MATHEMATICS FOR MANAGEMENT

IE University
Professor: **ANTONIO GARCIA ROMERO**

E-mail: agr22@faculty.ie.edu

Degree course: FIRST
Semester: 2º
Category: COMPULSORY
Number of credits: 5.0
Language: English

PREREQUISITES

Concepts covered in Applied Business Mathematics, including: linear and quadratics functions; exponential and logarithmic functions; derivatives, optimization of functions of one real variable, and integration. A good knowledge of MS-EXCEL® is highly recommendable.

SUBJECT DESCRIPTION

This subject is the second course of a one-year sequence designed to give you the intuition to think about economic ideas in mathematical terms and interpret mathematical concepts in the context of economics. Your understanding of both economics and mathematics will have improved after this sequence.

Mathematics is increasingly vital regarding the expression and communication of ideas in Economics. Good knowledge of mathematics helps to understand economic laws and their application to business management. Especially some elements of calculus and linear algebra are crucial to the study of economics.

Economic concepts and models can often be easily and precisely described regarding mathematical notation when words and graphs would fail or mislead us. Mathematics for Management aims to teach you how to use mathematics to understand economics and business management. Therefore, as applications of the mathematical concepts covered in class, examples, and motivation will be drawn from important topics in economics and business. Topics covered include linear algebra, matrices, and systems of linear equations, derivatives of functions of several variables, interpretations of the derivative, convexity, constrained and unconstrained optimization, financial applications of Mathematics. The course includes an introduction to Linear Programming by using the program Solver in EXCEL® which is crucial for modern business management.

OBJECTIVES AND SKILLS

The main goal of this course is to provide a mathematical foundation for analysing data and drawing inferences from that analysis. Moreover, the course aims to increase the student's mastery of the deductive nature of reasoning and understanding the nature of critical thinking. To increase the student's ability in problem solving and abstract reasoning.

We classify the skills in two groups: specific and generic. Regarding the specific skills, the student will be able to:

18th November 2020
Edited by IE Editorial

Define a matrix and carry out arithmetic operations involving matrices.

- Solve a system of linear equations by Gaussian elimination and Gauss–Jordan elimination.
- Define a determinant and evaluate 2 × 2 and 3 × 3 determinants.
- Solve a system of linear equations using Cramer's rule.
- Calculate the inverse of a 2 × 2 and 3 × 3 matrix.
- Solve a system of linear equations by the inverse matrix method.
- Use Excel to carry out elementary row operations to solve a system of linear equations and to calculate the inverse of a matrix.
- Calculate first- and second-order partial derivatives.
- Calculate differentials and incremental changes.
- Calculate marginal functions and the law of diminishing returns.
- Show that a Cobb–Douglas function is homogeneous degree r and determine whether the function exhibits constant, decreasing or increasing returns to scale.
- Use partial derivatives to analyse the properties of production functions and utility functions.
- Calculate partial elasticities.
- Locate and determine the nature of stationary points for functions of several variables.
- Use Lagrange multipliers to determine maximum and minimum values for functions of two variables subject to a constraint.
- Solve linear programming problems and illustrate the results graphically.
- Use Solver in EXCEL® to find constrained maxima and minima, and to carry out what-if analysis.
- Solve problems based on arithmetic and geometric series and applications.
- Calculate present and future values based on simple interest.
- Calculate present and future values based on compound interest using various conversion periods.
- Solve for any of the four variables in the compound interest formula when the values of the other three variables are given.
- Calculate annual percentage rates.
- Calculate the future value of an asset using the straight line and depreciating balance depreciation.
- Calculate NPV and IRR and use these as investment appraisal techniques.
- Calculate the future value for an initial investment P_0 and annual deposits A_0.
- Calculate the present and future values of ordinary annuities.
- Use Excel for all of the above financial calculations.

Regarding the general skills, the student will develop the abilities:

- To address economic and financial problems by means of abstract models.

- To solve the above formal models.

- To use the basic tools which are needed in the modern analysis of economic problems.
Throughout the course, the student should maintain:

An inquisitive attitude when developing logical reasoning, being able to tell apart a proof from an example.

- An entrepreneurial and imaginative attitude towards the examples studied.

- A critical attitude towards formal results.

METHODOLOGY

Students must work before each class. The Syllabus indicates what "Worked Examples" and "Progress Exercises" from the textbook should be read before each session. A good approach should be to read the suggested worked examples to make sure you understand the method; then try to solve the problem by yourself. The course lectures will be based on a combination of theoretical explanations and several practical exercises. Each mathematical concept will be followed immediately by one or more examples. Student participation is considered very important to acquire the skills needed to pose and solve exercises.

We encourage students to work in groups when solving homework problems. However, we highly recommend that each student tries, at the same time, to solve problems by himself.

Teaching methodology	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	20.0 %	25 hours
Discussions	0.0 %	0 hours
Exercises	20.0 %	25 hours
Group work	16.0 %	20 hours
Other individual studying	44.0 %	55 hours
TOTAL	100.0 %	125 hours

EVALUATION CRITERIA

Your final grade in the course will be based on both individual and group work of different characteristics that will be weighted in the following way:

A. CLASS PARTICIPATION:

It will be worth 10% of the overall grade - students are expected to come prepared and participate actively (and voluntarily) during lectures. Your class grade will be based also on attendance, punctuality, participation, and class conduct – there may be a penalty if you create a disruption, talk excessively, or use electronic devices. Your overall class participation grade will be obtained by adding the class grades across all the sessions.

B. QUIZZES:

It will be worth 40% of the overall grade.

There will be 3 quizzes. Please keep in mind that if you miss a quiz, you cannot retake it later The final grade in this part will take into account just the two best results.

C. ASSIGNMENTS:

It will be worth 20% of the overall grade. And it will be based on the individual and group works proposed to the students during the asynchronous sessions and following professor´s instructions.

D. FINAL EXAM:

It is worth 30% of the overall grade. **You need to score at least 3.5 on the final exam to pass the overall course**, even if you have already passed the course through the other course assessments. The final exam will consist of FOUR open questions that will cover the whole subject (i.e.: Topics 1-3). Neither graphical nor programmable calculators are allowed.

* Sobresaliente/Outstanding: 9.0-10.0 (A to A+)

Consistently produces work of the highest quality and craft; exhibits notable progress and development over the course of the semester; meets all course objectives at the highest level; attendance is near-perfect, and contributions to course discussions are extremely valuable.

　*Notable: 7.0-8.9 (B to B+)

Completes all assignments with work of above-average quality and craft; exhibits significant progress and development; meets most course objectives; attendance and participation are very good.

* Aprobado: 6.0-7.0 (C to C+)

Completes all assignments with work of acceptable quality and craft; exhibits some progress and development; meets a majority of course objectives. Attendance and participation are acceptable.　* Aprobado: 5.0-6.0 (D)

Assignments are delivered but are incomplete and/or of low quality and craft; exhibits little progress and development; meets few course objectives. Attendance and participation are poor, but absences do not total more than 30%.

* Suspenso: 0-4.9 (F)

Work is incomplete, missing, or does not meet course objectives. Attendance and participation are poor.

* Automatic Failure/Suspenso: 0 (F)

Please note that a student who misses 30% or more of the scheduled sessions receives an automatic 0.0, and loses his or her right to the second "convocatoria."

Criteria	Percentage	Comments
Class Participation	10 %	
Quizzes	40 %	
Assignment	20 %	
Final Exam	30 %	

PROFESSOR BIO

Professor: **ANTONIO GARCIA ROMERO**

E-mail: agr22@faculty.ie.edu

Antonio García Romero, Full-Time (Assistant) Professor, Area of Operations. IE Business School

ACADEMIC BACKGROUND

- Ph.D. in Economics and Business Administration, Universidad Autónoma de Madrid, Spain, 2002
- Master in Management of Innovation, Universidad Carlos III de Madrid, Spain, 1993
- BSc. in Theoretical Physics, Universidad de Granada, Spain, 1991

ACADEMIC EXPERIENCE

- Assistant Professor. Area of Operations and Decision Sciences, IE Business School, Spain, 2015-Present
- Coordinator of Mathematics, IE University, 2014-present
- Adjunct Professor. IE University, 2013-2015
- Adjunct Professor. Dept. Economics, U. Carlos III de Madrid, Spain, 1998-2003 and 20082013
- Adjunct Professor. U. Europea de Madrid, Spain, 2005-2007
- Adjunct Professor. UOC, Spain, 2000-2003 **BUSINESS EXPERIENCE**

- Consultant in Healthcare Innovation, 2013-present
- Head of Biomedical Research Policy Unit, Ministry of Health, Regional Government of Madrid, Spain, 2003-2013

LATEST PUBLICATIONS

- García-Romero, A, A. Escribano, and J.A. Tribó. 2017. The Impact of Health Research on Length of Stay in Spanish Public Hospitals. Research Policy, 46(3): 591-604 (FT50)
- García-Romero A, D. Santín, and G. Sicilia. 2016. Another brick in the wall. A new Ranking of Academic Journals in Economics using FDH. Scientometrics, 97(1): 91-101
- García-Romero A and JM. Estrada. 2014. A bibliometric analysis of plagiarism and selfplagiarism through Déjà vu. Scientometrics, 101(1):381-396.