Course: MinE 661 – Num. Analysis for Mine Design

Semester: Spring 2008

Course Format
And Credit Hours: 3 hr Lecture

Prerequisites: Graduate Standing or Consent

Instructor: Dr. Keith A. Heasley, 359H Mineral Resources Building
Mining Engineering Department, CEMR, WVU
(304) 293-7680 x3307, keith.heasley@mail.wvu.edu

Schedule: Mon. 9:00 – 11:30

Location: MRB 243

Office Hours: Open Door Policy or by appointment

Course Objectives: This course seeks to introduce the mining, civil or geotechnical engineer to a number of different programs specifically developed for designing mines and geologic structures. The emphasis of the course is on practical application of the programs with a sufficient understanding of the underlying mathematical formulation in order to prevent mis-application of the programs or mis-interpretation of the results. The course starts simple with a brief introduction to the Analysis of Longwall Pillar Stability (ALPS) program, the Analysis of Retreat Mining Pillar Stability (ARMPS) program and the Analysis of Multiple Seam Systems (AMSS) program, three programs are essential to a practicing mining engineer’s tool kit. The technical level increases in the remainder of the course as the time is equally divided between the boundary-element programs, LaM2D and LaModel (used for designing single and multiple-seam mines), the finite-difference program, FLAC (used for detailed analysis of mines, slopes, soils and other geomechanical problems) and the discrete-element program, UDEC (used for analysis of blocky geologic systems). All programs and program documentation are provided in the course.

Expected Learning Outcomes: By the end of the course, students will be able to:
1. analyze the geomechanical stability of a longwall mining scenario using the ALPS program, including optimizing the pillar sizes and using advanced entry geometry,
2. analyze the stability of a retreat room-and-pillar mining system using the ARMPS program, including determining predicted pillar stress,
3. analyze the stability of multiple-seam mining systems using the AMSS program, including both longwall and room-and-pillar systems, both over and under mining, and both gob-solid
boundaries and remnant pillars,
4. understand the inherent strengths, weaknesses and best practices for applying various numerical analysis techniques (boundary-element, finite-element, finite-difference, discrete element) to specific geologic environments, mining geometries, and material behaviors,
5. analyze the detailed stress and displacements from multiple-seam mining scenarios in two dimensions using the LaM2D program, including yielding pillar elements, pillar safety factors, and multiple-seam subsidence,
6. analyze the detailed stress and displacements from multiple-seam mining scenarios in three dimensions using the LaModel program, including pillar safety factors, multiple-seam subsidence, and automatic grid generation,
7. analyze mining and geotechnical situations using the FLAC program, including both static elastic situations and continuous plastic flow situations,
8. analyze the mechanical behavior of discrete particle systems commonly found in mining using the UDEC program, including automatic joint set creation and fully independent particle movement.

Required Texts: (All Provided Electronically)
Lam2D Tutorial; LaModel Tutorial1; LaModel Tutorial2; LamPre User’s Guide; LaModel User’s Guide; LamPlt User’s Guide; FLAC User’s Guide; UDEC User’s Guide

Grading:
Homeworks & Quizzes 60%
Mid-Term Project 20%
Final Project 20%

Grade Assignment: 100 - 90 A
89 - 80 B
79 - 70 C
69 - 60 D
59 - 0 F

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 or project grading appeals must be submitted in writing on the day the exam or project 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 60% of the class grade.

Quizzes: Short quizzes to judge student preparedness and understanding may be given throughout the class. The sum of the homework assignments and quizzes will be worth 60% of the class grade.

Mid-Term and Final Project: A mid-term and final design project will be given to each individual student during the term. The projects will essentially consist of developing an appropriate model to solve a practical mining problem developed by the student. The project deliverables will include a succinct write-up of the problem, analysis and solution, as well as all input and output files from the numerical analysis. The mid-term project will be due the eighth week of the term, and will be worth 20% of the final grade. The final project will be due the week before dead week, and will be worth 20% of the final grade.

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:

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<td>Understanding the ALPS analysis method: HW - ALPS Detailed Analysis</td>
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<td>Using the ARMS program: HW – ARMS Examples</td>
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<td>4.</td>
<td>Using the AMSS program: HW – AMSS Examples</td>
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<td>5.</td>
<td>Using the LaM2D program: HW – LaM2D examples</td>
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