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| **Course code** | CC7 |
| **Type and description** |  |
| **ECTS credit** | 1 |
| **Course name** | **Mathematical Methods in life sciences and engineering 1** |
| **Course name in Polish** | **Metody matematyczne w naukach przyrodniczych i technicznych 1** |
| **Language of instruction** | English |
| **Course level** | 8 PRK |
| **Course coordinator** | **Katarzyna Szymańska-Dębowska** |
| **Course instructors** | **J. Banasiak** |
| **Delivery methods and course duration** | |  | **Lecture** | **Tutorials** | **Laboratory** | **Project** | **Seminar** | **Other** | **Total of teaching hours during semester** | | --- | --- | --- | --- | --- | --- | --- | --- | | Contact hours | 10 | 0 | 0 | 0 | 5 | 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 on formulating models in technical and other applied sciences and identifying them within appropriate mathematical structures.  2. Acquiring knowledge in the field of functional analysis methods, partial differential equations and infinite dynamic systems used for model analysis.  3. Acquiring knowledge in the field of asymptotic methods used in multi-scale models.  4. Acquiring the ability to interpret the results of mathematical analysis of models in the context of selected applied sciences. |
| **Learning outcomes** | A PhD student after completing the course can:  1. Build and modify models based on their verbal description and available experimental data - effects W1-W2, U2, K1, K3  2. Identify models within appropriate mathematical structures - effects W1, W2, U1, K1-K3  3. Analyze models in a qualitative and quantitative way and interpret mathematical results in the language of the field from which the models come - effects of 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, basic course in functional analysis |
| **Course content with delivery methods** | The content of the course divided into the delivery methods:  LECTURES  1. Formulating models in technical sciences. Basic mathematical questions posed in these fields.  2. Advanced methods of partial differential equations - problems with free boundaries, variational inequalities.  3. Non-local issues and differential-integral equations in applications to polymerization / depolymerization models and related issues.  4. Methods of asymptotic analysis and state aggregation.  5. Running waves and their applications.  PROJECT  1. Qualitative analysis of selected models using the methods discussed in the lecture. |
| **Basic reference materials** | 1. A. Friedman, W. Littman, Industrial Mathematics: A Course in Solving Real-World Problems, SIAM, 1987  2. J. Ockendon, S. Howison, A. Lacey, A. Movchan, Applied partial differential equations, Oxford, 2003  3. A. C. Fowler, Mathematical Models in the Applied Sciences, Cambridge, 1997  4. J. D. Logan, An introduction to nonlinear partial differential equations. Wiley-Interscience, 2008  5. J. Banasiak, W. Lamb, P. Laurençot, Analytic Methods for Coagulation-Fragmentation Models, CRC Press, 2019 |
| **Other reference materials** | 1. J. Smoller, Shock waves and reaction-diffusion equations, Springer, 1994. 2. D. Kinderlehrer, G. Stampacchia, An introduction to variational inequalities and their applications. Academic Press, 1980. 3. C.V. Pao, C. V. Nonlinear parabolic and elliptic equations. Plenum Press, 1992. |
| **Average student workload outside classroom** | 10 h |
| **Comments** |  |
| **Last update** |  |