Differential and Integral Calculus for Economic Analysis

Course Details

COURSE CODE/TITLE	:	ECOCAL2 (Differential and Integral Calculus for Economic Analysis)
PRE-REQUISITE	:	ECOCAL1
PRE-REQUISITE TO	:	ECOMATH; LBYMATH
FACULTY	:	Justin Raymond S. Eloriaga
TERM/TIME/ROOM	:	Term 3 A.Y. 2019 – 2020, 18:00 – 21:00 (H), Pure Online

Course Description

This course serves as the second introductory course in mathematics for economic analysis at the undergraduate 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 and introduces differential equations and phase diagrams. 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 differential equations using techniques of integral calculus. • Graph dynamic behavior using phase diagrams.
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

During the course, students are expected to improve their written communication, interpersonal communication, problem solving, numeracy, and teamwork skills. Finally, students should be able to express their analyses and appraisals in written form.

Learning Outcome	Student Assessment Methods
LO1: Apply both qualitative and quantitative concepts of the derivative of a function.	Problem Set 1
LO2: Interpret the concept of a definite integral as the area of a given region.	Problem Set 2
LO3: Differentiate differential and integral calculus and the relationship between them.	Problem Sets 1, 2, and 3
LO4: Correctly apply differentiation rules	Problem Sets 1 and 3
LO5: Apply differential calculus in an economic context.	Problem Set 1
LO6: Demonstrate the applicability of integral calculus in the capital accumulation and welfare concept of economics.	Problem Set 2
LO7: Solve problems of integration using the different techniques of integral calculus.	Problem Sets 2 and 3
LO8: Solve differential equations using techniques of integral calculus.	Problem Set 3
LO9: Graph dynamic behavior using phase diagrams.	Problem Set 3
LO10: Confidently express graphical and conceptual models in equation form.	Problem Sets 1, 2, and 3
LO11: Exhibit resilience in solving economic problems mathematically.	Problem Sets 1, 2, and 3
LO12: Exhibit willingness to work well within a team, to be open-minded and receptive to others' insights and constructive feedback, and to develop initiative	Problem Sets 1, 2, and 3

COURSE TOPICS

Topics / Schedule of Lectures and Exams (subject to change):

Learning Outcomes	Topic	Week No.	Learning Activities
LO1, LO4, LO5, LO10, LO11, LO12	I. Differential Calculus and Applications of Differentiation 1. Differentials 2. Functions of Several Variables a. Partial Derivatives b. Total Differentials and Total Derivatives 3. Taylor Approximation 4. L'Hospital's Rule 5. Optimization a. Local and Global Maximum and Minimum Values b. The First Derivative Test and Second Derivative Test c. Concavity, Convexity, and Inflection Points d. Optimization Problems	1 - 4	Discussion, Asynchronous Lecture Videos, Class Collaboration
Problem Set 1 (Week 5)			
LO2, LO3, LO6, LO7, LO10, LO11, LO12	II. Integral Calculus 1. Antidifferentiation and Indefinite Integrals 2. Area Under a Curve and Definite Integrals 3. Integration by Substitution 4. Integration by Parts 5. Integration by Using Partial Fractions 6. Improper Integrals 7. Applications of the Integral a. Area between Curves b. Total and Marginal Cost Functions c. Total and Marginal Revenue Functions d. Investment and Capital Formation and Capital Accumulation e. Welfare Economics	6-8	Discussion, Asynchronous Lecture Videos, Class Collaboration
Problem Set 2 (Week 9)			

LO3, LO4, LO7, LO8, LO9, LO10, LO11, LO12	III. First-Order Differential Equations 1. Introduction to Differential Equations 2. Solutions of Differential Equations 3. Separable Differential Equations 4. Homogeneous Differential Equations 5. Exact Differential Equations 6. Phase Diagrams	10-13	Discussion, Asynchronous Lecture Videos, Class Collaboration
Problem Set 3 (Week 14)			

REQUIRED AND REFERENCE TEXTS

- Chiang, A. and K. Wainwright. (2005). Fundamental Methods of Mathematical Economics. 4th edition. McGraw-Hill/Irwin: New York.
- Danao, R. (2017). Core Concepts of Calculus with Applications. The University of the Philippines Press: Quezon City.
- Danao, R. (2011). Mathematical Methods in Economics and Business. The University of the Philippines Press: Quezon City.
- Dowling, E.T. (2001). Schaum's Outlines: Introduction to Mathematical Economics, 3rd edition. McGraw-Hill, Inc: New York.
- Sydsæter, K. and P. Hammond. (2012). Essential Mathematics for Economic Analysis, 4th edition. Pearson Education Limited: England.

OTHER REQUIREMENTS

1. *Home reading*. Students are encouraged to review the assigned readings (i.e. PowerPoint lectures and corresponding topics in the reference texts) before they are tackled in class.
2. *Class lectures*. Lectures expound on the assigned reading materials. Treatment of certain materials, however, may be different from the text and references. The most difficult materials are generally covered in class lectures.
3. *Problem Sets.* Students will be given 3 problem sets during the term that tackle the application of concepts and techniques that have been previously discussed in class. These problem sets are an **individual effort**. A single grade of 0.0 will be given for outputs that are suspected to be copies (in full or in part) of each other. The recommended submission dates of these problem sets will be announced in class and are in thee syllabus. However, given the nature of Term 3, I am setting an open deadline for all requirements. That is, the student can opt to submit all requirements up until the end of the 14th week. However, it is not recommended that the student cram and procrastinate. They should be able to answer the problem set and practice on their own time. All submissions are to be sent to justin.eloriaga@dlsu.edu.ph
4. The most important rule you need to follow in my class is to have fun learning. I will teach you how to think, live, and breathe mathematics during your stay in the School of Economics. ECOCAL2 is a difficult subject, but it is highly interesting and fun. I only require you to open your mind and to approach it, not with fear or wariness, but with curiosity.

GRADING SYSTEM

First Problem Set	34%	96 ≤ grade ≤ 100	4.0
Second Problem Set	33%	90 ≤ grade ≤ 95.9…	3.5
Third Problem Set	33%	84 ≤ grade ≤ 89.9…	3.0
		78 ≤ grade ≤ 83.9…	2.5
		72 ≤ grade ≤ 77.9…	2.0
		66 ≤ grade ≤ 71.9…	1.5
Total	100%	60 ≤ grade ≤ 65.9…	1.0
NOTE: Passing Mark	60%	grade < 60	0.0

CONTACT AND CONSULTATION HOURS

Contact: justin.eloriaga@dlsu.edu.ph
Office: 2nd floor of L221 (School of Economics Office)
Consultation hours: By appointment. It is best that the student sets up an appointment at least one day in advance

NOTED AND APPROVED BY

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Dr. Marites Tiongco, Dean Dr. Arlene Inocencio, Chair