Mathematical Economics

Course Syllabus
Graduate School of Economics
De La Salle University

Instructor: Justin Raymond S. Eloriaga
Class schedule: Saturday 09:00 - 12:00 (Fully Online) Term 1, A.Y. 2020 - 2021
Consultation: By email (justin.eloriaga@dlsu.edu.ph)

1 Course Description

This course serves as an introductory course in mathematics for economic analysis at the graduate level. The course focuses on the mathematical foundations used in economic theory, and the objective is for students to learn how to use the necessary mathematical tools in studying and understanding economics. The course discusses concepts on the applications of differential calculus and integral calculus, linear and non-linear optimization, and matrix algebra. At this level, it is important that students should be able to successfully complete all of the calculations needed with consistency and accuracy, and consequently, develop the ability to interpret and understand mathematical equations and calculations. After building on students' mathematical foundations, the course shifts over to economic applications and analyses. At this point, mathematical theories with economic applications will be covered in class to help students use the language of mathematics to describe and analyze economic models and solve economic problems.

School of Economics' Course Learning Outcomes:	
Knowledge	· Apply both qualitative and quantitative concepts of the derivative of a function. · Interpret the concept of a definite integral as the area of a given region. · Differentiate differential and integral calculus and the relationship between them.
Skills	· Correctly apply differentiation rules. · Apply differential calculus in an economic context. · Demonstrate the applicability of integral calculus in the capital accumulation and welfare concept of economics. · Solve problems of integration using the different techniques of integral calculus. · Solve matrix algebra problems and apply the concepts in economic applications such as input-output models · Have a full grasp of both linear and non-linear optimization techniques
Behavior	· Confidently express graphical and conceptual models in equation form. · Exhibit resilience in solving economic problems mathematically. · Exhibit willingness to work well within a team, to be open-minded and receptive to others' insights and constructive feedback, and to develop initiative

2 Main References

2.1 Required References

- Chiang, A. and K. Wainwright. (2005). Fundamental Methods of Mathematical Economics. 4th edition. McGraw-Hill/Irwin: New York. (Main Reference)
- Sydsæter, K. and P. Hammond. (2012). Essential Mathematics for Economic Analysis, 4th edition. Pearson Education Limited: England
- Eloriaga, J. (2020). Mathematical Economics

2.2 Other References

- Danao, R. (2011). Mathematical Methods in Economics and Business. The University of the Philippines Press: Quezon City.

3 Grading System and Requirements

Given the unique circumstance of the term, the subject shall no longer require students to undertake a summative midterm or final examination. Instead, the course material shall be broken down into eight (8) problem sets divided equally. These 8 problem sets are *long* problem sets which cover all grounds on the topics planned to be covered. Students are required to accomplish at least 7 problem sets as the average of the highest 7 problem sets will be the student's corresponding grade. All problem sets are *individually accomplished* but collaboration (to the extent of discussion) is certainly permitted.

Grading Component		$96 \leq grade \leq 100$	4.0
Long Problem Sets (8 in Total)	100%	$90 \leq grade \leq 95.9\ldots$	3.5
		$84 \leq grade \leq 89.9\ldots$	3.0
		$78 \leq grade \leq 83.9\ldots$	2.5
		$72 \leq grade \leq 77.9\ldots$	2.0
		$66 \leq grade \leq 71.9\ldots$	1.5
Total	100%	$60 \leq grade \leq 65.9\ldots$	1.0
NOTE: Passing Mark	72%	grade <60	0.0

4 Lectures

The course will revolve heavily on the prepared content in the Mathematical Economics lecture notes by Justin Eloriaga. The class will operate around the content of the material and examples contained inside the lecture notes shall be answered in class. Students are encouraged to immediately work on the problem sets thereafter to have a consistent flow. In addition, lecture videos on YouTube (Channel Name: *Justin Eloriaga*) concerning various topics in Mathematical Economics are also there for reference. With the class' consent, all synchronous classes will be recorded and uploaded to an *unlisted*[1] playlist on the same channel as well.

During synchronous lectures, it is highly encouraged that students' webcam are turned on while mics are turned off. No penalty will be incurred from the negligence to follow the stated policy. Attendance will not be monitored due to conditions arising from the pandemic.

[1] Only people with the video link may find and view the video

5 Course Plan

Topics	Activities
Course Introduction (Week 1)	
Introductory Concepts on Differentiation	
The Difference Quotient	Lecture
The Derivative	Class Exercise
Single Variable Differentiation	Problem Sets
Further Dive on Differentiation (Week 2-3)	
Multiple Variable Differentiation	Lecture
Single Variable Optimization	Class Exercise
Taylor Approximations	Problem Sets
Implicit Differentiation	
Fermat's Theorem	
Concavity and Convexity	
Rolle's Theorem	
Weirstrauss' Theorem	
Introductory Integration (Week 4)	
The Anti-derivative	Lecture
Indefinite Integration	Class Exercise
The Area Under a Curve	Problem Sets
The Definite Integral	
The Fundamental Theorem of Calculus	
Techniques of Integration (Week 5-6)	
Integration by Substitution	Lecture
Integration by Parts	Class Exercise
Integration by Partial Fractions	Problem Sets
Integration by Partial Fractions with Repeated Factors	
Improper Integrals	
Area Between Curves	
Economic Applications of Integration	
Introduction to Matrix Algebra (Weeks 7-8)	
Introduction to Matrices	Lecture
Matrix Operations	Class Exercise
Solving Systems of Linear Equations using Matrices	Problem Sets
Determinants	
Cramer's Rule and Matrix Inversion	
Deep Dive on Matrix Algebra (Week 9)	
Eigenvalues and Eigendecomposition	Lecture
Comparative Statics	Class Exercise
Economic Applications of Matrix Algebra	Problem Sets
Unconstrained and Constrained Optimization (Weeks 10-11)	
The Extremum	Lecture
Solving for Local Maxima and Local Minima	Class Exercise
The Hessian Matrix	Problem Sets
The Lagrangean Method	
The Bordered Hessian Matrix	
Linear Programming	
The Lagrangean Method	
Duality Conditions	
Individual Consultation for Select Topics (Weeks 12-13)	
Submission of Problem Sets (Week 14)	

6 Course Guidelines

1. We shall utilize AnimoSpace as the virtual classroom for the course. All announcements and classroom materials shall be posted in the Canvas website, which you can access via dlsu.instructure.com. You'll have to use your DLSU email to log in.
2. We shall devote at most 3 hours of synchronous learning sessions each week, which will cover lectures, class exercises, and live online consultations and discussions. At most 3 hours per week shall be allocated to asynchronous learning that shall cover the time for problem sets and consultations which can be done through AnimoSpace or social media such as Zoom or Facebook.
3. Synchronous learning sessions will be saved for the benefit of the students who cannot be online on schedule. In addition, short video clips of the topics and concepts covered in each chapter/module shall be available for the students to catch up. These short videos can be accessed through the instructor's YouTube page.
4. As noted above, occasional exercises will be done during synchronous (i.e. conference) learning sessions. The problems are typically included in the slides. Students are encouraged to collaborate with the rest of the class and ask questions during the session.
5. Problem sets will be assigned after each topic. Asynchronous channels are also available for students in case they need assistance with regards to the lessons. The students are also encouraged to collaborate with their classmates in answering the problem sets.

7 Contact and Consultation Hours

My consultation hours are from 18:00 - 19:00 (Thursday) over Zoom. Please set an appointment at least 24 hours in advance. Consultation is strictly by appointment only. All contact may be made through justin.eloriaga@dlsu.edu.ph or through 09260321823. Alternatively, students may fill up the contact form in justineloriaga.com

Syllabus prepared by:

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Noted by:

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