Appendix No. 1.5 to the Resolution No. 61/2025
of the Rector of the University of Rzeszów

SYLLABUS

REGARDING THE QUALIFICATION CYCLE FROM 2026 TO 2029
ACADEMIC YEAR 2028/2029

1. BASIC COURSE/MODULE INFORMATION

Course/Module title	Introduction to Mathematical Economics
Course/Module code *	
Faculty (name of the unit offering the field of study)	Faculty of Exact and Technical Sciences
Name of the unit running the course	Institute of Mathematics
Field of study	Mathematics
Qualification level	First-cycle studies (Bachelor's)
Profile	General academic
Study mode	Full-time
Year and semester of studies	Year 3, Semester 5
Course type	Specialisation course
Language of instruction	English
Coordinator	Prof. Mykhaylo Zarichnyy, PhD, DSc
Course instructor	Prof. Mykhaylo Zarichnyy, PhD, DSc

* - as agreed at the faculty

1.1.Learning format – number of hours and ECTS credits

Semester (no.)	Lectures	Classes	Laboratories	Seminars	Practical classes	Internships	others	**ECTS credits**
5	30	15	15					5

1.2. Course delivery methods

☒ <u>conducted in a traditional way</u>
☐ involving distance education methods and techniques

1.3. Course/Module assessment (exam, pass with a grade, pass without a grade)

Lecture – exam
classes, laboratories – pass with a grade

2. PREREQUISITES

Knowledge of basic definitions and theorems in mathematical analysis and elements of logic and set theory.

3. OBJECTIVES, LEARNING OUTCOMES, COURSE CONTENT, AND INSTRUCTIONAL METHODS

3.1. Course/Module objectives

O1	Introducing students to basic mathematical models used in economics.
O2	To familiarize students with the construction, solution and interpretation of mathematical economics models.
O3	Acquiring practical skills in using computer programs (Mathematica, Statistica, Excel) to build and analyze mathematical economic models.

3.2. COURSE/MODULE LEARNING OUTCOMES (TO BE COMPLETED BY THE COORDINATOR)

Learning Outcome	The description of the learning outcome defined for the course/module	Relation to the degree programme outcomes
LO_01	The student knows and understands the significance of mathematical concepts and mathematical modelling in economics.	K_W07
LO_02	The student can use mathematical tools, concepts, and methods to analyze and model various economic relationships.	K_U16
LO_03	The student can independently update their knowledge in the field of mathematical economics and use it for their professional development.	K_U22
LO_04	The student is ready to responsibly fulfill professional roles requiring knowledge of the application of mathematics in economic sciences.	K_K07
LO_05	The student is ready to analyze their strengths and weaknesses in the use of mathematics to model economic phenomena.	K_K04
LO_06	The student is ready to take action to solve problems related to mathematical modeling in economics.	K_K05

3.3. Course content (to be completed by the coordinator)

A. Lectures

Content outline
Mathematical models of demand theory. Mathematical models of production theory. Competitive equilibrium models. Economic growth and its description using mathematical models. Optimization problems in economics, profit maximization and cost minimization. Selected topics in optimal control theory. Analysis of the dynamics of economic phenomena using the theory of differential equations and time series.

B. Classes, laboratories, seminars, practical classes

Content outline (classes)
Mathematical modeling of economic phenomena. Analysis of models related to demand theory. Analysis of models related to production theory. Modeling of competitive equilibrium problems. Practical problem-solving related to optimization in economics. Practical analysis of the dynamics of economic phenomena using the theory of differential equations and time series, including forecasting.

Content outline (laboratories)
Description of the basic functions of Mathematica, Statistica, and Excel software used in the mathematical modeling of economic phenomena. Use of Mathematica, Statistica, and Excel to create and analyze models related to demand theory. Use of Mathematica, Statistica, and Excel to create and analyze models related to production theory.

Computer modeling of competitive equilibrium problems. Computer modeling of economic growth using Mathematica, Statistica, and Excel. Use of Mathematica, Statistica, and Excel in optimal control theory.

3.4. Methods of Instruction

Classes:
group work / problem solving / discussion.

Laboratory classes:
designing and conducting experiments.

Lectures:
problem-solving lecture with multimedia presentation.

4. Assessment techniques and criteria

4.1 Methods of evaluating learning outcomes

Learning outcome	Methods of assessment of learning outcomes (e.g. test, oral exam, written exam, project, report, observation during classes)	Learning format (lectures, classes,…)
LO-01	PROJECT, OBSERVATION DURING CLASSES, WRITTEN EXAM	LECTURES, CLASSES, LABORATORY
LO-02	PROJECT, OBSERVATION DURING CLASSES, WRITTEN EXAM	LECTURES, CLASSES, LABORATORY
LO-03	PROJECT, OBSERVATION DURING CLASSES, WRITTEN EXAM	LECTURES, CLASSES, LABORATORY
LO-04	PROJECT, OBSERVATION DURING CLASSES, WRITTEN EXAM	LECTURES, CLASSES, LABORATORY
LO-05	PROJECT, OBSERVATION DURING CLASSES, WRITTEN EXAM	LECTURES, CLASSES, LABORATORY
LO-06	PROJECT, OBSERVATION DURING CLASSES, WRITTEN EXAM	LECTURES, CLASSES, LABORATORY

4.2 Course assessment criteria

The condition for passing the course is obtaining a passing grade from the tutorials, a passing grade from the laboratory classes, and a passing grade from the exam. Classes: The condition for passing is obtaining a passing grade for a prepared presentation/paper.

Laboratory Classes: The condition for passing is obtaining a passing grade for an independently completed practical project, which consists of building and analyzing a selected mathematical economics model. Exam: The condition for passing the exam is obtaining a passing grade on a knowledge assessment test. Both the exam and the project will be graded on a point system, where a passing grade requires >50% of the points. The grading scale is as follows: 51 – 59% – Satisfactory 60 – 69% – Satisfactory plus 70 – 79% – Good 80 – 89% – Good plus 90 – 100% – Very good

5. Total student workload needed to achieve the intended learning outcomes – number of hours and ECTS credits

Activity	Number of hours
Course hours	60
Other contact hours involving the teacher (consultation hours, examinations)	10
Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.)	60
Total number of hours	130
Total number of ECTS credits	5

* One ECTS point corresponds to 25-30 hours of total student workload

6. Internships related to the course/module

Number of hours	*Not applicable*
Internship regulations and procedures	*Not applicable*

7. Instructional materials

Compulsory literature: 1. Andreu Mas-Colell; Michael D. Whinston; Jerry R. Green, Microeconomic Theory, Oxford University Press, 1995, ISBN: 978-0-19-507340-9 2. Carl P. Simon; Lawrence Blume, Mathematics for Economists, W. W. Norton & Company, 1994, ISBN: 978-0-393-95733-4 3. Michael Gerard Rhodes Carter, Foundations of Mathematical Economics, 2001, The MIT Press, 365 pp.

Complementary literature:
1. Kim C. Border, Fixed Point Theorems with Applications to Economics and Game Theory, Cambridge Studies in Economic Theory, Cambridge University Press, 1985, ISBN: 978-0-521-30381-3

2. Akira Takayama, Mathematical Economics, Cambridge University Press, 1985 (2nd edition), ISBN: 978-0-521-31454-3

Approved by the Head of the Department or an authorised person