



COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Mathematical Methods	

Academic Staff	Core academic unit(s)
Coordinator: Assoc. Prof. Dr. Gintautas Bareikis Other(s):	Faculty of Economics and Business Administration

Study cycle	Type of the course unit
First (Bachelor's)	Compulsory

Mode of delivery	Semester or period when it is delivered	Language of instruction
Face-to-face	Semester 1 and 2	English

Requisites	
Prerequisites:	Co-requisites (if relevant):

Number of ECTS credits allocated	Student's workload (total)	Contact hours	Individual work
10	260	84	176

Purpose of the course unit		
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 course unit	Teaching and learning methods	Assessment methods
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%).
Use and interpret mathematical models describing economic or financial phenomena.		
Construct mathematical arguments and communicate them in a clear manner through written.		
Expand own understanding, knowledge and skills working on problem sets independently.	Problem sets at home.	

Content	Contact hours							Individual work: time and assignments	
	Lectures	Tutorials	Seminars	Workshops	Laboratory work	Internship	Contact hours, total	Individual work	Tasks for individual work
FALL semester									
Introductory topics. Logic	2			2			4	6	SH chapters 1-2. Problem set GB.
Sets operations. The sets of real numbers. $\sup A$, $\inf A$. modulus, distance. Sequences of real numbers.	3			3			6	10	Problem set 1 due. Emphasis on linear algebra and its vast applications. SH chapters 15-16. Problem set GB.
Functions of one variable. Graphs, tables, formulas. Inverse function, composition of the functions. Classical functions, their graphs and properties. Function limit. Continuity.	7			7			14	18	SH chapters 4-7 Problem set GB.
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.	7			7			14	22	SH chapter 8. Applications to economics. Problem set GB.
Indefinite and definite integrals. Integration by parts, integration by substitution. Infinite intervals of integration.	5			5			10	22	SH chapter 9. Applications to economic problems, interpretation. Problem set GB.
SPRING semester									
Systems of linear equations. Matrix algebra. Determinants, matrix inverse. Applications.	4			4			8	22	Emphasis on linear algebra and its vast applications. SH chapters 15-16, SHSS chapter 1. Problem set GB.
Vector spaces, linear independence, basis of the vector space. Space dimension, subspaces.	4			3			7	20	HP chapters 5,6, 88-138. Problem set GB.

Eigenvalues, quadratic forms, positive and negative (semi-)definite matrices.	2			2			4	10	HP chapter 3, 53-70. Problem set GB
Functions of many variables. Partial derivatives. Linear approximation, differentials for multivariable functions. Convex sets. (Quasi-)concavity/convexity of functions. Gradient and the Hessian matrix.	3			3			6	20	SH chapters 11, 12.1-12.9. SHSS chapter 2.1-2.4, 2.7. Applications in economics. Problem set GB.
Multivariable optimization. Constrained optimization. Lagrange multipliers and their interpretation.	3			3			6	16	SH chapters 13, 14.1-14.6. SHSS chapter 3.1-3.4. Applications in economics. Problem set GB.
Multiple integrals over general domains. The multiple Riemann integral. Change of variables. Generalized multiple integrals.	2			3			5	10	Emphasis on calculus, applications to economic problems. SHSS chapter 4.1, 4.4-4.8. Problem set GB.
Total	42			42			84	176	

Assessment strategy	Weight %	Deadline	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 (s)	Publishing year	Title	Issue no. or volume	Publishing house or web link
Required reading				
Michael Harrison and Patric Waldron (Referred to as HP)	2011	Mathematics for Economics and Finance	ISBN 978-0-415-57303-0 (hbk)	Routledge
Sydsaeter, K, Hammond, P, Seierstad, A and A Strøm (Referred to as SHSS)	2008	Further Mathematics for Economic Analysis	2 nd edition	Prentice Hall

Bareikis, G. (Referred as GB)	2022	Lecture notes	e-form	
Recommended 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