|  |  |
| --- | --- |
| **Course code** | CC8 |
| **Type and description** |  |
| **ECTS credit** | 1 |
| **Course name** | **Mathematical Methods in life sciences and engineering 2** |
| **Course name in Polish** | **Metody matematyczne w naukach przyrodniczych i technicznych 2** |
| **Language of instruction** | English |
| **Course level** | 8 PRK |
| **Course coordinator** | **Jacek Banasiak** |
| **Course instructors** | **Katarzyna Szymańska-Dębowska** |
| **Delivery methods and course duration** | |  | **Lecture** | **Tutorials** | **Laboratory** | **Project** | **Seminar** | **Other** | **Total of teaching hours during semester** | | --- | --- | --- | --- | --- | --- | --- | --- | | Contact hours | 10 | 5 | 0 | 0 | 0 | 0 | 15 | | E-learning | No | No | No | No | No | No |  | | Assessment criteria (weightage) | 0,00 |  |  |  |  | 0,00 |  | |
| **Course objective** | Objective of the course:  1. Acquiring knowledge in the field of basic concepts related to PDEs systems with free boundary;  2. Acquiring knowledge in the field of proving theorems and investigating the properties of radially symmetric solutions of PDEs systems with free boundary;  3. Gaining knowledge in the field of application of PDEs with free boundary. |
| **Learning outcomes** | A PhD student after completing the course can:  1. Examine the basic properties of solutions of selected of PDEs systems with free boundary, examine the properties of the radius of the free boundary - effects W1, W2, U1, U2  2. Examine the basic properties of radially symmetric solutions of selected of PDEs systems with free boundary, examine the properties of the of the radius of the free boundary - effects W1, W2, U1  3. Apply the acquired knowledge to the analysis of specific mathematical models: effects W1, U1, U2, K1-K3 |
| **Assessment methods** | The final mark consists of :  Oral exam mark - 80%  Seminar presentation - 20% |
| **Prerequisites** | Basic theory of ordinary and partial differential equations and dynamical systems. |
| **Course content with delivery methods** | The content of the course divided into the delivery methods:  LECTURES  1. Problems on a set with a free boundary, with flux and no flux.  2. Study of the properties of solutions to boundary problems and the behaviour of the boundary using known theorems from partial equations, for example the maximum principle.  3. Considering the problem in radially symmetrical case.  4. Study of the properties of radially symmetrical solutions of boundary problems and the behaviour of the radius of the boundary.  5. Search for stationary solutions using the shooting method.  PROJEKT   1. Prezentacja analizy konkretnego modelu.   PROJECT  1 Presentation of the analysis of a particular model.  2. Discussing the mathematical methods presented in the presentation. |
| **Basic reference materials** | 1. A. Friedman, Mathematical biology. Modeling and analysis. CBMS Regional Conference Series in Mathematics, 127. Published for the Conference Board of the Mathematical Sciences, Washington, DC; by the American Mathematical Society, Providence, RI, 2018.  2. A. Friedman, K.Y. Lam, On the stability of steady states in a granuloma model. J. Differential Equations 256 (2014), no. 11, 3743–3769.  3. A. Friedman, Free boundary problems arising in biology. Discrete Contin. Dyn. Syst. Ser. B 23 (2018), no. 1, 193–202. |
| **Other reference materials** |  |
| **Average student workload outside classroom** | 10 h |
| **Comments** |  |
| **Last update** |  |