Mass Classifications* |
| ***2*** *1/18* | *Rock Mass Applications* | *Rock Mass Applications* |
| ***3*** *1/25* | *Stress Calculations* | *Stress Calculations* |
| ***4*** *2/1* | *Intact Rock Material I* | *Intact Rock Material I* |
| ***5*** *2/8* | *Intact Rock Material II* | *Intact Rock Material II* |
| ***6*** *2/15* | *Intact Rock Material III* | *Intact Rock Material III* |
| ***7*** *2/22* | *Rock Strength: Griffith Criterion* | *Rock Strength: Coulomb Criterion* |
| ***8*** *2/29* | *Rock Strength: Hoek Brown Criterion* | *Rock Strength: Hoek Brown Criterion* ***Project Outlines Due*** |
| ***9*** *3/7* | Spring Break | Spring Break |
| ***10*** *3/14* | *Discontinuities I: Joints* | *Discontinuities I: Joints* |
| ***11*** *3/21* | No Class ***Work on projects*** | No Class ***Work on projects*** |
| ***12*** *3/28* | *Discontinuities II: Faults* | *Discontinuities II: Faults* |
| ***13*** *4/4* | *Discontinuities III: Deformation Bands* | *Discontinuities III: Deformation Bands* |
| ***14*** *4/11* | No Class ***Work on projects*** | No Class ***Work on projects*** |
| ***15*** *4/18* | *Lithosphere* | *Lithospheric Stress States* |
| ***16*** *4/25* | *Project Presentation* ***Project Reports Due*** | *Project Presentation* |
| ***17*** *5/2* | Reading Day | No Class |
| ***18*** *5/9* | ***No Exam*** | |

## CONTACT

Dr. Christian Klimczak (klimczak@uga.edu, 706-542-2977)
Office hours: W 10-12 (Office 310)
The best way to get a hold of me is via email.

## TEXTBOOK & COURSE MATERIALS

There are no mandatory textbooks and appropriate reading materials will be handed out in class. Some interesting literature and reference books include:

*Fundamentals of Rock Mechanics* by Jaeger, Cook, and Zimmerman
Blackwell Publishing, ISBN: 978-0-632-05759-7

*Reservoir Geomechanics* by Zoback
Cambridge University Press, ISBN: 978-0-521-14619-7

*Rock Mechanics for Underground Mining* by Brady and Brown
Chapman and Hall, ISBN: 978-1-4020-2064-3

*Engineering Rock Mass Classifications* by Bieniawski
Wiley, ISBN: 978-0-471-60172-2

*Discontinuity Analysis for Rock Engineering* by Priest
Chapman and Hall, ISBN: 978-94-011-1498-1

Some necessary course materials include:

- Scientific calculator
- Graphing paper
- Drawing materials (protractor, compass, ruler, sharp pencils)
- Measure tape

## COURSE SUMMARY AND COURSE GOALS

This course is aimed as an introduction to the brittle field of rock deformation, the rock mass concept, and its role for site characterization and engineering design. We will develop an understanding of rock as a material, the relationship between stress and strain, and deformation and failure of rock to classify rock fracture types and rock fracturing behavior. You are expected to learn the new material and then to be able to apply it to practical problems in geology or your area of interest. The learning objectives for this class include:

- Understanding the principal controls on rock mass strength and deformability
- Recognition, occurrence, and types of fractures and deformation bands
- Using and Interpreting rock mass classification systems (especially RMR)

- Developing an understanding and capability to solve standard problems in 2-D stress analysis (including stress transformation and resolved stress components on planes), frictional sliding (including Coulomb and Hoek-Brown criteria), linear elasticity (Hooke's law), and nonlinear peak strength envelopes for rock
- Understanding the main laboratory tests for rock strength (tensile, compressive, and shear) and their physical basis
- Understanding of the Complete Stress-Strain Curve for Rock and its applicability to fractured outcrops and rock masses
- Knowledge of basic rock fracture mechanics, including stress concentration, stress intensity factor, displacement modes I–III, fracture and deformation band classification and criteria for recognition, propagation criteria, and use of fractures and deformation bands as stress indicators.

## LECTURE

*Tuesday and Thursday 3:30 pm to 04:45pm; Room 143*

Lectures will follow the course outline closely, but it may become necessary to change the content and/or the outlined order of lectures. Lectures include the teaching of new content, review of previously taught content, and discussion of homework assignments. Questions pertaining to the course content are encouraged and expected and can be asked anytime during the lecture. Students are expected to take handwritten notes. Lectures will be presented via PowerPoint; the lectures will not be distributed, or otherwise made available such as via the web, to students in the class, so please do not ask me for them. You are expected to attend class and take notes, as this is one of the best ways to learn new material, followed by regular review outside of class.

## HOMEWORK

All homework assignments will count toward the final grade. Assignments will be given in the lecture and are intended to reinforce concepts and techniques introduced during the lecture. The number of assignments will depend on the general class performance. Homework will be due at the beginning of the lecture one week after it was assigned. Homework turned in late will not be accepted and graded with a zero.

## CLASS PROJECTS

Students taking the 4360 portion of this course are required to complete one class project that includes a detailed rock mass classification of an outcrop of their choice. Students taking the 6360 portion of this course are required to complete two class projects that include (1) the rock mass classification and (2) a topic involving original research pertaining to an aspect of geomechanics and/or structural geology. All topics must be outlined in writing, with outlines due on March 3. All projects must be presented orally to the class starting April 26 with students taking the 4360 portion presenting the procedure and results of their rock mass classification and students taking the 6360 portion presenting their research project. Talks should be aimed for a 10-15 min time slot. The final reports, due April 26, should be comparable in length and style format of a

professional journal article. The minimum requirements for the reports include 4 pages of single-spaced text (Times New Roman, font size 12pt), excluding figures/tables, figure/table captions, and references.

## EXAMS & QUIZZES

This class is designed to teach content in a stress-free environment via homework and field/theoretical projects. There will be no exams or quizzes.

## EXTRA CREDIT

There are no extra credit tasks intended for this course. Each student is expected to work toward the best possible grade starting with the very first lecture.

## GRADING

All grades and scores are non-negotiable. There will be no curving of total course scores. All assignments and reports will count toward the final grade. The total grade consists of all scores from homework, report(s), and oral presentation(s) with the following breakdown:

| | | 4360 | 6360 |
|---|---|---|---|
| • Homework | …… | 45% | 30% |
| • Report 1 | …… | 45% | 30% |
| • Report 2 | …… | n/a | 30% |
| • Presentation | …… | 10% | 10% |

The following letter grades will be assigned to the total performance:

| | |
|---|---|
| 95 or higher | A |
| 90 – 94.9 | A– |
| 89 – 89.9 | B+ |
| 85 – 88.9 | B |
| 80 – 84.9 | B– |
| 79 – 79.9 | C+ |
| 75 – 78.9 | C |
| 70 – 74.9 | C– |
| 65 – 69.9 | D |
| Below 65 | F |

## ATTENDANCE

Students are required to attend all lectures. Deadlines are non-negotiable. It is each student's personal responsibility to meet all deadlines. Personal conflicts must be

discussed well in advance for alternative solutions. Emergencies must be sufficiently documented and will be judged on a case-by-case basis.

## ETHICS AND CLASS ETIQUETTE

- Plagiarism will not be tolerated in this class. Students are expected to observe a conduct in accordance with the academic honesty policy outlined in "A Culture of Honesty" published by the University of Georgia. Academic dishonesty may lead to expulsion. (http://ovpi.uga.edu/academic-honesty)
- The use of portable electronic devices, including but not limited to smart phones, tablet computers, or laptops, is not welcome in class, unless specifically requested by the course instructor. All devices must be muted and remain out of sight for the duration of the entire lecture.
- If class is cancelled due to inclement weather or other unexpected events, all deadlines and due dates falling in that time period will be transferred to the first day of class after the regular schedule resumes.
- Class is over when it is officially dismissed by the instructor. Personal conflicts that require an early departure must be discussed with the course instructor prior to the lecture.
- Chewing tobacco or bubble gum while in class is unacceptable. Furthermore, having a full meal during the lecture is not welcome.

## DISCLAIMER

This course syllabus is a general plan for the course. Deviations announced to the class by the instructor may be necessary.