

## Subject card

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                          |                                                                                                                                                                   |                                     |                                                                                                    |            |     |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------|------------|-----|
| Subject name and code                       | Mathematical Software, PG_00155276                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |                                                                                                                                                                   |                                     |                                                                                                    |            |     |
| Field of study                              | Mathematical Modeling and Data Analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                                                                                                                                                   |                                     |                                                                                                    |            |     |
| Date of commencement of studies             | October 2024                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          | Academic year of realisation of subject                                                                                                                           |                                     | 2025/2026                                                                                          |            |     |
| Education level                             | Bachelor's studies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          | Subject group                                                                                                                                                     |                                     | Obligatory subject group in the field of study                                                     |            |     |
| Mode of study                               | full-time studies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          | Mode of delivery                                                                                                                                                  |                                     | at the university                                                                                  |            |     |
| Year of study                               | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          | Language of instruction                                                                                                                                           |                                     | Polish<br>The course may be conducted in English.                                                  |            |     |
| Semester of study                           | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          | ECTS credits                                                                                                                                                      |                                     | 2.0                                                                                                |            |     |
| Learning profile                            | academic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                          | Assessment form                                                                                                                                                   |                                     | credit                                                                                             |            |     |
| Conducting unit                             | Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                          |                                                                                                                                                                   |                                     |                                                                                                    |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          | dr Michał Banacki                                                                                                                                                 |                                     |                                                                                                    |            |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                          |                                                                                                                                                                   |                                     |                                                                                                    |            |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Lecture                                                  | Tutorial                                                                                                                                                          | Laboratory                          | Project                                                                                            | Seminar    | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.0                                                      | 0.0                                                                                                                                                               | 30.0                                | 0.0                                                                                                | 0.0        | 30  |
|                                             | E-learning hours included: 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                                                                                                                                                                   |                                     |                                                                                                    |            |     |
| Learning activity and number of study hours | Learning activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Participation in didactic classes included in study plan |                                                                                                                                                                   | Participation in consultation hours |                                                                                                    | Self-study | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 30                                                       |                                                                                                                                                                   | 5.0                                 |                                                                                                    | 15.0       | 50  |
| Subject objectives                          | <ul style="list-style-type: none"><li>• Introduction to using math packages.</li><li>• Using math packages to solve math problems.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                  |                                                          |                                                                                                                                                                   |                                     |                                                                                                    |            |     |
| Learning outcomes                           | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          | Subject outcome                                                                                                                                                   |                                     | Method of verification                                                                             |            |     |
|                                             | [MMiADL3_U09] is able to use the learned software package or the learned programming language to solve selected problems from the known fields, in particular from mathematical analysis, linear algebra and statistics                                                                                                                                                                                                                                                                                                       |                                                          | The student is able to use the known software package or programming language to solve selected problems in the known fields of mathematics.                      |                                     | [SU2] presentation/project/paper/report<br>[SU5] implementation of a problem task                  |            |     |
|                                             | [MMiADL3_K03] is ready to work in a team; understands the need for systematic work on all projects that have a long-term character                                                                                                                                                                                                                                                                                                                                                                                            |                                                          | The student is able to work in a team and understands the importance of a systematic approach in working on mathematical problems.                                |                                     | [SK2] presentation/project/paper/report<br>[SK8] observation of student's independent or team work |            |     |
|                                             | [MMiADL3_W10] knows and understands at least one software package for symbolic calculations                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                          | The student knows at a basic level at least one mathematical software package.                                                                                    |                                     | [SW5] implementation of a problem task                                                             |            |     |
|                                             | [MMiADL3_W09] knows and understands the basics of computational and programming techniques supporting mathematician's work and understands their limitations                                                                                                                                                                                                                                                                                                                                                                  |                                                          | The student knows the basics of computational and programming techniques associated with a given mathematical software package and is aware of their limitations. |                                     | [SW5] implementation of a problem task                                                             |            |     |
| Subject contents                            | <ol style="list-style-type: none"><li>1. Presentation of a CAS package selected by the lecturer (e.g. Maxima, Mathematica, SageMath)</li><li>2. Discuss the limitations of this type of software packages.</li><li>3. Using software to solve selected mathematical problems (related to e.g. mathematical analysis and linear algebra) requiring the use of a computer.</li><li>4. Using programming techniques to solve mathematical problems</li><li>5. Presentation of subject-related nomenclature in English.</li></ol> |                                                          |                                                                                                                                                                   |                                     |                                                                                                    |            |     |

|                                                                |                                                                                                    |                                                                                                                                                                                                             |                               |
|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Prerequisites and co-requisites                                | Basic knowledge of calculus, linear algebra and programming obtained in the first year of studies. |                                                                                                                                                                                                             |                               |
| Assessment methods and criteria                                | Subject passing criteria                                                                           | Passing threshold                                                                                                                                                                                           | Percentage of the final grade |
|                                                                | observation of the student's attitude                                                              | 51.0%                                                                                                                                                                                                       | 0.0%                          |
|                                                                | tests and/or project                                                                               | 51.0%                                                                                                                                                                                                       | 100.0%                        |
| Recommended reading                                            | Basic literature                                                                                   | User manuals for software packages selected by the instructor.                                                                                                                                              |                               |
|                                                                | Supplementary literature                                                                           | 1. P. Zimmermann et al., Computational Mathematics with SageMath, Society for Industrial and Applied Mathematics, 2018.<br><br>2. G. V. Bard, Sage for Undergraduates, American Mathematical Society, 2015. |                               |
|                                                                | eResources addresses                                                                               | Supplementary<br><a href="https://doc.sagemath.org/html/en/index.html">https://doc.sagemath.org/html/en/index.html</a> - SageMath package documentation.                                                    |                               |
| Example issues/<br>example questions/<br>tasks being completed | None                                                                                               |                                                                                                                                                                                                             |                               |
| Work placement                                                 | Not applicable                                                                                     |                                                                                                                                                                                                             |                               |

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