

Course: **MinE 411 – Rock Mechanics/Ground Control**

Semester: Fall 2011

Course Format
And Credit Hours: 3 hr. Lecture, 2 hr. labs, 1 field trip?

Prerequisites: MinE 205, MinE 206, MAE 241, MAE 243, Geol 342 or Instructor Approval

Instructor: Dr. Keith A. Heasley, 359H Mineral Resources Building
Mining Engineering Department, CEMR, WVU
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Schedule: Lecture: Monday & Wednesday - 10:00 – 11:15 - ESB G78B
Lab Section 2: Monday – 5:30-6:20 – MRB 243 or MRB 158
Lab Section 3: Tuesday – 6:00-7:50 – MRB 243 or MRB 158

Office Hours: Open Door Policy or by appointment

Course Objectives: This course provides the mining engineering student with the necessary knowledge, skills, tools and ability to design the ground control aspects of a surface or underground mine. This course presents the basic principals rock mechanics including: stress analysis, geology, discontinuities, rock mass classification, etc. The course also teaches the application of the rock mechanics principals for the overall analysis and design of the various ground control sub-systems including: entry widths, pillars, roof bolts, supplemental support, slopes, etc. The course provides the student with numerous practical applications of mathematics, mechanics and engineering to solve problems and design sub-systems related to ground control.

Expected Learning Outcomes:

By the end of the course, students will be able to:

1. determine: Elastic Modulus, Poisson's Ratio, Tensile and Shear Strength for rock from laboratory experiments.
2. rotate the stress field in space, determine principal stresses and determine stress concentrations around underground openings
3. design a mine layout and pillar plan with consideration of horizontal tectonic stresses
4. understand the effect of geology and geologic anomalies on ground control and the appropriate approach for effective ground control
5. calculate and utilize geologic classification systems for engineering design
6. design the pillars in an underground mine considering, retreat mining, multiple seams, floor heave, etc.
7. design the primary roof support system for a given geology and application.
8. design the supplemental roof support system for a given geology and application.

9. understand the implementation and output of geomechanical instrumentation
10. calculate subsidence displacements slopes and strains and remediation the subsidence effects
11. design the slope for a soil or rock embankment
12. understand the practical, legal, and economic constraints of ground control design
13. complete an initial ground control design for an operating underground and/or surface mine

Required Text: Peng, S. S., 2008, Coal Mine Ground Control, 3rd edition, Syd S. Peng, Morgantown, WV, 750 p.

<u>Grading:</u>	Homework	10%
	Labs	15%
	Mid-Terms & Quizzes	45%
	Final Exam	20%
	Final Project	10%

<u>Grade Assignment:</u>	100 – 90	A
	89 – 80	B
	79 – 70	C
	69 – 60	D
	59 - 0	F

Attendance: It is expected that students will make every effort to attend class. Students may be absent from class with pre-approval.

Grading Policy: No make-up exams except by prior arrangement with instructor. Late assignments are docked 10% per day, or part of a day, that they are late. Exam grading appeals must be submitted in writing on the day the exam is returned.

HW Assignments: Homework assignments and/or quizzes will be given approximately every week and each assignment will be worth approximately the same credit. The sum of the homework assignments and quizzes will be worth about 25% of the class grade.

Quizzes: Short quizzes to judge student preparedness and understanding will be given frequently throughout the class. The sum of the homework assignments and quizzes will be about 25% of the class grade.

Final Project: A final design project will be given to each individual student at the mid-point of the term. The project will essentially consist of developing the ground control aspects for a mine in a given coal seam and geology. The final project will be due the week before dead week, and will be worth 10% of the final grade.

Field Trip: One field trip will typically be scheduled each term to go to an outcrop and calculate the CMRR.

Attendance Policy: Consistent with WVU guidelines, students absent from regularly scheduled examinations or quizzes because of authorized University activities will have the opportunity to take them at an alternate time. Make-up exams or quizzes for absences due to any other reason will be at the discretion of the instructor.

Professional Registration: As part of the academic and professional development of young mining engineers, the Mining Engineering Department strongly encourages student to take the Fundamentals of Engineering (FE) exam and to then follow this by becoming registered as a Professional Engineer (PE).

Social Justice Statement: West Virginia is committed to social justice. I concur with that commitment and expect to maintain a positive learning environment based upon open communication, mutual respect, and nondiscrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration.

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with Disability Services (293-6700).

Days of Special Concern: WVU recognizes the diversity of its students and the needs of those who wish to be absent from class to participate in Days of Special Concern, which are listed in the Schedule of Courses. Students should notify their instructors by the end of the second week of classes or prior to the first Day of Special Concern, whichever is earlier, regarding Day of Special Concern observances that will affect their attendance. Further, students must abide by the attendance policy of their instructors as stated on their syllabi. Faculty will make reasonable accommodation for tests or field trips that a student misses as a result of observing a Day of Special Concern.

Course Schedule:

Week	Topic
1	Lecture: Syllabus Review, Introduction, Mechanics Refresher Lab: Computer Lab: Stress Calculations in Excel
2	Lecture: Stress Concentrations Lab: Computer Lab: Stress Calculations in Excel
3	Lecture: Horizontal Stress, Depositional Environment, Geologic Anomalies Lab: Rock Lab: Orientation, Specimen Preparation
4	Lecture: Geologic Anomalies, StereoNets Lab: RockLab: Strain Gauge Installation
5	Lecture: Rock Mass Classification Systems, MIDTERM Lab: RockLab: Compressive Tests, Indirect Tension Tests
6	Lecture: Pillar Design: Fundamentals, Analysis of Longwall Pillar Systems (ALPS) Lab: Field Trip: Coal Mine Roof Rating (CMRR)
7	Lecture: Pillar Design: Analysis of Retreat Mining Pillar Systems (ARMPS), LaModel Lab: RockLab: Direct Shear Tests
8	Lecture: Pillar Design: AMSS, Stone Mines, CPF, Highwall Mining, Floor Heave, Bumps Lab: Computer Lab: LaModel
9	Lecture: Pillar Design: AMSS, Stone Mines, CPF, Highwall Mining, Floor Heave, Bumps Lab: Rock Lab: Point Load Test
10	Lecture: Roof Bolt Design, Analysis of Roof Bolt Systems (ARBS), MIDTERM Lab: Rock Lab: Flexural Tests
11	Lecture: Supplemental Support: Overview Lab: Study Period
12	Lecture: Outside Lecture, MIDTERM Lab: Rock Lab: Slake Durability Tests
13	Lecture: Instrumentation, Subsidence Lab: Computer Lab: Support Technology Optimization Program (STOP)
14	FALL BREAK
15	Lecture: Slope Stability: Soil and Rock Lab: Instrumentation
16	Lecture: Final Project Lab: Final Project
17	Finals Week