Appendix No. 1.5 to the Resolution No. 7/2023

of the Rector of the University of Rzeszów

**SYLLABUS**

**regarding the qualification cycle FROM 2024TO 2025**

1. Basic Course/Module Information

|  |  |
| --- | --- |
| Course/Module title | DIFFERENTIAL EQUATIONS |
| Course/Module code \* |  |
| Faculty (name of the unit offering the field of study) | *College of Natural Sciences* |
| Name of the unit running the course | *Institute of Mathematics* |
| Field of study | Mathematics |
| Qualification level | Second degree |
| Profile | *Academic* |
| Study mode | *Full-time* |
| Year and semester of studies | *1st year, 2nd semester* |
| Course type | *Basic* |
| Language of instruction | English |
| Coordinator | Ewa Rak, PhD |
| Course instructor | *Mirosława Zima, PhD, DSc* |

\* - as agreed at the faculty

1.1.Learning format – number of hours and ECTS credits

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Semester  (n0.) | Lectures | Classes | Laboratories | Seminars | Practical classes | Internships | others | **ECTS credits** |
| 1 |  | 30 |  |  |  |  |  | 5 |

1.2. Course delivery methods

☒ conducted in a traditional way

☒ involving distance education methods and techniques

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

Exam

2. Prerequisites

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| Single variable calculus, linear algebra, metric spaces. |

3. Objectives, Learning Outcomes, Course Content, and Instructional Methods

3.1. Course/Module objectives

|  |  |
| --- | --- |
| O1 | Familiarization with the basic concepts and classical methods of ordinary differential equations |
| O2 | Familiarization with the methods of solving selected types of ordinary differential equations |
| O3 | Introduction to modern methods of solving ordinary differential equations. |
| O4 | Introduction to the basic applications of differential equations. |

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 | Knowledge and understanding notions and theorems on ordinary differential equations. Knowledge of the methods of solving selected types of ordinary differential equations | K\_W01 |
| LO\_02 | Knowledge and understanding the role and significance of theorems on the existence and uniqueness of solutions of the Cauchy problems and the idea of their proofs | K\_W02 |
| LO\_03 | Able to solve selected types of differential equations using the calculus and algebra. | K\_U01 |
| LO\_04 | Able to prove classical existence and uniqueness theorems using the topological and algebraic methods | K\_U02 |
| LO\_05 | Able to verify and justify corectness of reasoning in the proofs from differential equations theory | K\_U03 |
| LO\_06 | Able to recognize topological and algebraic structures in the theory of differential equations | K\_U04 |
| LO\_07 | Ready to ask questions on theory, methods and applications of differential equations | K\_K01 |

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

|  |
| --- |
| Content outline |
| First order differential equations: separable equation, linear equations, Bernoulli equation, exact differential equation, integrating factor. Applications to physics, economy, geometry. |
| Cauchy problem, Peano theorem, Picard theorem. |
| Linear equations of n-th order. Fundamental set of solutions, Wronskian, Liouville’s formula. Homogeneous equations with constant coefficients, characteristic equation. Non-homogeneous equation – method of undetermined coefficients, method of the variation of the constants. |
| Homogeneous linear system of the first order – properties of solutions.  Fundamental set of solutions, Wronskian, Liouville’s formula. Homogeneous equations with constant coefficients, characteristic equation. Non-homogeneous linear systems of the first order – method of the variation of the constants. |

3.4. Methods of Instruction

e.g.

*Lecture: a problem-solving lecture/a lecture supported by a multimedia presentation/ distance learning*

*Classes: text analysis and discussion/project work (research project, implementation project, practical project)/ group work (problem solving, case study, discussion)/didactic games/ distance learning*

*Laboratory classes: designing and conducting experiments*

Classes: working in groups and individual - task solving and proving theorems.

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 | observation during classes, test | Classes |
| LO-02 | oral exam | Classes |
| LO-03 | test | Classes |
| LO-04 | oral exam | Classes |
| LO-05 | oral exam | Classes |
| LO-06 | observation during classes, oral exam | Classes |
| LO-07 | observation during classes | Classes |

4.2 Course assessment criteria

|  |
| --- |
| students are Assessed regularly solving tasks writing.  The examination of students' knowledge in the test and oral exam.  Grading score:  3.0 for 50 - 60%, 3.5 for 61 - 70 %, 4.0 for 71 – 80%, 4.5 for 81 – 90%; 5.0 for 91 – 100 % |

5. Total student workload needed to achieve the intended learning outcomes

– number of hours and ECTS credits

|  |  |
| --- | --- |
| Activity | Number of hours |
| Scheduled course contact hours | 30 |
| Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.) | 70 |
| Total number of hours | 100 |
| Total number of ECTS credits | 5 Ects |

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

6. Internships related to the course/module

|  |  |
| --- | --- |
| Number of hours |  |
| Internship regulations and procedures |  |

7. Instructional materials

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| Compulsory literature:  P. Hartman, Ordinary differential equations, Wiley, New York 1964  E. Swokowski, Calculus with analytic geometry,Prindle, Boston 1983. |
| Complementary literature:  J. M. Rassias, Counter examples in differential equations and related topics, World Scientific, Singapore 1991 |

Approved by the Head of the Department or an authorised person