Course:	**MinE 662 – Displacement DiscontinuityModeling in Mining**
Semester:	Spring 2010
Course Format And Credit Hours:	3 hr Lecture
Prerequisites:	MinE 661 or Consent
Instructor:	Dr. Keith A. Heasley, 359H Mineral Resources Building Mining Engineering Department, CEMR, WVU (304) 293-3842, keith.heasley@mail.wvu.edu
Schedule:	Mon., Wed. 9:30 – 10:45
Location:	MRB 243
Office Hours:	Open Door Policy or by appointment
Course Objectives:	This course seeks to train the mining, civil or geotechnical engineer to competently utilize the Displacement-Discontinuity (DD) method for solving practical problems in coal mines and other thin seam deposits. The emphasis of the course is on practical application of the LaModel and LaM2D, but the mathematical basis of the DD method will also be presented and studied. Students will learn the pitfalls to be avoided and will explore the optimum properties and techniques for fast accurate solutions. The various numerical techniques used to calculate; multiple-seam stresses, surface subsidence, free-surface effects, non-linear material properties, automatic grid generation and automatic properties generation will be presented and demonstrated. The students will derive analytical solutions for simplified problems that will be used to understand and verify the numerical codes. Many additional concepts will be demonstrated using simplified models in the Lam2D and LaModel programs. Also, actual models from field investigations will be presented and analyzed, and ultimately the student will configure, execute and analyze a complete model of their own choosing.

Expected Learning Outcomes:

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

1. develop a single or multiple seam model in LaModel to solve practical mining problems,
2. develop a single or multiple seam model in LaM2D to solve practical mining problems,
3. utilize the AMSS program to pre-process the data for LaM2D,
4. understand the inherent strengths, weaknesses and best practices for applying the displacement discontinuity variation of the boundary-element method to specific geologic

environments, mining geometries, and material behaviors,
5. understand the application of automatic material generation, gob generation and yield zone generation to coal mines,
6. understand the calculation of multiple-seam stress, pillar safety factors and multiple-seam subsidence in LaModel,
7. develop the fundamental equation and influence functions for laminated overburden,
8. implement a second-order, central difference, finite-difference solution of the fundamental equation of the laminated overburden,
9. implement convergence criteria, boundary conditions, material properties and off-seam stress calculations into the finite-difference solution,
10. develop model grids using the automatic mine and topographic grid generators.
11. perform a LaModel solution to a practical mining problem.

Required Texts: (All Provided Electronically)
Lam2D Tutorial; LaModel Tutorial1; LaModel Tutorial2; LamPre User's Guide; LaModel User's Guide; LamPlt User's Guide; Automatic Grid Generation Tutorial

Grading:

Homeworks & Quizzes	70%
Final Project	30%

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 most 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 or two, and each assignment will be worth approximately the same credit. The sum of the homework assignments and quizzes will be worth 70% 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 70% of the class grade.

Final Project: A final design project will be given to each individual student during the term. The project will essentially consist of developing an appropriate Displacement Discontinuity 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 final project will be due the week before dead week and will be worth 30% 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:

Week Topic

1. Introduction to the LaModel Program: HW – LaModel Tutorial 1
2. Multiple seams with the LaModel program: HW – LaModel Tutorial 2
3. Details of using LaModel: HW – Bieniawski Coal Properties
4. Techniques for Calibrating: Lamination Thickness, Gob Properties, Coal Strength
5. Introduction to the LaM2D program: HW – LaM2D Tutorial
6. Introduction to the AMSS program: HW – AMSS Tutorial
7. Derivation of the fundamental equation for laminated overburden: HW – Slot Analysis
8. Derivation of the influence function for laminated overburden: HW – Subsidence Calc.
9. Numerical solution, the finite-difference tech.: HW – Excel SOR1, assign final project
10. Implement convergence criteria, boundary conditions: HW – Excel SOR2
11. Implement material properties and material stress: HW – Excel SOR3
12. Implement multiple-seam stress: HW – Excel SOR4
13. Details of the over-relaxation factor: HW – Over-Relaxation Factor
14. Using automatic mine grid generation: HW – Huff Creek Model
15. Using automatic topographic grid generation: HW – Huff Creek Model
16. Practical application of LaModel: Final Project