



## Subject card

|   |  |  |   |                                     |  |            |     |
|---|--|--|---|-------------------------------------|--|------------|-----|
| Subject name and code                       | Partial differential equations , PG_00025512   |  |   |                                     |  |            |     |
| Field of study                              | Mathematics  |  |   |                                     |  |            |     |
| Date of commencement of studies             | October 2023   |  | Academic year of realisation of subject   |                                     | 2025/2026  |            |     |
| Education level                             | first-cycle studies  |  | Subject group   |                                     | Obligatory subject group in the field of study<br>Subject group related to scientific research in the field of study         |            |     |
| Mode of study                               | Full-time studies  |  | Mode of delivery  |                                     | at the university  |            |     |
| Year of study                               | 3  |  | Language of instruction   |                                     | Polish   |            |     |
| Semester of study                           | 6  |  | ECTS credits  |                                     | 5.0  |            |     |
| Learning profile                            | general academic profile   |  | Assessment form   |                                     | assessment   |            |     |
| Conducting unit                             | Department of Differential Equations and Mathematical Applications -> Faculty of Applied Physics and Mathematics |  |   |                                     |  |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor   |  | dr Agnieszka Bartłomiejczyk   |                                     |  |            |     |
|   | Teachers   |  |   |                                     |  |            |     |
| Lesson types and methods of instruction     | Lesson type  | Lecture  | Tutorial  | Laboratory                          | Project  | Seminar    | SUM |
|   | Number of study hours  | 30.0   | 30.0  | 0.0                                 | 0.0  | 0.0        | 60  |
|   | E-learning hours included: 0.0   |  |   |                                     |  |            |     |
|   | Adresy na platformie eNauczanie:   |  |   |                                     |  |            |     |
| 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  | 60   |   | 5.0                                 |  | 60.0       | 125 |
| Subject objectives                          | Acquiring basic knowledge of the theory of partial differential equations and their applications.                |  |   |                                     |  |            |     |
| Learning outcomes                           | Course outcome   |  | Subject outcome   |                                     | Method of verification   |            |     |
|   | K6_U07   |  | Student uses selected algorithms for solving differential equations.  |                                     | [SU4] Assessment of ability to use methods and tools   |            |     |
|   | K6_W03   |  | Student understands the construction of mathematical theories, mathematical formalism can be used to construct and analyze simple mathematical models in other sciences |                                     | [SW2] Assessment of knowledge contained in presentation  |            |     |
|   | K6_U06   |  | Student knows how to use theorems and methods of calculus of functions of one and several variables   |                                     | [SU4] Assessment of ability to use methods and tools   |            |     |
|   | K6_U09   |  | Student uses ordinary equations to solve partial differential equations   |                                     | [SU4] Assessment of ability to use methods and tools<br>[SU3] Assessment of ability to use knowledge gained from the subject |            |     |
|   | K6_W01   |  | The student has knowledge of the theory of partial differential equations.  |                                     | [SW1] Assessment of factual knowledge  |            |     |

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|--|---|---|-------------------------------|
| Subject contents   | 1. Brief history of Partial Differential Equations.<br>2. First integrals' method of solving non-linear systems of ODEs.<br>3. Basic definitions and examples of problems that lead to PDEs.<br>4. PDEs of the first order. Method of characteristics.<br>5. Classification and canonical forms of second order equations in two independent variables.<br>6. Hyperbolic equations. Free and forced vibrations of an infinite string. The Fourier method for free vibrations of the finite string. The Sturm-Liouville boundary value problem.<br>7. Parabolic equations on the example of the thermal conductivity equation. Construction of solutions using the Fourier method of separation of variables.<br>8. Elliptic equations: harmonic functions and their properties; Laplace`s equation. The Dirichlet boundary problem.<br>9. The Cauchy problem in the class of analytical functions |   |                               |
| Prerequisites and co-requisites                                | The knowledge of Mathematical Analysis and Ordinary Differential Equations  |   |                               |
| Assessment methods and criteria                                | Subject passing criteria  | Passing threshold   | Percentage of the final grade |
|  | tests   | 50.0%   | 100.0%                        |
| Recommended reading  | Basic literature  | 1. L.C. Evans Równania różniczkowe cząstkowe, PWN 2002.<br>2. Z. Kamont Równania różniczkowe cząstkowe pierwszego rzędu, GTN 2003.<br>3. H. Marcinkowska Wstęp do teorii równań różniczkowych cząstkowych, PWN 1972.<br>4. P. Strzelecki Krótkie wprowadzenie do równań różniczkowych cząstkowych, Wydawnictwo Uniwersytetu Warszawskiego, 2006.<br>5. W. Żakowski, W. Leksiński Matematyka", tom IV, PWN 1984. |                               |
|  | Supplementary literature  | 1. D. Bobrowski, J. Mikołajski, J. Morchało, Równania różniczkowe cząstkowe w zastosowaniach, Wydawnictwo Politechniki Poznańskiej, Poznań, 1995.<br>2. J. Niedoba, W. Niedoba Równania różniczkowe zwyczajne i cząstkowe, AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, 2001.<br>3. M.M. Smirnow, Zadania z równań różniczkowych cząstkowych, PWN, Warszawa, 1970.   |                               |
|  | eResources addresses  |   |                               |
| Example issues/<br>example questions/<br>tasks being completed | The definition of a harmonic function<br>Solve PDEs by separation of variables<br>Formulate the initial problem for infinite string   |   |                               |
| Work placement   | Not applicable  |   |                               |