University of South Florida
College of Arts and Sciences
Department of Economics

ECO 4401 Introduction to Mathematical Economics

Syllabus

CRN 90978, Section 001, 3 Credits

Class Meeting Time: Mon & Wed 2:00 – 3:15 pm
Class Meeting Location: CIS 1047
Instructor: Xingxing (Shinshin) Yang
Office Location: CMC 207H
Office Hour: Tue 2:30 – 4:30 pm
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TA: Mohammed Kaif Alam Khan (mkhan22@usf.edu)

I. Welcome!

This course is a survey of essential mathematics for economists and is consisted of two modules: linear algebra and multivariable calculus. As for the former, the topics include solving a system of linear equations, vector and matrix operations, and matrix properties like determinants; as for the latter, topics include a review of one-variable calculus, partial derivatives, and (constrained) optimization problem for function of two variables.

This course is more about mathematics than economic applications. The reason is that applications of math in economics are ubiquitous and you will learn (or have learned) about them in other courses. My goal here is to equip you with the necessary math maturity (e.g. ease with math notations, abstract thinking) for economic analyses. As modern economics has become more and more math-oriented, this will better prepare you for success in the graduate school or a career in business. That said, we'll spend about two weeks (or more if time permits) on application of mathematical modeling in economics.

I welcome any questions or concerns about the class throughout the semester. Your questions are important for me to monitor your learning progress and learn about the effectiveness of my teaching; hence they will benefit the whole class. Please don't hesitate to ask questions whenever you need more clarifications.

II. University Course Description

Survey of multivariable calculus and linear algebra topics which are essential for economic analysis.

Course Prerequisites: ECO 2013 and ECO 2023, and MAC 2241 or MAC 2233

III. Textbooks and Readings

There is no single required textbook for this course, but it's recommended that you get this book (earlier edition is acceptable):

***Essential Mathematics for Economic Analysis*,** 6th edition, 2021, by Knut Sydsaeter, Peter Hammond, Arne Strom, and Andrés Carvajal, ISBN 9781292359281

This book is the main source for the multivariable calculus module and is available in the bookstore.

As for the linear algebra module, the following book is used to develop my lecture notes:

***Introduction to Linear Algebra*, 4th edition**, 2009, by Gilbert Strang
However, you don't have to get this book. It suffices to study with my lecture notes.

You may also find the following resources helpful:

- Linear Algebra series on YouTube (by 3Blue1Brown)
- Interactive Linear Algebra textbook
- *Mathematics for Economists*, 1994, by Carl P. Simon and Lawrence Blume
- *How to Solve It: A New Aspect of Mathematical Method,* reprint, 2014, by G. Polya

IV. Learning Outcome

- Knowledge of linear algebra, which includes: the Gaussian method for solving a system of linear equations, vector and matrix operations, and properties of a matrix such as its inverse and determinant.
- Knowledge of basic concepts of calculus, such as the notion of continuous function, derivatives, and partial derivatives (for a function of two variables).
- Ability to solve constrained optimization problems, which includes application problems in economics.
- To further develop math maturity, such as familiarity with mathematical notations and definitions, ease with mathematical/deductive reasoning.
- Critical thinking. With training of mathematics, you should develop the habit of clear thinking, the ability to critically assess an argument, and the tolerance of ambiguity.

V. How to Succeed in this Course

- **Motivation.** Motivation is much more important than the so called intelligence. Some of you may have doubts about the usefulness of a math class for your career. I can assure you that mathematics is super useful in economics, both in terms of intellectual inquiry and business applications. Unfortunately, modern mathematics has evolved to be too complicated, it takes time and dedication to appreciate the relevance of math skills in solving real world problems. **Mathematics is most rewarding if you are patient with it.**
- **Practices.** Doing math requires a lot of uninterrupted time for exercises. The exercises will be mostly efficient if you can try your best to solve them on your own. So please plan enough time every week (three hours or more) to digest the lectures and complete the homework assignments.
- Motivation again. To succeed in this class, you must be an ***active leaner***. Even if you are taking this course only for your degree requirements, please keep an open mind and have some curiosity about it.

VI. Grading Scale

Percentage	Grade
94 - 100	A
90 – 93.99	A-
87 – 89.99	B+
84 – 86.99	B
80 – 83.99	B-

77 – 79.99	C+
74 – 76.99	C
70 – 73.99	C-
67 – 69.99	D+
64 – 66.99	D
60 – 63.99	D-
0 – 59.99	F

VII. Grade Categories and Weights

Items	Weight
Quizzes	15%
Problem Sets	20%
Midterm	30%
Final Exam	35%
Bonus points	5%

Quizzes

There are **four** online quizzes throughout the semester. For each quiz, you'll have two attempts and only the highest score is kept. Late submission is accepted but there'll be **10% penalty per day**.

Problems Sets

There **four** problem sets in total. You'll need to show your work and submit an electronic version on Canvas for the problem sets. Each problem set will be due on a Thursday midnight. **For problem sets, late submission is NOT accepted.** Exception may be granted in situations like illness or family emergency (details are provided below). Solutions for problem sets will be posted after due. You're expected to review the answer keys carefully and ask questions promptly for clarification.

Exams

There will be two in-class midterms and a final exam. **As for the midterm, only your highest score will be kept** (so one of your midterm scores will be dropped). **The final exam is cumulative** and will be held in at the date and time determined by the university.

Regarding rescheduling and make-up exam: A make-up exam can be provided only if the student notifies the instructor in time and provides valid documents by the end of the day in which the exam is scheduled. Make-up exam is scheduled at the convenience of the instructor. Also, the final exam will only be provided at the time specified by the university, early final exam is NOT allowed.

Extra Credits

There are three ways to earn extra credits: 1) **End-of-term evaluation: 2.5 bonus points**; 2) **Participation: 2.5 bonus points**. Attending class worths 2 points (I will record class attendance for five randomly selected sessions) and the remaining 0.5 points comes from attending office hour and activities like in-class exercises; 3) bonus points question at the end of each problem set: roughly ten percent of the problem set grade.

Medical Excuses: To be approved for an assignment extension or makeup exam, a valid document such as your doctor's notes must be presented to the instructor (in particular, the Verification of Care Form from SHS is NOT a valid document for medical excuse).

Grades of "Incomplete"("I"): An "I" grade may be awarded to a student only when a small portion of the student's work is incomplete and the student is otherwise earning a passing grade. The time limit for removing the "I" is the second week of the next semester. "I" grades not removed by the end of the time limit will be changed to "IF" or "IU," whichever is appropriate.

VIII. Course Schedule

Class plan for fall 2025*

Week	Date	Lecture Topic
week 1	25-Aug	Syllabus review and set basics
	27-Aug	Vectors and vector operations
week 2	1-Sep	Labor Day Holiday
	3-Sep	System of equations and Gaussian Elimination
week 3	8-Sep	Matrix-vector multiplications
	10-Sep	Matrix inverse, Transpose, and permutation
week 4	15-Sep	Introduction to Determinants
	17-Sep	Methods for calculating determinants
week 5	22-Sep	Eigenvalue and eigenvectors
	24-Sep	Applications
week 6	29-Sep	Review
	1-Oct	Midterm 01
week 7	6-Oct	Sets and relations
	8-Oct	Relations, and functions
week 8	13-Oct	Derivatives (review of one variable calculus)
	15-Oct	Partial Derivatives and Gradients
week 9	20-Oct	Level curves of a multivariable function
	22-Oct	Concave and Convex functions (two variables)
week 10	27-Oct	Concave and Convex function (two variables)
	29-Oct	Unconstrained optimization
week 11	3-Nov	Unconstrained optimization (continue)
	5-Nov	Constrained optimization (equality constraints)
week 12	10-Nov	Review
	12-Nov	Midterm 02
week 13	17-Nov	Constrained optimization applications
	19-Nov	Constrained optimization applications
week 14	24-Nov	TBD
	26-Nov	TBD
week 15	1-Dec	Review
	3-Dec	Review
week 16	Dec 8 or 10	Final exam

* This schedule is subject to revision at my discretion

IX. Course Policies: Technology and Media

Canvas: This course will be offered via USF's learning management system (LMS), Canvas. If you need help learning how to perform various tasks related to this course or other courses being offered in Canvas, please view the following videos or consult the Canvas help guides. You may also contact USF's IT department at (813) 974-1222 or help@usf.edu.

Generative AI (GenAI) policy: While **GenAI** tools (such as ChatGPT) can offer inspiration and new possibilities, they should not be seen as substitutes for your own work. In particular, this course assumes that work submitted for a grade by students – homework assignments, quizzes, and exam answer – are generated by the students themselves, working individually or in groups as directed by class assignment instructions. In particular, the following constitute violations of academic honesty:

- A student has another person/entity do the work of any substantive portion of a graded assignment for them, which includes purchasing work from a company, hiring a person or company to complete an assignment or exam, and/or using ANY GenAI tools.

If you have questions about what constitutes a violation of this statement, please contact me.

Also, please note that academic integrity policies still apply in terms of digital communication. Informing others about the contents of a test is prohibited by the official regulation, as is receiving unauthorized information about an examination.

Course Hero / Chegg Policy: The USF Policy on Academic Integrity specifies that students should not use websites that enable cheating, such as by uploading or downloading material for this purpose. This does apply specifically to Chegg.com and CourseHero.com – any use of these websites (including uploading proprietary materials) constitutes a violation of the academic integrity policy.

X. Course Policies: Student Expectations

Attendance Policy: Attendance is NOT mandatory. However it goes without saying that attending classes is your responsibility and you should show up regularly to keep up with the progress of the lectures.

Professionalism Policy: It's expected that you should maintain a professional demeanor in the classroom. Per university policy and classroom etiquette; mobile phones, iPods, etc. **must be silenced** during all classroom and lab lectures. Those not heeding this rule will be asked to leave the classroom/lab immediately so as to not disrupt the learning environment. Please arrive on time for all class meetings. Students who habitually disturb the class by talking, arriving late, etc., and have been warned may suffer a reduction in their final class grade. In addition, please adhere to the policy of no food, tobacco products, or like items in the classroom. Beverages are allowed but must be bottled/capped.

Title IX Policy: Title IX provides federal protections for discrimination based on sex, which includes discrimination based on pregnancy, sexual harassment, and interpersonal violence. To provide support and equal access, USF has designated all faculty (including TAs, Adjunct, etc.) as Responsible Employees (RE). REs are required to report any disclosures of sexual harassment, sexual violence, relationship violence or stalking. The Title IX Office makes every effort, when safe to do so, to reach out and provide resources and accommodations, and to discuss possible options for resolution. Anyone wishing to make a Title IX report or seeking accommodations may do so online, in person, via phone, or email to the Title IX Office. For information about Title IX or for a full list of resources please visit: https://www.usf.edu/title-ix/gethelp/resources.aspx. If you are unsure what to do,

please contact Victim Advocacy – a confidential resource that can review all your options – at 813-974-5756 or va@admin.usf.edu.

XI. Standard University Policies

Policies about disability access, religious observances, academic grievances, academic integrity and misconduct, academic continuity, food insecurity, and sexual harassment are governed by a central set of policies that apply to all classes at USF. These may be accessed at: https://www.usf.edu/provost/faculty/core-syllabus-policy-statements.aspx

XII. Learning Support and Campus Offices

Academic Success Center: For those of you who need extra help in math this course, please check out the resources in Academic Success Center at Academic Success Center | USF. They have tutor hubs for subjects in math and multiple other subjects. Please check them out and take advantage of these resources if needed.

Academic Accommodations: Students with disabilities are responsible for registering with Student Accessibility Services (SAS) to receive academic accommodations for assignments and exams. For additional information about academic accommodations and resources, please visit the SAS website for the Tampa campuses**.**

Student Ombuds Office: The Student Ombuds Office is a confidential, impartial, informal, and independent resource for students experiencing challenges related to the university. Ombuds can help you safely explore options, clarify processes, and consider next steps. Learn more or make an appointment at usf.edu/student-ombuds.