

|                                                                                                                                                       |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------------|-------------------|----------------------------------|--------------------------------|---------------------------------|-------------------------|--------------------|---------------|
| <b>Course title</b>                                                                                                                                   |    | Mathematical Economics                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                         |                       |                        |                   |                                  | <b>ECTS code</b>               |                                 | 14.3.EE.KZ.3539         |                    |               |
|                                                                                                                                                       |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   |                                  | <b>ECTS credits</b>            |                                 | 3                       |                    |               |
| <b>Name of unit administrating study</b>                                                                                                              |    | KMikr                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                         | <b>Field of study</b> |                        | Economics         |                                  | <b>Field of specialisation</b> |                                 | L&M;                    |                    |               |
| <b>Teaching staff</b>                                                                                                                                 |    | Anna Blajer-Gołębiewska, Associate Professor                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Number of hours</b>                                                                                                                                |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Lectures</b>                                                                                                                                       | 15 | <b>Classes</b>                                                                                                                                                                                                                                                                                                                                                     | 15                                                                                                                                                                                                      | <b>Tutorials</b>      | 0                      | <b>Laboratory</b> | 0                                | <b>Seminars</b>                | 0                               | <b>Language classes</b> | 0                  |               |
| <b>Forma aktywności</b>                                                                                                                               |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   | <b>Year&amp;Type of studies*</b> |                                | 2 SS2,                          |                         |                    |               |
| Hours with the participation of the academic teacher (including office hours, exams, others):                                                         |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   | <b>Semester:</b>                 |                                | 3,                              |                         |                    |               |
| Hours without the participation of the academic teacher (student's self-study, homeworks):                                                            |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   | <b>Type of course:</b>           |                                | obligatory                      |                         |                    |               |
| Total number of hours:                                                                                                                                |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   | 0                                |                                | <b>Language of instruction:</b> |                         | English            |               |
| <b>Teaching form</b>                                                                                                                                  |    | in-class learning                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Teaching methods</b>                                                                                                                               |    | Lectures including multimodal presentations, Activating methods in training classes,                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Prerequisites (required courses and introductory requirements)</b>                                                                                 |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Required courses</b>                                                                                                                               |    | Microeconomics, Macroeconomics, Mathematical applications in economics and management                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Introductory requirements</b>                                                                                                                      |    | <p>Knowledge: a student is able to define a given economic problem and explain the dependencies occurring in basic economic models.</p> <p>Skills: a student recognizes the causes and consequences of economic phenomena, interprets economic phenomena.</p> <p>Competences: a student works creatively formulating relationships between economic phenomena.</p> |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Assessment method, forms and criteria</b>                                                                                                          |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Assessment method</b>                                                                                                                              |    | Exam                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Assessment criteria</b>                                                                                                                            |    | <p>Classes: the grade depends on the points obtained in the final test.</p> <p>Passing classes entitles students to take the exam.</p> <p>The exam: the grade depends on the number of points obtained in the exam.</p> <p>The grading scale is consistent with study regulations.</p>                                                                             |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Course objectives</b>                                                                                                                              |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| The aim of the course is to familiarize a student with the basics of modelling economic processes and phenomena with the use of mathematical methods. |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Learning outcomes</b>                                                                                                                              |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Knowledge</b>                                                                                                                                      |    | E2_W01                                                                                                                                                                                                                                                                                                                                                             | A student has an in-depth knowledge of the nature of mathematical economics and its place in the system of sciences; knows the claims of contemporary economic theories based on mathematical approach. |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
|                                                                                                                                                       |    | E2_W04                                                                                                                                                                                                                                                                                                                                                             | A student knows different types of economic and social ties and regularities governing them in the frames of game theory; has an in-depth knowledge of economic ties between market players.            |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
|                                                                                                                                                       |    | E2_W06                                                                                                                                                                                                                                                                                                                                                             | A student knows mathematical and statistical methods and tools for description and macro- and microeconomic modelling of economic structures and processes occurring in them                            |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Verification of learning outcomes - Knowledge</b>                                                                                                  |    |                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                         |                       |                        |                   |                                  |                                |                                 |                         |                    |               |
| <b>Outcomes</b>                                                                                                                                       |    | written exam                                                                                                                                                                                                                                                                                                                                                       | oral exam                                                                                                                                                                                               | test                  | essay/paper /portfolio | tasks/ homeworks  | individual presentation          | group presentation             | classroom activities            | classroom discussion    | individual project | group project |
|                                                                                                                                                       |    | E2_W01                                                                                                                                                                                                                                                                                                                                                             | X                                                                                                                                                                                                       |                       | X                      |                   |                                  |                                |                                 |                         |                    |               |

|        |   |  |   |  |  |  |  |  |  |  |  |
|--------|---|--|---|--|--|--|--|--|--|--|--|
| E2_W04 | X |  | X |  |  |  |  |  |  |  |  |
| E2_W06 | X |  | X |  |  |  |  |  |  |  |  |

|        |        |                                                                                                                                                                                                                                                                                                       |  |  |  |  |  |  |  |  |  |
|--------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|
| Skills | E2_U01 | A student can creatively interpret and explain economic and social phenomena and relations between them, using acquired knowledge of mathematics and economics.                                                                                                                                       |  |  |  |  |  |  |  |  |  |
|        | E2_U02 | A student can use acquired knowledge in mathematical economics to describe and analyse the causes and course of economic and social processes and phenomena, and can formulate his/her own opinions and critically select analysis methods based on the achievements of economic and social sciences. |  |  |  |  |  |  |  |  |  |
|        | E2_U04 | A student can model economic and social processes using quantitative methods and tools developed by economic sciences, including game theory.                                                                                                                                                         |  |  |  |  |  |  |  |  |  |
|        | E2_U08 | A student can independently analyse economic and social phenomena and processes, and can perform a theoretically deepened assessment of such phenomena, using appropriately selected mathematical research method.                                                                                    |  |  |  |  |  |  |  |  |  |

**Verification of learning outcomes - Skills**

| Outcomes | written exam | oral exam | test | essay/paper /portfolio | tasks/ homeworks | individual presentation | group presentation | classroom activities | classroom discussion | individual project | group project |
|----------|--------------|-----------|------|------------------------|------------------|-------------------------|--------------------|----------------------|----------------------|--------------------|---------------|
| E2_U01   | X            |           | X    |                        |                  |                         |                    |                      |                      |                    |               |
| E2_U02   | X            |           | X    |                        |                  |                         |                    |                      |                      |                    |               |
| E2_U04   | X            |           | X    |                        |                  |                         |                    |                      |                      |                    |               |
| E2_U08   | X            |           | X    |                        |                  |                         |                    |                      |                      |                    |               |

|           |        |                                                                                                                                                                                                                                                      |  |  |  |  |  |  |  |  |  |
|-----------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|
| Attitudes | E2_K01 | A student recognises the importance of knowledge in the field of economics in the process of identifying and solving economic problems using mathematical approach and of consulting experts when having difficulties in solving them independently. |  |  |  |  |  |  |  |  |  |
|           | E2_K02 | A student is aware of the level of his/her knowledge in the field of mathematical economics; understands the need to extend and update this knowledge throughout his/her life.                                                                       |  |  |  |  |  |  |  |  |  |

**Verification of learning outcomes - Attitudes**

| Outcomes | written exam | oral exam | test | essay/paper /portfolio | tasks/ homeworks | individual presentation | group presentation | classroom activities | classroom discussion | individual project | group project |
|----------|--------------|-----------|------|------------------------|------------------|-------------------------|--------------------|----------------------|----------------------|--------------------|---------------|
| E2_K01   | X            |           | X    |                        |                  |                         |                    |                      |                      |                    |               |
| E2_K02   | X            |           | X    |                        |                  |                         |                    |                      |                      |                    |               |

**Course contents**

1. Mathematical theory of demand (constrained optimization for the consumer choice)
2. Modeling choice under conditions of risk and uncertainty (risk-avoiders, risk-seekers, utility functions, certainty equivalent, measures of risk, minimax, maximin, Hurwicz rule, Laplace-Bayes rule)
3. Mathematical game theory as a decision-making tool (zero-sum games, saddle point, simultaneous games, Nash equilibrium, Pareto equilibrium, dominant and dominated strategies, sequential games, backward induction)
4. Selected models of partial and general equilibrium (partial vs general equilibrium, Edgeworth box revised, Arrow-Hurwicz model, cobweb model)
5. Mathematical theory of production (properties of the production function, constrained optimization for the production processes)
6. Economic growth (models of exogenous and endogenous economic growth, technological progress in models of economic growth, the Solow model).

**Recommended reading lists**

Obligatory

- Alpha C. Chiang, Kevin Wainwright, *Fundamental Methods of Mathematical Economics*, McGraw-Hill Higher Education, 4th Edition, 2005.
- Eric Rasmusen, *Games and Information: an Introduction to Game Theory*, Wiley-Blackwell, 2007.

Facultative

- Robert M. Solow, A Contribution to the Theory of Economic Growth, *The Quarterly Journal of Economics*, Volume 70, Issue 1, 1956, pp. 65-94.
- Edward T. Dowling, *Introduction to Mathematical Economics*, McGraw-Hill, Schaum's Outline Series, 2001.
- Martin Osborne, *An Introduction to Game Theory*, Oxford University Press, 2009.
- Anna Blajer-Gołębiewska, Derivatives - exercises [in:] *Mathematical applications in economics and management*, ed. E. Babula, L. Czerwonka, University of Gdańsk Publishing House, Gdańsk, 2015, pp. 174-186.
- Anna Blajer-Gołębiewska, Integrals - exercises [in:] *Mathematical applications in economics and management*, ed. E. Babula L. Czerwonka, University of Gdańsk Publishing House, Gdańsk, 2015, p. 211-218.
- Anna Blajer-Gołębiewska, Individual corporate reputation and perception of collective corporate reputation regarding stock market investments, *PLoS ONE*, vol. 16, no. 9, s. 1-21, <https://doi.org/10.1371/journal.pone.0257323>

Contact

[anna.blajer-golebiewska@ug.edu.pl](mailto:anna.blajer-golebiewska@ug.edu.pl),

\* SS1- undergraduate studies \* SS2 - graduate studies \* SDang - doctoral studies

\*\* MSG - International Economic Relations