# X31 MATHEMATICS FOR ECONOMIC ANALYSIS

## COURSE OUTLINE

### 1. GENERAL

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|---|---|---|---|
| **SCHOOL** | ECONOMIC SCIENCES | | |
| **DEPARTMENT** | ECONOMICS AND SUSTAINABLE DEVELPOMENT | | |
| **LEVEL OF STUDY** | *Undergraduate* | | |
| **COURSE UNIT CODE** | **X31** | **SEMESTER OF STUDY** | **3rd** |
| **COURSE TITLE** | **Mathematics for Economic Analysis** | | |

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

This is an essential introductory subject that offers to the students the preliminary knowledge of calculus for economics science students. The aim is to develop basic skills and understanding of notions of differential calculus of one variable functions and function of several variables as well as their application in economic science. The focus is on those elements of a typical college calculus course that are most used in economics.

On successful completion of this module the learner will be able to:

- Use basic skills of calculus of functions of one variable
- Use basic skills of calculus of functions of several variables
- Use MATHEMATICA to address the above topics
- Understand, apply, and analyze calculus-based economic models

**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

Sequences and series. The principle of mathematical induction.

Functions: algebra of functions, inverse functions, polynomial and rational functions. Limits. Continuity, differentiation functions, implicit differentiation, L'Hopital's rule, tangent. Monotonicity, maximum and minimum values, concavity, symmetry, curve sketching.
Functions of several variables. Partial differentiation. Directional Derivatives. Total Differential. Jacobian Matrix. Homogeneous Functions. Euler's thorem. Convexity, Implicit Functions Derivatives, Parametric Functions Derivatives, Tangential Plane.
Unconstrained optimization and optimization under equality constraints.
Applications to Economic theory:

- Rate of change, supply and demand curves, finding equilibrium.
- Present value, Annuity, Logarithmic derivative. Percent rate of change, Marginal cost-revenue-profit, elasticity.
- Consumer theory (Indifference Curves, Marginal Rate of Substitution, consumer surplus, utility maximisation ),
- Theory of production (Marginal and Average products, Marginal Rate of Technical Substitution, Production functions, Returns to scale),
- Cost theory (Revenue, cost and profit, profit maximization).

All the above topics are illustrated with MATHEMATICA.

## 4. TEACHING METHODS - ASSESSMENT

<table>
<tr><td>MODE OF DELIVERY</td><td>Lectures in the classroom</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY</td><td>Electronic Presentations<br>Mathematica<br>Moodle e-learning platform</td></tr>
<tr><td>TEACHING METHODS</td><td>
<table>
<tr><th>Method description</th><th>Semester Workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Practice in the lab - Programming Assignments</td><td>13</td></tr>
<tr><td>Personal Study</td><td>128</td></tr>
<tr><td>Total</td><td>180</td></tr>
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<tr><td>ASSESSMENT METHODS</td><td>Final written examination (100%)</td></tr>
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## 5. RESOURCES

*- Recommended Book Resources:*


1. Alpha C. Chiang, Kevin Wainwright, Fundamental methods of Mathematical Economics, McGraw Hill, 2005.
1. Ian Jacques, Mathematics for Economics and Business, Pearson Education Limited, 2015.
2. Frank Ayres, Elliott Mendelson, Schaum's Outlines of Calculus, McGraw Hill, 2013.
3. Knut Sydsaeter, Peter J. Hammond, Mathematics for Economic Analysis, Pearson Education Limited, 2012