**COLORADO**SCHOOL**OF**MINES

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| **Subject:  EBGN       Number: 409/509**<br><br>**Course Title: Mathematical Economics**<br><br>**Section: 1**<br><br>**Semester/year: Fall 2017** |

**Instructor or Coordinator:** Steven M. Smith

> **Office:** Engineering Hall, 323
> **Email:** ssmith1@mines.edu
> **Phone:** (303) 273-3150
> **Office hours:** TTH: 1:30-3:00 and by appointment
> **Class meeting days/times:**  TTH: 9:30-10:45
> **Class meeting location:** Hill Hall 209
> **Web Page/Blackboard link:** Mines Canvas
> **Teaching Assistant: TBD**

**Instructional activity:**  _3__ hours lecture     ___ hours lab    __3_ semester hours

**Course designation:**   ___ Common Core   ___ Distributed Science or Engineering

                         _X_ Major requirement   ___ Elective    ___ Other (_____)

**Course description from Bulletin:**
This course reviews and re-enforces the mathematical and computer tools that are necessary to earn a graduate degree in Mineral Economics. It includes topics from differential and integral calculus; probability and statistics; algebra and matrix algebra; difference equations; and linear, mathematical and dynamic programming. It shows how these tools are applied in an economic and business context with applications taken from the mineral and energy industries. It requires both analytical as well as computer solutions. At the end of the course you will be able to appreciate and apply mathematics for better personal, economic and business decision making. Principles of Microeconomics, MATH111; or permission of instructor

**Required text:**

> Chiang, Alpha C., and Kevin Wainwright (2005). *Fundamental Methods of Mathematical Economics*, Fourth Edition. McGraw-Hill Irwin.

*Students may also consider procuring additional books as additional references:*

> Simon, Carl P., and Lawrence Blume (1994). *Mathematics for Economists.* W. W. Norton & Company.

Dowling, Edward T. (2011). Shaum's Outlines: *Introduction to Mathematical Economics,* Third Edition. McGraw-Hill Education

Dixit, Avinash K. (1990). *Optimization in Economic Theory,* Second Edition. Oxford University Press.

Sundaram, Rangajaran K. (1996). *A First Course in Optimization Theory.* Cambridge University Press.

**Student learning outcomes: At the conclusion of the class students will:**

1. Have a basic understanding of the role mathematics and mathematical modeling play in economics;
2. Possess mathematical knowledge necessary to engage with economic models;
3. Have familiarity with basic consumer and producer theory;
4. Be prepared for further graduate study in economics.

**Brief list of topics covered:**

1. Linear models and matrix algebra
2. Comparative statics and implicit functions
3. Optimization
4. Constrained Optimization
5. Dynamic analysis
6. Consumer Theory

**Grading Procedures:**
There will be 4 components of your final grade.

| Participation | 10% |
| Homework | 20% |
| Quizzes | 30% |
| Final | 40% |

**Grading Scale**

| A | 92.00-100.00 | C | 72.00-77.99 |
|---|---|---|---|
| A- | 90.00-91.99 | C- | 70.00-71.99 |
| B+ | 88.00-89.99 | D+ | 68.00-69.99 |
| B | 82.00-87.99 | D | 62.00-67.99 |
| B- | 80.00-81.99 | D- | 60.00-61.99 |
| C+ | 78.00-79.99 | F | <59.99 |

**Participation:** Active participation in your own education is critical. I am able to observe participation in a number of ways, including attending class, sharing ideas in class, working collaboratively with peers, utilizing office hours, etc. The only concrete requirement is that you attend office hours at least once prior Fall Break and this will account for 20 percent of your participation score. Your score will be negatively impact if you detract from the class's learning environment, so please be respectful to others in the class.

**Homework:** Throughout the semester there will be 6 problem sets to aid in your study of the subject. To work on these, I encourage you to form small groups (3-4 students) and work collaboratively. I am happy to arrange groups if you are not able to coordinate on your own. Each individual will be required to turn in his or her own work on the due date. In grading these, more emphasis will be placed on completion than correctness. Homework is due at the beginning of the indicated class.

**Quizzes:** For each problem set, there will be a short in-class quiz (20-30 minutes) covering similar material to assess your personal progress. These will be closed notes. It is expected that if you anticipate an excused absence on a quiz day, you arrange for an alternatively quiz time before you leave.

**Final:** There will be a comprehensive final at the end of the semester. For this you will be permitted a 3x5 notecard with your own notes on both sides. For undergraduates enrolled in 409, you will have the option of to design a mathematical model of an economic system in lieu of the exam if you choose.

**Detailed Course Schedule:**

| Day | Topic | Book Chapter(s) | Due/Activity |
|---|---|---|---|
| Aug. 22 | Introduction and Economic Models | 1, 2 | |
| Aug. 24 | **NO CLASS** | | Attend MEE Kickoff events |
| Aug. 29 | Application: Preferences | | |
| Aug. 31 | Application: Choice Sets and WARP | | |
| Sept. 5 | Equilibrium Analysis in Economics | 3, 4 | *Quiz 1; HW 1* |
| Sept. 7 | Linear Models and matrix algebra | 5 | |
| Sept. 12 | Linear Models and matrix algebra | 5 | |
| Sept. 14 | Derivatives and Comparative Statics | 6, 7 | |
| Sept. 19 | Comparative Static analysis | 8 | |
| Sept. 21 | Comparative Static analysis | 8 | |
| Sept. 26 | Optimization | 9 | *Quiz 2; HW2* |
| Sept. 28 | Optimization | 9 | |
| Oct. 3 | Exponential and logarithmic functions | 10 | |
| Oct. 5 | Multivariable Optimization | 11 | |
| Oct. 10 | Multivariable Optimization | 11 | |
| Oct. 12 | Multivariable Optimization | 11 | |
| Oct. 17 | **NO CLASS** | | Fall Break |
| Oct. 19 | Constrained Optimization | 12 | *Quiz 3; HW3* |
| Oct. 24 | Constrained Optimization | 12 | |
| Oct. 26 | Constrained Optimization | 13 | |
| Oct. 31 | Constrained Optimization | 13 | |
| Nov. 2 | Constrained Optimization | 13 | |
| Nov. 7 | Application: Utility Maximization | | *Quiz 4; HW 4* |
| Nov. 9 | Envelope Theorem | 13 | |
| Nov. 14 | Application: Expenditure Minimization | | |
| Nov. 16 | Mathematical Relationships of the consumer problems | 13 | |

| Nov. 21 | Welfare | | Quiz 5; HW5 |
|---------|---------|---|------------|
| **Nov. 23** | **NO CLASS** | | Thanksgiving |
| Nov. 28 | Welfare | | |
| Nov. 30 | Dynamics and Integral Calculus | 14 | |
| Dec. 5 | Differential Equations | 15 | |
| Dec. 7 | Wrap up and Review | 15 | Quiz 6; HW6 |
| | ***Cumulative Exam*** | | |

**Policy on academic integrity/misconduct:** The Colorado School of Mines affirms the principle that all individuals associated with the Mines academic community have a responsibility for establishing, maintaining and fostering an understanding and appreciation for academic integrity. In broad terms, this implies protecting the environment of mutual trust within which scholarly exchange occurs, supporting the ability of the faculty to fairly and effectively evaluate every student's academic achievements, and giving credence to the university's educational mission, its scholarly objectives and the substance of the degrees it awards. The protection of academic integrity requires there to be clear and consistent standards, as well as confrontation and sanctions when individuals violate those standards. The Colorado School of Mines desires an environment free of any and all forms of academic misconduct and expects students to act with integrity at all times.

Academic misconduct is the intentional act of fraud, in which an individual seeks to claim credit for the work and efforts of another without authorization, or uses unauthorized materials or fabricated information in any academic exercise. Student Academic Misconduct arises when a student violates the principle of academic integrity. Such behavior erodes mutual trust, distorts the fair evaluation of academic achievements, violates the ethical code of behavior upon which education and scholarship rest, and undermines the credibility of the university. Because of the serious institutional and individual ramifications, student misconduct arising from violations of academic integrity is not tolerated at Mines. If a student is found to have engaged in such misconduct sanctions such as change of a grade, loss of institutional privileges, or academic suspension or dismissal may be imposed.

The complete policy is [online](online).

**Disability policy:** The Colorado School of Mines is committed to ensuring the full participation of all students in its programs, including students with disabilities. If you are registered with Disability Support Services (DSS) and I have received your letter of accommodations, please contact me at your earliest convenience so we can discuss your needs in this course. For questions or other inquiries regarding disabilities, I encourage you to visit [disabilities.mines.edu](disabilities.mines.edu) for more information.

**Coursework Return Policy:** All reasonable efforts will be made to return coursework within 7 days.

**Absence Policy:** No formal attendance will be taken, but systematic absences will explicitly negatively impact your participation score negatively. We will follow standard university policy for excused absences.

**Email Policy:** Expect email responses within 24 weekday hours. I will be hesitant to respond to questions for which the answer can be found in the syllabus. Help on specific homework problems is difficult to provide over email and usually best dealt with in office hours.