

## Subject card

|                                             |                                                                                       |                                                          |                                         |                                     |                        |            |     |
|---------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|------------------------|------------|-----|
| Subject name and code                       | Waving and diffusion, PG_00170078                                                     |                                                          |                                         |                                     |                        |            |     |
| Field of study                              | Mathematics                                                                           |                                                          |                                         |                                     |                        |            |     |
| Date of commencement of studies             | October 2024                                                                          |                                                          | Academic year of realisation of subject |                                     | 2024/2025              |            |     |
| Education level                             | Master's studies                                                                      |                                                          | Subject group                           |                                     | Optional subject group |            |     |
| Mode of study                               | full-time studies                                                                     |                                                          | Mode of delivery                        |                                     | at the university      |            |     |
| Year of study                               | 1                                                                                     |                                                          | Language of instruction                 |                                     | Polish                 |            |     |
| Semester of study                           | 2                                                                                     |                                                          | ECTS credits                            |                                     | 5.0                    |            |     |
| 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 Milena Matusik                       |                                     |                        |            |     |
|                                             | Teachers                                                                              |                                                          | dr Milena Matusik                       |                                     |                        |            |     |
| Lesson types                                | Lesson type                                                                           | Lecture                                                  | Tutorial                                | Laboratory                          | Project                | Seminar    | SUM |
|                                             | Number of study hours                                                                 | 0.0                                                      | 0.0                                     | 0.0                                 | 0.0                    | 30.0       | 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                                 |                        | 90.0       | 125 |
| Subject objectives                          | The aim is to prepare students to write a master's thesis.                            |                                                          |                                         |                                     |                        |            |     |

| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                               | Subject outcome                                                                                                            | Method of verification                                  |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
|                                 | [MATMU2_W07] knows and understands the basic legal and ethical conditions related to scientific and teaching activities                                                                                                                                                                      | The student acquires knowledge about copyright and intellectual property.                                                  | [SW1] oral statement/conversation/discussion            |
|                                 | [MATMU2_K06] is ready to formulate opinions on basic mathematical issues                                                                                                                                                                                                                     | The student can formulate opinions on mathematical issues.                                                                 | [SK1] oral statement/conversation/discussion            |
|                                 | [MATMU2_K02] is ready to precisely formulate questions to deepen his/her understanding of a given topic or find missing elements of reasoning                                                                                                                                                | The student can precisely formulate questions to deepen understanding of a given topic.                                    | [SK1] oral statement/conversation/discussion            |
|                                 | [MATMU2_U02] can express mathematical content in speech and writing, in mathematical texts of various nature                                                                                                                                                                                 | The student can express mathematical content orally and in writing in mathematical texts.                                  | [SU2] presentation/project/paper/report                 |
|                                 | [MATMU2_U07] is able to define his/her interests and develop them; in particular, is able to establish contact with specialists in his/her field, e.g. understand their lectures intended for young mathematicians                                                                           | The student can identify his or her interests in mathematical discussions.                                                 | [SU1] oral statement/conversation/discussion            |
|                                 | [MATMU2_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; ethical conduct                                                                                                                                           | The student understands and appreciates the importance of intellectual honesty.                                            | [SK8] observation of student's independent or team work |
|                                 | [MATMU2_U04] is able, at an advanced level and including modern mathematics, to apply and present, orally and in writing, methods of at least one selected branch of mathematics                                                                                                             | The student can apply and present methods of a selected branch of mathematics at an advanced level.                        | [SU2] presentation/project/paper/report                 |
|                                 | [MATMU2_K05] is ready to independently search for information in literature, also in foreign languages                                                                                                                                                                                       | The student can independently search for information in professional literature.                                           | [SK2] presentation/project/paper/report                 |
|                                 | [MATMU2_U05] can perform proofs in a selected field and, if necessary, also use tools from other areas of mathematics                                                                                                                                                                        | The student can apply the methods of a selected field of mathematics in argumentation and proof.                           | [SU2] presentation/project/paper/report                 |
|                                 | [MATMU2_W03] knows and understands in-depth a selected field of theoretical or applied mathematics and is able to understand the formulations of issues in this field that are still at the research stage and knows the connections of issues in this field with other areas of mathematics | The student has in-depth theoretical knowledge of results and arguments in a chosen field of mathematics.                  | [SW2] presentation/project/paper/report                 |
|                                 | [MATMU2_K01] is willing to acknowledge the limitations of his or her own knowledge and is willing to pursue further education                                                                                                                                                                | The student knows the limitations of his or her own knowledge and demonstrates readiness for further education.            | [SK8] observation of student's independent or team work |
|                                 | [MATMU2_U03] can understand mathematical texts of various types from selected fields of mathematics                                                                                                                                                                                          | The student acquires the ability to understand mathematical texts in a selected field of mathematics at an advanced level. | [SU2] presentation/project/paper/report                 |
|                                 | [MATMU2_U09] can prepare oral presentations in-depth in Polish and at least one foreign language, in a selected field of mathematics                                                                                                                                                         | The student can prepare a paper and present it on a given topic.                                                           | [SU2] presentation/project/paper/report                 |
|                                 | [MATMU2_U08] is able to prepare in-depth written works in Polish and at least one foreign language in a selected field of mathematics                                                                                                                                                        | The student can prepare a written presentation on a given topic                                                            | [SU2] presentation/project/paper/report                 |
| Subject contents                | <ul style="list-style-type: none"> <li>Wave equations and differential diagrams.</li> <li>Differential equations in modeling biological phenomena.</li> <li>Numerical approximations of diffusion equations.</li> </ul>                                                                      |                                                                                                                            |                                                         |
| Prerequisites and co-requisites |                                                                                                                                                                                                                                                                                              |                                                                                                                            |                                                         |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                     | Passing threshold                                                                                                          | Percentage of the final grade                           |
|                                 | Presentation                                                                                                                                                                                                                                                                                 | 51.0%                                                                                                                      | 80.0%                                                   |
|                                 | Activity in the discussion                                                                                                                                                                                                                                                                   | 51.0%                                                                                                                      | 20.0%                                                   |

|                                                                |                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Recommended reading                                            | Basic literature         | <ul style="list-style-type: none"> <li>• L. C. Evans, Równania różniczkowe cząstkowe, PWN 2002.</li> <li>• J. A. Trangenstein, Numerical Solution of Hyperbolic Partial Differential Equations. Cambridge, 2009.</li> <li>• M. Schatzman, Numerical Analysis. A Mathematical Introduction. Oxford 2011.</li> <li>• A. Fasano, M. Primicerio, Nonlinear Diffusion Problems, CIME, 1985.</li> <li>• E. Platen, N. Bruti-Liberati, Numerical Solution of Stochastic Differential Equations with Jumps in Finance, Springer, 2010.</li> </ul> |
|                                                                | Supplementary literature | <ul style="list-style-type: none"> <li>• K. Atkinson, W. Han "Theoretical Numerical Analysis", 2001, Springer-Verlag, NY..</li> <li>• W. Walter, "Ordinary Differential Equations", 1998, Springer-Verlag, NY.</li> <li>• Kincaid D., Cheney W. "Numerical analysis. Mathematics of scientific computing", 2009, AMS.</li> </ul>                                                                                                                                                                                                          |
|                                                                | eResources addresses     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Example issues/<br>example questions/<br>tasks being completed | n/a                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Work placement                                                 | Not applicable           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

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