#### card of course

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| --- | --- |
| Subject name | Mathematics |

1. The placement of the subject in the study system

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| --- | --- |
| 1.1. Field of study | Management |
| 1.2. Form and path of study | Full-time/Part-time |
| 1.3. Level of education | First-cycle studies |
| 1.4. Study profile | Practical |

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| --- | --- |
| 1. 5. Specialty | - |
| 1.6. Subject Coordinator | Dr Ewa Łazuka |

2. General characteristics of the subject

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| 2.1. Belonging to a subject group | Interdisciplinary/Practical |
| 2.2. Number of ECTS | 3 |
| 2.3. Language of lectures | English |
| 2.4. Semesters in which the subject is taught | I |
| 2.5.Criteria for selecting course participants | - |

1. Learning outcomes and course delivery
   1. Subject Objectives

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| No. | Subject Objectives |
|
| C1 | To introduce students to elementary mathematical issues such as: set calculus, sequences and their limits, functions and their basic properties. |
| C2 | To familiarize students with the concept of the derivative of a function and to acquire the skills to efficiently apply differential calculus to various practical issues, including optimization problems. |
| C3 | To familiarize students with the concept of integral of a function and to acquire the skills to efficiently apply integrals in selected practical problems. |
| C4 | To familiarize students with the concept of a matrix and basic matrix operations and to acquire the ability to use matrices in various problems, e.g. in solving systems of linear equations. |

* 1. Subject-specific learning outcomes, divided into knowledge , skills and competences , with reference to the directional learning outcomes

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| --- | --- | --- | --- | --- | --- | --- |
| No. | Description of subject  learning outcomes | Reference to  directional effects  learning (symbols) | Method of implementation (mark "X") | | | |
| ST | | NST | |
| Classes at the University | Activities on  the platform | Classes at the University | Activities on  the platform |
| After passing the course, the student knows and understands **the knowledge** | | | | | | |
| W1 | The concept of a set, operations performed on sets, the concept of a sequence and its limit, the concept of a function and its properties, including the issue of continuity of functions | Z1\_W08 | X |  |  | X |
| W2 | The concept of derivative, methods of calculating derivative and its most important applications (including the use of derivative in optimization problems) | X |  |  | X |
| W3 | The concept of integral, methods of calculating integrals and the use of integrals, e.g. for calculating areas between graphs of functions | X |  |  | X |
| W4 | The concept of a matrix, the determinant of a matrix, basic operations on matrices, and the use of matrices to solve systems of linear equations | X |  |  | X |
| After passing the course, the student is **able** to: | | | | | | |
| U1 | Efficiently perform operations on sets, calculate the limits of sequences and functions, and study the basic properties of functions. | Z1\_U01  Z1\_U05 | X |  | X |  |
| U2 | Calculate derivatives and apply differential calculus to selected practical problems, including solving optimization problems | X |  | X |  |
| U3 | Calculate simple integrals and use integrals to determine areas between graphs of functions. | X |  | X |  |
| U4 | Perform basic matrix operations and apply matrix calculus to solve systems of linear equations | X |  | X |  |
| After completing the course, the student is ready to take part in **social competences.** | | | | | | |
| K1 | Understand the limitations of your own knowledge of mathematics and critically evaluate the results of your own work | Z1\_K01 | X |  | X |  |

3.3. Forms of teaching and their number of hours - Full-time studies (ST), Part-time studies (NST)

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Path | Lecture | Exercises | Design | Workshop | Laboratory | Seminar | Lecturer | Classes conducted using distance learning methods and techniques in the form of a lecture | Other | **ECTS points** |
| **ST** | 15 | 30 |  |  |  |  |  |  |  | 3 |
| **NST** |  | 15 |  |  |  |  |  | 15 |  | 3 |

3.4. Content of education (separately for each form of classes: (W, ĆW, PROJ, WAR, LAB, LEK, OTHER). It should be marked (X) how the given content will be implemented (classes at the university or classes on the e-learning platform conducted using distance learning methods and techniques)

TYPE OF CLASS: LECTURE

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| --- | --- | --- | --- | --- | --- | --- |
| No. | Content of the course | Reference to subject-specific learning outcomes | Method of implementation (mark "X") | | | |
| ST | | NST | |
| **Classes at the University** | **Activities on  the platform** | **Classes at the University** | **Activities on  the platform** |
| 1. | Introduction to mathematical logic. The concept of a sentence in the sense of logic, logical values. Basic logical connectives: negation, disjunction, conjunction, implication, equivalence. Basic logical laws. Quantifiers. | **W1, U1, K1** | X |  |  | X |
| 2. | Sets and methods of describing sets. Classification of sets. Relations between sets: equal sets, disjoint sets, intersecting sets. Subsets. Power set. | **W1, U1, K1** | X |  |  | X |
| 3. | Sequences and methods of defining sequences. The concept of a bounded and monotonic sequence. The concept of a limit of a sequence. Selected properties of limits of sequences. | **W1, U1, K1** | X |  |  | X |
| 4. | Function and its basic properties. Elementary functions. Types of functions, including monotone, even, odd, bijections. Composition of functions. Inverse functions. Continuous functions. | **W1, U1, K1** | X |  |  | X |
| 5. | Derivative of a function and methods of calculating it. Derivative of a function at a point. Properties of the derivative. | **W2, U2, K1** | X |  |  | X |
| 6. | The concept of an antiderivative and an indefinite integral. Properties of indefinite integrals. The definite integral and its basic properties. | **W3, U3, K1** | X |  |  | X |
| 7. | Matrices, matrix types, and basic matrix operations. Elements of vector calculus, including the scalar and vector product. Systems of linear equations. | **W4, U4, K1** | X |  |  | X |
| 8. | Summary of classes and discussion of grades |  | X |  |  | X |

TYPE OF CLASSES: EXERCISES

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| --- | --- | --- | --- | --- | --- | --- |
| No. | Content of the course | Reference to subject-specific learning outcomes | Method of implementation (mark "X") | | | |
| ST | | NST | |
| **Classes at the University** | **Activities on  the platform** | **Classes at the University** | **Activities on  the platform** |
| 1. | Number sets. Basic operations on sets: union, product, difference, symmetric difference. Complement of a set. Cartesian product of sets. | **W1, U1, K1** | X |  | X |  |
| 2. | Limits of selected sequences. Theorem about three sequences. | **W1, U1, K1** | X |  | X |  |
| 3. | Function and its properties. One-to-one and onto functions. Limit of a function at a point. Continuity of a function at a point and in the domain. | W1, U1, K1 | X |  | X |  |
| 4. | Derivative of a function. Application of differential calculus, including the study of monotonicity of a function, determining the tangent to a graph, finding extrema. L'Hopital's rule. Optimization problems. | **W2, U2, K1** | X |  | X |  |
| 5. | Calculating integrals of functions. Integration by parts and substitution. Using integrals to calculate areas between graphs of functions. | **W3, U3, K1** | X |  | X |  |
| 6. | Matrices. Determinant of a matrix. Inverse matrix. Using matrices to solve systems of linear equations (Cramer's rule, inverse matrix method). | **W4, U4, K1** | X |  | X |  |
| 7. | Summary of classes and discussion of grades |  | X |  | X |  |

3.5. Methods of verifying learning outcomes (indication and description of methods of conducting classes and verification of achievement of learning outcomes and method of documentation)

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| --- | --- | --- | --- |
| Subject Effects | Teaching methods | Methods of verifying learning outcomes | Documentation methods |
| KNOWLEDGE | | | |
| W1-W4 | solving tasks combined with discussion of the obtained results; group work; lecture combined with solving sample problems and discussion | colloquium (exercises) and exam (lecture) verifying acquired knowledge, skills and competences | Colloquium sheet  Examination sheet |
| SKILLS | | | |
| U1-U4 | solving tasks combined with discussion of the obtained results; group work; lecture combined with solving sample problems and discussion | colloquium (exercises) and exam (lecture) verifying acquired knowledge, skills and competences | Colloquium sheet  Examination sheet |
| SOCIAL COMPETENCES | | | |
| K1 | solving tasks combined with discussion of the obtained results; group work; lecture combined with solving sample problems and discussion | colloquium (exercises) and exam (lecture) verifying acquired knowledge, skills and competences | Colloquium sheet  Examination sheet |

3.6. Assessment criteria for the achieved learning outcomes

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| Learning effect | For a grade of 3 or "pass."  the student knows and understands/is able to/is ready to | For a grade of 3.5, the student knows and understands/is able to/is ready to | For a grade of 4, the student knows and understands/is able to/is ready to | For a grade of 4.5, the student knows and understands/is able to/is ready to | For a grade of 5, the student knows and understands/is able to/is ready to |
| W | 51-60% of knowledge indicated in learning outcomes | 61-70% of knowledge indicated in learning outcomes | 71-80% of knowledge indicated in learning outcomes | 81-90% of knowledge indicated in learning outcomes | 91-100% of knowledge indicated in learning outcomes |
| U | 51-60% of skills indicated in learning outcomes | 61-70% of skills indicated in learning outcomes | 71-80% of skills indicated in learning outcomes | 81-90% of skills indicated in learning outcomes | 91-100% of skills indicated in learning outcomes |
| K | 51-60% of skills indicated in learning outcomes | 61-70% of skills indicated in learning outcomes | 71-80% of skills indicated in learning outcomes | 81-90% of skills indicated in learning outcomes | 91-100% of skills indicated in learning outcomes |

3.7. Recommended reading

**Basic**

* Batóg B., Bieszk-Stolorz B., Foryś I., Matematyka dla kierunków ekonomicznych : teoria, przykłady, zadania, Difin, Warszawa, 2016
* „Analiza matematyczna 1: definicje, twierdzenia, wzory”, Marian Gewert, Zbigniew Skoczylas. - Wyd. 19, popr., Wrocław : Oficyna Wydawnicza GiS, 2009;
* „Analiza matematyczna 1: przykłady i zadania”, Marian Gewert, Zbigniew Skoczylas. - Wyd. 18 popr., Wrocław : Oficyna Wydawnicza GiS, 2009;

**Supplementary**

* Analiza matematyczna w zadaniach. Cz. 1”, Włodzimierz Krysicki, Lech Włodarski. - Wyd. 29, 6 dodruk. Warszawa: Wydawnictwo Naukowe PWN, 2008;
* „Analiza matematyczna w zadaniach. Cz. 2”, Włodzimierz Krysicki, Lech Włodarski. - Wyd. 27, 5 dodruk. Warszawa: Wydawnictwo Naukowe PWN, 2008.

4. Student workload - ECTS points balance

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| --- | --- | --- |
| **Types of student activity** | **Student Load** | |
| **ST** | **NST** |
| **Classes requiring direct contact between the student and the academic teacher at the university premises** | **45** | **30** |
| Classes included in the study plan | 45 | 30 |
| **Student's own work** | **30** | **45** |
| Ongoing preparation for classes, preparation of project work/presentations/etc. | 15 | 25 |
| Preparation for passing classes | 15 | 20 |
| **TOTAL STUDENT HOURLY LOAD** | **75** | **75** |
| **Number of ECTS points** | **3** | **3** |

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| Last change date | 30/09/2024 |
| The changes were introduced | ZAZ Education Quality Team |
| The changes were approved | Mgr Anna Bielak |