



COURSE (MODULE) DESCRIPTION

Course title	Code
MATHEMATICAL METHODS	

Staff	Department
Coordinator: Assoc. Prof. Dr. Gintautas Bareikis (Semester 1) and Milda Norkutė, PhD (Semester 2) Other(s):	Faculty of Economics and Business Administration

Study cycle	Course type
First (Bachelor's)	Compulsory

Form of implementation	Period of implementation	Language of instruction
Face-to-face	Semester 1 and 2	English

Requirements for student	
Prerequisites:	Additional requirements:

Number of ECTS credits	Student's workload	Contact hours	Individual work
10	300	84	216

Purpose of the course and competences developed			
The aim of the course is to provide students with good understanding of key mathematical concepts and techniques needed for the rest of the programme and be able to apply these to solve economic and financial problems.			
Learning outcomes of the programme	Learning outcomes of the course	Teaching methods	Assessment methods
1.2	Have acquired knowledge in mathematical methods and is able to competently apply them.	Lectures, seminars, analysis of exercises, consultations, discussions, tutorials.	Fall semester detail assessment: Written exam, theory (TBD%), Colloquiums (TBD%), Quizzes (TBD%), 1,2 problems (TBD%).
3.2	Use and interpret mathematical models describing economic or financial phenomena.		
4.2	Construct mathematical arguments and communicate them in a clear manner through written.		
5.1	Expand own understanding, knowledge and skills working on problem sets independently.	Problem sets at home.	

Course themes	Contact / Individual work: time and assignments								Assignments due date
	Lectures	Tutorials	Seminars	Practical classes	Laboratory work	Practice	Contact hours	Individual work	
FALL semester									
Introductory topics. Logic	1						1	10	SH chapters 1-2
Sets operations. The sets of real numbers. $\sup A$, $\inf A$. modulus, distance. Sequences of real numbers.	4			4			8	24	Problem set 1 due. Emphasis on linear algebra and its vast applications. SH chapters 15-16
Functions of one variable. Graphs, tables, formulas. Inverse function, composition of the functions. Classical functions, their graphs and properties. Function limit. Continuity.	5			7			12	21	SH chapters 4-7
Derivative of the function one variable. Differential. Derivatives higher order. Main theorems of continuous and differentiable functions. Taylor formula. Optimization, concavity-convexity of the function one variable.	8			9			17	38	SH chapter 8. Applications to economics.
Indefinite and definite integrals. Integration by parts, integration by substitution. Infinite intervals of integration.	6			4			10	39	SH chapter 9. Applications to economic problems, interpretation. Problem set 2 due.
SPRING semester									
Systems of linear equations. Matrix algebra. Determinants, matrix inverse. Eigenvalues, quadratic forms, positive and negative (semi-)definite matrices.	8			4			12	30	Emphasis on linear algebra and its vast applications. SH chapters 15-16, SHSS chapter 1.
Functions of many variables. Partial derivatives. Linear approximation, differentials for multivariable functions. Implicit differentiation. Convex sets. (Quasi-)concavity/convexity of functions. Gradient and the Hessian matrix.	6			3			9	20	SH chapters 11, 12.1-12.9. SHSS chapter 2.1-2.4, 2.7. Applications in economics. Problem set 3.
Multivariable optimization. Constrained optimization. Lagrange multipliers and their interpretation.	6			3			9	20	SH chapters 13, 14.1-14.6. SHSS chapter 3.1-3.4. Applications in economics.

Multiple integrals over general domains. The multiple Riemann integral. Change of variables. Generalized multiple integrals.	4			2			6	14	Emphasis on calculus, applications to economic problems. SHSS chapter 4.1, 4.4-4.8. Problem set 4.
Total	48			36			84	216	

Assessment strategy	Share in %	Time of assessment	Assessment criteria
Written exam 1	TBD	End of fall semester	Closed and open-ended problems, with a focus on mathematical rigour and ability to apply mathematical tools to economic problems. The exhaustiveness of the answer and the ability to creatively apply mathematical methods will be given a bonus.
Written exam 2	TBD	End of spring semester	
Problem sets	TBD	Throughout the year	Each problem set will include 5 problems to be solved at home. Rigour and depth of solutions will be assessed.
Quizzes	TBD	Throughout the year	TBD
Colloquiums	TBD	Throughout the year	TBD

Author	Published in	Title	Issue No. or Volume	Publishing house or Internet site
Required reading				
Sydsaeter, K and P Hammond (Referred to as SH)	2016	Essential Mathematics for Economic Analysis	5 th edition	Prentice Hall
Sydsaeter, K, Hammond, P, Seierstad, A and A Strøm (Referred to as SHSS)	2008	Further Mathematics for Economic Analysis	2 nd edition	Prentice Hall
Supplementary reading				
Bradley, T	2013	Essential Mathematics for Economics and Business	4 th edition	Wiley
Chiang, A	2004	Fundamental Methods of Mathematical Economics	4 th edition	McGraw-Hill
Pemberton, M and N Rau	2015	Mathematics for Economists	4 th edition	Oxford University Press