X62 COMPUTATIONAL MATHEMATICS

COURSE OUTLINE

1. GENERAL

SCHOOL	ECONOMIC SCIENCES		
DEPARTMENT	ECONOMICS AND SUSTAINABLE DEVELOPMENT		
LEVEL OF STUDY	*Undergraduate*		
COURSE UNIT CODE	**X62**	**SEMESTER OF STUDY**	**6th**
COURSE TITLE	**COMPUTATIONAL MATHEMATICS**		

COURSEWORK BREAKDOWN	**TEACHING WEEKLY HOURS**	**ECTS Credits**
Lectures	**4**	**7,5**

COURSE UNIT TYPE	Compulsory
PREREQUISITES :	NO
LANGUAGE OF INSTRUCTION/EXAMS:	English
COURSE DELIVERED TO ERASMUS STUDENTS	YES in English
MODULE WEB PAGE (URL)	

2. LEARNING OUTCOMES

Learning Outcomes

The aim of this course is to introduce students to computational mathematics. This includes numerical methods for the solution of linear and nonlinear systems, basic data fitting problems, and ordinary differential equations.
On successful completion of this module the learner will:

- be able to appreciate for the role of computers in mathematics and economic science as a complement to analytical and experimental approaches.
- have the knowledge of numerical approximation techniques, know how, why, and when these techniques can be expected to work
- be able to program simple numerical algorithms in MATLAB and MATHEMATICA
- be able use and evaluate alternative numerical methods, communicate the results of numerical computation, with adequate explanations, in written and graphical form.

General Skills

- Retrieve, analyze and synthesize data and information, with the use of necessary technologies.
- Make decisions.
- Advance free, creative and causative thinking.

3. COURSE CONTENTS

Review of Taylor series. Numerical error (floating-point representation, computer arithmetic, round-off errors)
Locating Roots of Equations, bisection method, Newton's method, secant method.
Introduction to the solution of systems of nonlinear equations - Newton's method for systems.
Solving Systems of Linear Equations: Direct methods, Gaussian elimination, LU factorization Iterative methods Jacobi, Gauss-Seidel, SOR.
Polynomial interpolation
Numerical Integration Newton-Cotes methods, adaptive quadrature.
Numerical differentiation.
Numerical Integration of ordinary differential equations with Runge-Kutta methods and multistep methods.
Programming in MATLAB, implementation of all above methods.

4. TEACHING METHODS - ASSESSMENT

MODE OF DELIVERY	Lectures in the classroom
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY	Electronic Presentations MATLAB, MATHEMATICA Moodle e-learning platform
TEACHING METHODS	
ASSESSMENT METHODS	Final written examination (100%)

Method description	***Semester Workload***
Lectures	39
Practice in the lab - Programming Assignments	13
Personal Study	128
Total	***180***

5. RESOURCES

Recommended Book Resources:

1. Cleve Moler, Numerical Computing with MATLAB, SIAM.
2. Stormy Attaway, MATLAB A practical introduction to programming and problem solving, Elsevier, 2017.
3. Hal R. Varian, Computational Economics and Finance – Modeling and Analysis with MATHEMATICA, Springer.
4. Kamram M. Dadkhah, Foundations of Mathematical and Computational Economics, Springer.