

# Econ 5305: Applied Mathematical Economics

Section 001, CRN 14602, Fall 2023

University of Texas at El Paso

Time and Location: R 6:00 – 8:50 pm, BUSN 304

Instructor: Feng Liu, Ph.D.

Email: [fliu@utep.edu](mailto:fliu@utep.edu) (Students should contact me using their UTEP emails  
and put “Econ 5305 001 + full name” in the subject line.)

Office Hours: TR 12:30 – 2:30 pm or by appointment, BUSN 212

Blackboard course site: <https://blackboardlearn.utep.edu> (Students will find assignments and other class  
matters on BB. Students should visit BB on a regular basis for updates.)

## Course Description

This course is required for the Master’s of Science in Economics program. Students must pass this course with a B or better to continue in the program.

This is a course in mathematical methods for economists. It is expected that students have taken calculus and are comfortable with derivatives, as well as intermediate economic theory. The language of mathematics will be used to describe situations that occur in economics, finance, and business. Mathematical modeling is an important tool in economics, finance, business, and management. Mathematics enables us to solve problems that cannot be effectively solved in other ways.

## Course Goals

After taking this course, students are expected to be able

- to understand mathematical models that are relate to economic problems,
- to apply optimization to economic problems,
- to perform comparative static analysis,
- to solve economic models and econometric problems using matrix algebra.

## Course Assignments and Grades

### 1. Assignments

<i>Assignment</i>	<i>Points</i>	<i>Date</i>
Exam 1	100	Take-home, TBD
Exam 2	100	Take-home, TBD
Final Exam	100	Take-home, TBD
Homework	300 = 50 points × 6	Take-home, TBD
Total	600	

- There will be three exams. Due to its comprehensive nature, the final exam requires students to have knowledge from previous chapters. Mathematics is cumulative by nature, and the final exam is cumulative as well. If you get behind or have difficulty early on, don't delay getting help or you will have more difficulty as the course proceeds. There would be no make-up exams.
- There will be eight problem sets (HW). Homework assignments are to be used to check your understanding of the material and to help you work through some of the technical issues in this course. The problem sets will be available on Blackboard and must be submitted before or on the due date. The due dates are not flexible, and no late work will be accepted without an acceptable excuse.
- I strongly urge students to use the problem sets as preparation for the exams. Mathematics cannot be learned passively, and the problem sets are a part of active learning.

## 2. Grading Scale

<i>Letter Grade</i>	<i>Percentages</i>	<i>Points</i>
A	[90, 100]	[540, 600]
B	[80, 90)	[480, 540)
C	[70, 80)	[420, 480)
D	[60, 70)	[360, 420)
F	below 60	below 360

- There are no exceptions to the grading policy. I sympathize with students who are close to the cutoff for the next higher grade. However, it is unfair to others to give special consideration to any student.
- **Grades will be posted on Blackboard**, so students can monitor their status throughout the semester. Any end-of-semester adjustments on final grades will be administered at the instructor's discretion and are extremely unlikely.

### Online Classes

Due to my pregnancy, and as approved by the department, we will switch to online classes once I deliver. My due date is currently November 2, so we can expect the last few classes to be online.

### Textbook and Software (Required)

1. Fundamental Methods of Mathematical Economics, 4<sup>th</sup> edition, by Chiang and Wainwright, McGraw-Hill, 2005. ISBN-13: 978-0070109100
2. R studio is needed.

### Classroom Decorum

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The learning process is more productive when there is a positive classroom environment. Part of the responsibility for maintaining that environment rests with students. What I ask is less for my benefit than for the benefit of your fellow students. Students should follow the simple guidelines below:

1. Treat class time as if it were a professional meeting. Disruptive student behavior, such as having personal conversations during lectures, is unacceptable.
2. Attendance is required. Students are responsible to catch up on any missed work.
3. Electronic devices are permitted only if students are using them to take notes or view the textbook. Please silence cell phones and other electronic devices before class starts.
4. Academic dishonesty is a serious offense. Cheating, plagiarism, collusion, or falsification will result in a **zero mark**. Academic dishonesty is defined by the University at <https://www.utep.edu/student-affairs/osccr/student-conduct/academic-integrity.html>.

**Note:** Failure to adhere to course rules and expectations may result in a student being administratively dropped from the course or being downgraded to the next grade letter. For example, from B down to C.

### **Communication**

The best way to reach me is via email. I strongly prefer to communicate through emails rather than Blackboard course messages. Please send emails to [fliu@utep.edu](mailto:fliu@utep.edu) and put “Econ 5305 001 + full name” in the subject line all the time. I will make every attempt to respond to your message within 24 to 48 hours of receipt. For email etiquette, see <https://www.unr.edu/writing-speaking-center/student-resources/writing-speaking-resources/email-etiquette-for-students>.

### **Academic Integrity and Scholastic Dishonesty**

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures (HOOP). It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, processing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as one’s own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso will be reported to the [Office of Student Conduct and Conflict Resolution](#) (OSCCR) for possible disciplinary action. To learn more, please visit [HOOP: Student Conduct and Discipline](#). All students are responsible for knowing and adhering to UTEP’s policy on academic honesty.

### **Accommodations Policy**

The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs, services and

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activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University. Students requesting an accommodation based on a disability must register with the [UTEP Center for Accommodations and Support Services](#) (CASS). Contact CASS at 915-747-5148 or email them at [cass@utep.edu](mailto:cass@utep.edu), or apply for accommodation online via the [CASS portal](#).

### **Withdrawal and Incomplete Grade Policy**

A student may officially withdraw from this class in accordance with UTEP policy and within the UTEP academic calendar dates. Automatic withdrawals will NOT be made by the instructor. To be withdrawn from the class, students must take the appropriate actions on or before the university deadlines.

Incomplete grades may be requested only in exceptional circumstances after you have completed at least half of the course requirements. Talk to me immediately if you believe an incomplete is warranted. If granted, we will establish a contract of work to be completed with deadlines. The student must have a reasonable chance of passing the course to be considered for an incomplete. An incomplete will not be granted to avoid failing the course.

### **Course Evaluation**

Your constructive assessment of this course plays an indispensable role in shaping education at UTEP. Upon completing the course, please take the time to fill out the online course evaluation.

### **Copyright Statement**

All materials used in this course are protected by copyright law. The course materials are only for the use of students currently enrolled in this course and only for the purpose of this course. They may not be further disseminated.

### **COVID-19 Precautions**

If you have tested positive for COVID-19, you are encouraged to report your result to [covidaction@utep.edu](mailto:covidaction@utep.edu), so that the Dean of Student Office can provide you with support and help with communication with your professors. It is important to follow all instructions that you receive as part of the diagnosis, including isolation and staying at home until a negative test is produced.

If you experience COVID-19 symptoms, please follow the isolation protocol by staying at home and getting tested as soon as possible. If the test is negative but you are still seeking accommodations, please contact the

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Dean of Students Office for guidance in a timely manner. Your instructor will work with Dean of Students Office to determine the extent of any such accommodations.

### **Final Note**

The contents of the syllabus are tentative and subject to change. Any changes will be made known to the students beforehand and posted to Blackboard course site.

### **Tentative Course Content**

The outline below provides a general plan for this course. Deviations may be necessary.

#### **Module 1 Economic Models (chapters 2, 10)**

1. Ingredients of a mathematical model (section 2.1)
2. Types of functions (section 2.5)
3. Exponential and logarithmic functions (sections 10.1, 10.3, 10.5)
4. Relations and functions (section 2.4)
5. Functions of two or more independent variables (section 2.6)

#### **Module 2 Derivatives (chapters 6, 7, 10)**

1. Sensitivity, rate of change, slope of a curve (sections 6.2, 6.3)
2. Differentiation rules (section 7.1)
3. Examples (section 10.7)
4. Partial differentiation (sections 7.2-7.4)
5. Higher-order derivatives

#### **Module 3 Derivative Applications (chapters 9)**

1. Taylor series (section 9.5)
2. Elasticity, substitution of elasticity
3. Plotting a function: increasing/decreasing, concave/convex, boundary
4. Local extrema and finding local extrema for univariate/multivariate functions
5. Global extrema and finding global extrema for univariate/multivariate functions

#### **Module 4 Optimization (chapters 9, 11, 12, 13)**

1. Graphical representation (section 9.1)
2. First-derivative test (section 9.2)
3. Second-derivative test (sections 9.3, 9.4)
4. Example (section 10.6)
5. Optimization with more than one variable (section 11.4)

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6. Optimization with equal constraints (chapter 12)
  7. Optimization with inequalities: Kuhn-Tucker conditions (section 13.1)

### **Module 5 Equilibrium Analysis (chapter 3)**

1. The meaning of equilibrium (section 3.1)
2. Example 1 D-S model (market model): graphical illustration, solving by elimination of variables (sections 3.2, 3.3)
3. Example 2 National-income model: graphical representation, solving by elimination of variables (section 3.5)

### **Module 6 Matrix Algebra: a more efficient way to solve linear systems of equations (chapters 4, 5)**

1. Matrix representation (section 4.1)
2. Basic matrix operations (sections 4.2 – 4.6)
3. Finding matrix inverse (section 5.4)
4. Application to market and national-income models (section 5.6)

### **Module 7 Existence of Equilibria in Linear Models (chapter 5)**

1. Determinant, Cramer's rule (section 5.5)
2. Rank (section 5.3)
3. Existence of solutions and nonsingularity (sections 5.1, 5.2)
4. Linearly dependent

### **Module 8 (tentative) Comparative Static analysis (chapters 8, 13)**

1. Comparative statics of general-function models (section 8.6)
2. Maximum-value functions and the envelope theorem (section 13.5)
3. Duality and the envelope theorem (section 13.6)
4. Does it matter a lot if there is an optimization error (i.e., if there is a deviation from the optimal solution)?

### **Module 9 (tentative) More Matrix Algebra Applications**

1. Dot product
2. Geometric meanings of matrix operations
3. Diagonalization and decomposition
4. Definiteness: The second order condition of optimization
5. Linear dynamic models/Markov chain: steady state