



MATHEMATICAL METHODS IN ECONOMICS

Course code	<i>FUN105</i>
Course title	<i>Mathematical Methods In Economics</i>
Type of course	<i>Main</i>
Department	<i>Undergraduate studies</i>
Year of study	<i>Second</i>
Semester	<i>Autumn</i>
ECTS	<i>6: 24 hours of theory, 22 hours of practice, 2 hours of examination, 112 hours of self-study</i>
Coordinating lecturer	<i>Kristina Aldošina</i>
Study form	<i>Full-time</i>
Course prerequisites	<i>Mathematical Analysis, Finite Mathematics</i>
Language of instruction	<i>English</i>

Course description

Students learn to solve first and second order differential and difference equations and apply them in economic problem solving. The main attention of this course is focus on static and dynamic optimization techniques and their application in day-to-day problems and decision making of economics and management.

Aim of the course

This course aims to broaden the knowledge and skills in advanced mathematical analysis, which is usually applied in solution of various economic problems.

Course learning outcomes (CLO)	Study methods	Evaluation methods
CLO1. To be acquainted with concepts and principles of advanced mathematical analysis	Lectures, consultations	Midterm and final exams
CLO2. Be able to formulate, model, and solve static optimization problems	Lectures, seminars, self-studies, consultations	Midterm and final exams
CLO3. Be able to formulate, model, and solve dynamic optimization problems	Lectures, seminars, self-studies, consultations	Midterm and final exams
CLO4. Be able to analyze solved problems and make conclusions	Lectures, seminars, self-studies, consultations	Midterm and final exams
CLO5. Be able to convey information sequentially, logically, accurately and clearly, both in written and oral form	Lectures, consultations	Midterm and final exams

Quality assurance

The lecturer assures a variety of teaching methods and testing, which will be subject for discussion and evaluation in class during and after the course. Feedback is highly appreciated by the lecturer.

Cheating prevention

Students are required to behave in accordance with the requirements of the academic ethics. Tasks of midterm and final exams require specific problem solving skills and could not be easily completed even if the assessments were open-book.

Course content

Week	Topic	Contact hours		Readings (pages of the main book)
		Theory	Practice	
1	<i>Introduction to the course.</i> 1. Linear algebra. Linear independence. Rank of matrix. Eigenvalues and eigenvectors.	2	2	7-13, 19-23
2	2. Multivariable calculus. Gradient. Convex sets. Concavity of a function.	2	2	44-46, 50-64, 68-76
3	3. Static optimization. Global and local extrema of multivariable function. Lagrange problem.	2	2	110-114, 115-126
4	4. Static optimization. Nonlinear programming: inequality constraints.	2	2	129-139
5	5. Static optimization. Nonlinear programming: nonnegativity constraints.	2	2	143-146
6	Midterm exam	2	0	
7	6. First order differential equations. Introduction. Separable equations. Linear equations.	2	2	190-191, 194-204
8	7. Second order differential equations in the plane. Introduction. Equations where x or t is missing. Homogeneous linear equations with constant coefficients. Nonhomogeneous linear equations with constant coefficients. Euler's equation. Stability for linear equations.	4	2	223-236
9	8. Simultaneous equations in the plane. Solution methods. Equilibrium points for linear systems, stability.	2	2	237-246
10	9. Calculus of variations. Problem formulation. Terminal conditions.	2	2	288-304
11	10. Control theory. Problem formulation. Terminal conditions. Variable final time.	2	2	306-311, 314-319, 324-327, 336-338
12	11. Difference equations. First order equations, stability. Second order equations. Linear equations with constant coefficients, stability.	2	2	390-409
Total:		26	22	

Individual work and assessment

Assessment type	Topic	Self-study hours	Weight, %
Midterm exam	1 – 5	47	40
Final exam	6 – 11	67	60
Total:		112	100

Each of exams is two academic hours long closed-book written examination. Only non-text, non-graphical calculators (without solving functions), provided sheet with formulas and language dictionary will be allowed.

Precision of composite evaluations is left intact (up to 2 decimal places) until the end of semester and only the final evaluation will be subject to rounding.

In case of the negative final evaluation, exam retake is possible, topics will cover the material of the whole course and will comprise 100% of the final mark. Structure of retake is the same as structure of exam.

Literature

Main

K. Sydsæter, P. Hammond, A. Seierstad, A. Strøm (2008). Further mathematics for economic analysis. Prentice Hall.

Optional

- Turckington, D.A. (2007). Mathematical Tools for Economics. Blackwell Publishing.
- K. Sydsæter, P. Hammond, A. Seierstad, A. Strøm (2008). Essential mathematics for economic analysis. Prentice Hall.