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**ECON 103 – MATHEMATICS FOR ECONOMISTS**

**Spring 2023**

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| Instructor | Dr. Zahid Iqbal  |
| Room No  | E 208 |
| Office Hours | Monday, Wednesday (9am – 10am)  |
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| **COURSE INFORMATION**  |
| Name  | Mathematics for Economists (ECON 103) – Section C  |
| Credits | 3 |
| Duration | 75 min  |
| Lecture (s)  | 2 lectures per week  |
| schedule | Tuesday and Thursday : 11:00am – 12:15am  |
| Room No  | E204 |

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| **COURSE DESCRIPTION** |
| This course is designed for students who intend to pursue a major in Economics. It will provide students with the basic tools of mathematical economics and their applications to economic analysis required to prepare students for higher level courses in economics. The objective of this course is to provide the basic foundations of the nature of mathematical economics, real number system, set theory and economics, comparative static analysis, linear models and matrix algebra, tools of algebra and calculus, application of calculus in economics, optimization of one and multivariable functions, optimization with constraints, and economic application of optimization. Students are encouraged to to take MATH 102 and MATH 201 before taking this course to ensure better understanding of the concepts taught in class.  |

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| **COURSE OBJECTIVES** |
| This course aims to:* Demonstrate understanding of basic mathematical concepts and methods used by economists
* Boost the student’s ability to understand economic reasoning using basic mathematical tools and improve their problem solving skills
* Provide students with the basic foundations of mathematical techniques required for understanding economic concepts in Microeconomic II (ECON 201) and Macroeconomics II (ECON 202)
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| **LEARNING OUTCOMES** |
| Upon completion of course, students should be able to:* Differentiate between linear and non-linear functions, and solve models using these functions under Partial Market and General Market Equilibrium
* Solve the linear equation system using matrix approach
* Use the basic principles of calculus to differentiate functions and locate local/global maximum and minimum values
* Understand the concept of derivatives and learn the rules of differentiation, partial derivatives, derivative of explicit and implicit functions
* Understand the concept and difference between slope and elasticity and their economic interpretation
* Use first order and second order conditions to understand optimization problems of one and multivariable functions for utility maximization, profit maximization and cost minimization
* Solve optimization problems for one multivariable functions using Lagrange Multiplier method and check for optimization conditions using bordered hessian
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| **GRADING BREAKUP** |
| Quizzes\*\* 15%Assignments 20%Mid term 1 15%Mid term 2 15%Final 35%\*\* There will be a total of 4 quizzes. One will be dropped. There will be no MAKEUP quizzes.  |

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| **COURSE MATERIAL** |
| * Chiang, Alpha, C. and K. Wainwright, Fundamental Methods of Mathematical Economics, 4th Edition, 2004. McGraw Hill/Irwin.
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| **Week** | **Contents** | **Learning Material & Activities** |
| 1.1 | Why should we study mathematical economics? Ingredients of mathematical models: variables, constant, parameters and their economic interpretation, equations and its types, and their economic application | Ch1 (pg. 1-4); Ch2 (pg. 5-7) |
| 1.2 | The real number system and set theory: concept, types, operations and laws, Relations and functions  | Ch2 (pg. 7-19) |
| 2.1 | Types of functions, Equilibrium Analysis in Economics: the meaning of equilibrium, Partial Market Equilibrium – A Linear Model |  Ch2 (pg. 20-22)Ch3 (pg. 30-34) |
| 2.2 | Equilibrium Analysis: Partial equilibrium Analysis - Non-linear market models |  Ch3 (pg. 35-40) |
| 3.1 | General Market equilibrium – Two Commodity Market Model, Equilibrium in National – Income Analysis | Ch3 (pg. 40-47) |
| 3.2 | Nature of Comparative Statics, Rate of Change and Derivative, Derivative and Slope of a Curve, Concept of limit | Ch 6 (pg. 124-130) |
| 4.1 | Rules of differentiation involving one, two or more Functions of the same variable and it’s economic application  | Ch 7 (pg. 148-161) |
| 4.2 | Rules of differentiation involving functions of different variables (chain rule and inverse function rule) and it’s economic application | Ch 7 (pg. 161-165) |
| 5.1 | Partial differentiation, Applications to comparative statistic analysis: Market model and national income model, Jacobian determinants and its application | Ch 7 (pg. 165-173) |
| *Midterm Exam 1* |
| 6.1 | Differentials and Elasticity, Derivatives of implicit Functions  | Ch 8 (pg. 178-205) |
| 6.2 | Exponential and logarithmic functions: derivative of exponential and logarithmic functions | Ch 10  |
| 7.1 | Optimization with one variable: Optimum Values and Extreme Values, Relative Maximum and Minimum: First Derivative Test, Second and higher derivatives, Second Derivative Test | Ch 9 (pg. 220-241) |
| 7.2 | Optimization with one variable: Profit maximisation, Cost minimisation and utility maximisation  | Practice Questions  |
| 8.1 | Optimization with more than one variable: conditions for optimization and its application: Profit maximisation, Cost minimisation and utility maximisation  | Ch 11 (pg. 291-301) |
| 8.2 |
| 9.1 | Optimization with equality constraints: Effects of a constraint, finding the stationary values, Lagrange Multiplier Method) | Ch 12 (pg. 347- 355) |
| 9.2 |
| *Midterm Exam 2* |
| 10.2 | Linear Models and Matrix Algebra: Matrices and vectors, matrix operations, commutative, associative and distributive laws | Chap 4 (pp. 48-70) |
| 11.1 | Identity matrices and null matrices , Transpose and Inverses, Conditions for nonsingularity, determinant of a matrix and basic properties of determinants | Chap 4 (pp. 70- 78)Chap 5 (pp. 94-102) |
| 11.2 | Finding the inverse of a 2x2 matrix and solving Market and National Income Models using the inversion method  | Practice questions |
| 12.1 | Finding the inverse of a 3x3 matrix and solving Market and National Income Models using the inversion method | Practice questions |
| 12.2 |
| 13.1 | Cramer’s Rule, Application to Market and National Income Model | Chap 5 (pp. 103-112) |
| 13.2 | Optimization with Bordered Hessian, Application: Profit maximisation, Cost minimisation and utility maximisation  | Chap 12 (pp. 356-363) |
| 14.1 |
| 14.2 | Revision  |  |
| *Final Exam* |

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| **GRADING SYSTEM** |

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| **Letter Grade** | **GPA** | **%age** | **Letter Grade** | **GPA** | **%age** |
| A | 4.0 | 93% - 100% | A- | 3.7 | 90% - 92% |
| B+ | 3.3 | 87% - 89% | B | 3.0 | 83% - 86% |
| B- | 2.7 | 80% - 82% | C+ | 2.3 | 77% - 79% |
| C | 2.0 | 73% - 76% | C- | 1.7 | 70% - 72% |
| D+ | 1.3 | 67% - 69% | D | 1.0 | 60% - 66% |
| F | 0.0 | Bellow 60% | W | Officially Withdrawal |

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| **STUDENT’S CONDUCT & OTHER ISSUES**  |
| * + Turn off your cell phone(s) before entering the class room either for lecture or for exam.
	+ After 10 minutes of the start of the class, no student will be allowed to enter in the class.
	+ You are expected to attend all classes. In case of absence **you are responsible for the announcements made and material given during that missed classes**. Minimum class attendance to participate in final examination is 80%.
	+ The course will have assignments and quizzes in class. The problem assignments will be submitted on due date; no late submission will be allowed. Problem sets will also be regularly provided and students are encouraged to solve them. **There will be no makeup quiz or examinations, therefore, don’t miss any exam or quiz.**
	+ Students can learn more from each other; therefore, you are encouraged to work together on problem sets/assignments outside the class as long as problem sets/assignments do not look like identical copies.
	+ Plagiarism and cheating are considered to be a most serious breach of academic integrity (see your students manual for detail). Any student found responsible for dishonest practice (for example, copying, use of unauthorized material in exam, etc.) in relation to any piece of work submitted for assessment shall be subject to the FCC's dishonest practice regulations which may result in various penalties, including forfeiture of marks for the piece of work submitted, an F grade for the paper, or in extreme cases exclusion from the University.
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