



COLORADO SCHOOL OF MINES

## Mathematical Economics-EBGN 409/509

Division of Economics and Business

Fall 2018

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

**Office:** Engineering Hall, 323

**Email:** [ssmith1@mines.edu](mailto:ssmith1@mines.edu)

**Phone:** (303) 273-3150

**Office hours:** M W: 1:30-3:00 and by appointment

**Class meeting days/times:** MW: 11:00-12:15

**Class meeting location:** Alderson Hall 134

**Web Page:** [Mines Canvas](#)

**Teaching Assistant:** TBD

**TA Office Hours:** TBD

**Instructional activity:**  3 hours lecture  hours lab  3 semester hours

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

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

**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 7 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 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 alternative quiz time before you leave.

**Final:** There will be a comprehensive final at the end of the semester. For this you will be permitted an 8x11 paper 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
Aug. 20	Introduction and Economic Models	1, 2	
Aug. 22	<b>NO CLASS</b>		Attend MEE Kickoff events
Aug. 27	Equilibrium Analysis in Economics	3	
Aug. 29	Linear Models and matrix algebra	4	<i>Quiz 1; HW 1</i>
Sep. 3	<b>NO CLASS</b>		Labor Day
Sept. 5	Linear Models and matrix algebra	5	
Sept. 10	Linear Models and matrix algebra	5	
Sept. 12	Derivatives and Comparative Statics	6, 7	<i>Quiz 2; HW2</i>
Sept. 17	Comparative Static analysis	8	
Sept. 19	Comparative Static analysis	8	
Sept. 24	Optimization	9	<i>Quiz 3; HW3</i>
Sept. 26	Optimization	9	
Oct. 1	Exponential and logarithmic functions	10	
Oct. 3	Multivariable Optimization	11	
Oct. 8	Multivariable Optimization	11	
Oct. 10	Multivariable Optimization	11	
Oct. 15	<b>NO CLASS</b>		Fall Break
Oct. 17	Constrained Optimization	12	<i>Quiz 4; HW4</i>
Oct. 22	Constrained Optimization	12	
Oct. 24	Constrained Optimization	13	
Oct. 29	Constrained Optimization	13	
Oct. 31	Constrained Optimization	13	
Nov. 5	Application: Utility Maximization		<i>Quiz 5; HW 5</i>
Nov. 7	Envelope Theorem	13	
Nov. 12	Application: Expenditure Minimization		
Nov. 14	Mathematical Relationships of the consumer problems	13	

Nov. 19	Welfare		Quiz 6; HW 6
<b>Nov. 21</b>	<b>NO CLASS</b>		Thanksgiving
Nov. 26	Welfare		
Nov. 28	Dynamics and Integral Calculus	14	
Dec. 3	Differential Equations	15	
Dec. 5	Wrap up and Review	15	Quiz 7; HW 7
	<b><i>Cumulative Exam</i></b>		

**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](#).

**Students with Disabilities:** In guidance put forth by the Department of Justice and the Office for Civil Rights, it is incumbent upon us as an institution to ensure that students know where to seek assistance for disability-related accommodations or information. Inclusion of a disability support statement in syllabi is a national best practice and standard supported by ADA enforcement agencies and AHEAD (Association on Higher Education and Disability), as part of a multi-pronged approach to supporting an inclusive culture on campus.

As such, please include the following statement (*italicized*) in your course syllabi at Mines. Additionally, please make sure to underscore the statement pertinence and directive as part of your course welcome.

***Disability Support Services*** - *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 or academic accommodations, I encourage you to visit [disabilities.mines.edu](http://disabilities.mines.edu) for more information.*

***Discrimination, Harassment and Title IX*** - All learning opportunities at Mines, including this course, require a safe environment for everyone to be productive and able to share and learn without fear of discrimination or harassment. Mines' core values of respect, diversity, compassion, and collaboration will be honored in this course (More information can be [found here](#)) and the standards in this class are the same as those expected in any professional work environment. **Discrimination or harassment of any type will not be tolerated.** As a participant in this course, we expect you to respect your instructor and your classmates. As your instructor, it is my responsibility to foster a learning environment that supports diversity of thoughts, perspectives and experiences, and honors your identities. To help accomplish this:

- Course rosters are provided to the instructor with the student's legal name. I will honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.
- If something is said or done in this course (by anyone, including myself) that made you or others feel

uncomfortable, or if your performance in the course is being impacted by your experiences outside of the course, please report it to:

- Me (if you are comfortable doing so)
- Wellness Center- Counseling (<https://www.mines.edu/counseling-center/>)
- Speak Up (<https://www.mines.edu/speak-up/>)- Anonymous Option

In this course, we will cultivate a community that supports survivors, prevents interpersonal violence, and promotes a harassment free environment. Title IX and Colorado State law protects individuals from discrimination based on sex and gender in educational programs or activities. Mines takes this obligation seriously and is committed to providing a campus community free from gender and sex-based discrimination. Discrimination, including sexual harassment, sexual violence, stalking, and domestic violence, is prohibited and will not be tolerated within the Mines campus community. If these issues have affected you or someone you know, you can access the appropriate resources here: <http://www.mines.edu/title-ix/>. You can also contact the Mines Title IX Coordinator, Karin Ranta-Curran, at 303-384-2558 or [krcurran@mines.edu](mailto:krcurran@mines.edu) for more information.

It's on us, all of the Mines community, to engineer a culture of respect.