Detailed course description/Syllabus

Faculty: ...
Programme: ...

I. General information

Name of the course	Mathematics for Economists / Mathematics
Name of the course in English	Mathematics for Economists / Mathematics
Language of instruction	English
Code/Specialization	International Business / Corporate Finance and Accounting
Profile of the course	General Academic
Course category	Basic
Type of studies	Full-time and Part-time
Number of semesters/semester no.	I / I
Number of hours	Full-time: Lectures: 30 Tutorials: 30 Part-time: Lectures: 30 Tutorials: 15
Number of ECTS	8/6

II. Preliminary requirements

No.	Description
1	Knowledge and skills from standard school mathematics, in particular: • arithmetic operations and algebraic manipulations, • graphs and properties of elementary functions (linear, quadratic, polynomials, rational, logarithmic, exponential, trigonometric), • solving of elementary equations and inequalities.

III. Objectives of the Course

Code	Description
C1	To provide students with basic concepts and techniques of higher mathematics, including basic concepts and techniques of linear algebra (matrices, determinants, simultaneous equations) as well as ones of calculus (limits, derivatives, investigation of function, integration, functions of several variables).
C2	To transfer knowledge and skills in linear algebra and mathematical analysis and their applications to the simple economic models and investigation.
C3	To develop the ability to abstract thinking and to drawing of logical conclusions.

IV. Learning outcomes

Code	Category	Description	KEK
E1	W	Students should know basic tools of linear algebra and calculus, in particular: operations on matrices, determinants, systems of simultaneous linear equations, investigation of functions of one and many variables.	WE-ST1-MG-W01-12/13Z WE-ST1-MG-W06-12/13Z
E2	U	Students make effective use of a variety of mathematical tools (including linear algebra and calculus tools) in the learning and application of mathematics in economics and interpreting results.	WE-ST1-MG-U02-12/13Z WE-ST1-MG-U04-12/13Z WE-ST1-MG-U05-12/13Z WE-ST1-MG-U08-12/13Z
E3	K	Students have positive attitudes towards mathematics, such as: • belief about the role of mathematics in explaining real-world processes and its usefulness, • interest and satisfaction of learning mathematics, • confidence in using mathematics. • perseverance in solving a problem. Students respect teachers and other students, can learn cooperatively and independently, as well as understand the necessity of continuous learning (LLL)	WE-ST1-MG-K01-12/13Z WE-ST1-MG-K03-12/13Z WE-ST1-MG-K05-12/13Z WE-ST1-MG-K04-12/13Z WE-ST1-MG-K07-12/13Z

V. Course contents

Lectures

Code	Description	D (30)	Z (30)
W1	**Introduction:** logical notations, basic logical operations	2	2

W2	**Set theory:** relations between sets, operations on sets, Cartesian product of sets. **Binary relations:** basic properties, preordering (quasi-ordering),weak ordering, partial ordering, linear (total) ordering, equivalence relation (indifference relation) and equivalence class. **Mappings:** injection, surjection and bijection, composition of functions, inverse of function.	4	4
W3	**Metric space:** basic topological concepts**,** sequence in metric space and its limit, basic properties.	2	2
W4	**Calculus of one variable functions:** limits, continuity, derivatives, asymptotes, increase and decrease, relative maxima and minima, concavity and second derivative; investigation of function, economic applications of derivatives: marginal concepts, elasticieties.	6	6
W5	**Integral calculus:** antiderivative, definite integral; improper integrals, applications of the definite integral in geometry.	6	6
W6	**Algebra of matrices: o**perations on matrices, determinant of a square matrix, inverse of a matrix, rank of a matrix, input – output analysis.	3	3
W7	**Systems of linear equations:** Cramer's system, general simultaneous equations, the Kronecker-Cappelli theorem.	3	3
W8	**Functions of several variables:** domain, partial derivatives, relative maxima and minima, Lagrange Multipliers, the method of least squares.	4	4

Tutorials

Code	Description	D (30)	Z (15)
C1	**Logic:** logic sentence, basic logical operators, tautologies of propositional calculus, sentential formulas and quantifiers, applications – definitions, theorems and proofs. Cartesian product of sets.	2	1
C2	**Binary relations - examples:** basic properties, preordering (quasi-ordering),weak ordering, partial ordering, linear (total) ordering, equivalence relation (indifference relation) and equivalence class. **Mappings - examples:** injection, surjection and bijection, composition of functions, inverse of function.	4	2
C3	**Metric space - examples**: imit of sequence in metric space.	2	1
C4	**Investigation of functions of one variable - examples:** limits, derivatives, asymptotes, increase and decrease, relative maxima and minima, concavity and second derivative; economic applications of derivatives.	6	3
C5	**Integral calculus - examples:** antiderivatives and indefinite integrals,	4	2

	definite integrals; improper integrals, applications of the definite integral in geometry.		
C6	**Algebra of matrices - examples:** operations on matrices, determinant of a square matrix, inverse of a matrix, rank of a matrix.	4	2
C7	**Systems of linear equations - examples:** Cramer's systems, any systems of linear equations.	4	2
C8	**Functions of several variables - examples:** domain, partial derivatives, relative maxima and minima, Lagrange Multipliers, the method of least squares.	4	2

VI. Methods of teaching

Code	Description
N1	Lecture
N3	Presentation
N4	Discussion
N7	Case study
N9	Blackboard problem solving
N11	E-learning
N12	Work with books

VII. Means of assessment

Tutorials' assessment

Code	Description
F1	Test
F2	Blackboard problem solving
F8	Effort in class

Lectures' assessment (final course grade)

Code	Description
P2	Written examination
P4	Weighted mean of constituent grades

VIII. Assessment criteria

Learning outcome `E1` *weight:* ***40%***

No achieving required outcome (grade 2.0)	The required outcome not achieved to a satisfactory degree
Achieving the outcome to a satisfactory degree (grade 3.0)	Student knows definitions, theorems, algorithms given in the lecture.
Achieving the outcome to a good degree (grade 4.0)	The outcome achieved to a satisfactory degree and student understands definitions and theorems.
Achieving the outcome to a very good degree (grade 5.0)	The outcome achieved to a good degree, and student understands proofs and properties; he knows relationships between different sections of the course
Achieving the outcome to an exceptional degree (grade 5.5)	Student achieved the outcome to a very good degree and has knowledge of linear algebra and calculus that goes beyond the material carried in the course.

Learning outcome `E2` *weight:* ***50%***

No achieving required outcome (grade 2.0)	The required outcome not achieved to a satisfactory degree
Achieving the outcome to a satisfactory degree (grade 3.0)	Student can solve typical problems and tasks of linear algebra and calculus.
Achieving the outcome to a good degree (grade 4.0)	Student achieved the outcome to a satisfactory degree and can solve nonstandard problems and tasks of linear algebra and calculus; he can use a variety of mathematical concepts and tools in the learning and apply them to economics
Achieving the outcome to a very good degree (grade 5.0)	Student achieved the outcome to a good degree and is able to construct complex reasoning, as well as to evaluate critically the techniques of problems solving used by other studenmts
Achieving the outcome to an exceptional degree (grade 5.5)	Student achieved the outcome to a very good degree and is able to develop his/her skills creatively, so that they go beyond the course content.

Learning outcome `E3` *weight:* ***10%***

No achieving required	The required outcome not achieved to a satisfactory degree; In

outcome (grade 2.0)	particular, student does not attend classes and attempts to cheating during tests/ exams
Achieving the outcome to a satisfactory degree (grade 3.0)	Student respects teachers and other students, can learn independently and understands the necessity of continuous learning
Achieving the outcome to a good degree (grade 4.0)	Student achieved the outcome to a satisfactory degree and is active during classes
Achieving the outcome to a very good degree (grade 5.0)	Student achieved the outcome to a good degree and can learn cooperatively, in particular wants to help other students
Achieving the outcome to an exceptional degree (grade 5.5)	Student achieved the outcome to a very good degree and his attitude is motivating to work for other students

Student may be awarded a positive final grade from the course provided that he achieves all learning outcomes at least to a satisfactory degree. The final grade is calculated according to the following formula:
40% * learning outcome `E1` + 50% * learning outcome `E2` + 10% * learning outcome `E3`

IX. Student workload

Type of activity	Number of hours	
	Full-time	Part-time
Contact hours with the teacher as set in the course content	60	45
Contact hours with the teacher during office hours (e.g. presentations, projects)	10	10
Contact hours with the teacher during tests and examinations	10	10
Preparation for classes (reading, preparing homework etc.)	20	30
Information gathering, preparation of results	10	10
Preparation of a report, project, paper, presentation, discussion	0	0
Preparation for a test, examination	40	45
Total	150	150
Number of ECTS	6	6

X. Course implementation matrix

Learning outcomes	KEK	Objectives of the course	Course contents	Methods of teaching	Means of assessment
E1	**WE-ST1-MG-W01-12/13Z** **WE-ST1-MG-W06-12/13Z**	C1, C2	W1, W2 , W3, W4, W5,W6, W7, W8 C1, C2 , C3, C4, C5,C6, C7, C8	N1, N3, N4, N7, N9, N11, N12	F1, F2, F8, P2, P4,
E2	**WE-ST1-MG-U02-12/13Z** **WE-ST1-MG-U04-12/13Z** **WE-ST1-MG-U05-12/13Z** **WE-ST1-MG-U08-12/13Z**	C1, C2	W1, W2 , W3, W4, W5,W6, W7, W8 C1, C2 , C3, C4, C5,C6, C7, C8	N4, N7, N9, N11, N12	F1, F2, F8, P2, P4,
E3	**WE-ST1-MG-K01-12/13Z** **WE-ST1-MG-K03-12/13Z** **WE-ST1-MG-K05-12/13Z** **WE-ST1-MG-K04-12/13Z** **WE-ST1-MG-K07-12/13Z**	C2, C3	C1, C2 , C3, C4, C5,C6, C7, C8	N1, N3, N4, N7, N9,	F1, F8, P2, P4,

XI. References

Primary references

No.	Description
1	Carl P. Simon, Lawrence Blume, *Mathematics for Economists*, W. W. Norton and Company, New Jork, 1994
2	Vassilis C. Mavron, Timothy N. Phillips, *Elements of Mathematics for Economics and Finance*, Springer-Verlag, London, 2007

Further references

No.	Description
1	L.D.Hoffmann, G.L. Bradley, *CALCULUS for Business, Economics, and the Social and Life Sciences*, Mc Graw-Hill, 1989

XII. Information on teachers

Person responsible for the course

Malawski Andrzej, prof. dr hab. (Department of Mathematics)

Ciałowicz Beata, dr (Department of Mathematics)

Teachers

No.	Teacher
1	Malawski Andrzej, prof. dr hab. (Department of Mathematics)
2	Ciałowicz Beata, dr (Department of Mathematics)
3	Kornafel Marta, mgr (Department of Mathematics)