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| **Course code** | CC1 |
| **Type and description** |  |
| **ECTS credit** | 1 |
| **Course name** | **Modern Mathematical Analysis 1** |
| **Course name in Polish** | **Nowoczesna Analiza Matematyczna 1** |
| **Language of instruction** | English |
| **Course level** | 8 PRK |
| **Course coordinator** | **Wojciech Kryszewski** |
| **Course instructors** | **Marek Balcerzak, Wojciech Kryszewski** |
| **Delivery methods and course duration** | |  | **Lecture** | **Tutorials** | **Laboratory** | **Project** | **Seminar** | **Other** | **Total of teaching hours during semester** | | --- | --- | --- | --- | --- | --- | --- | --- | | Contact hours | 12 | 0 | 0 |  | 3 | 0 | 15 | | E-learning | No | No | No | No | No | No |  | | Assessment criteria (weightage) | 0,00 |  |  |  |  | 0,00 |  | |
| **Course objective** | 1. Acquisition of knowledge concerning modern methods of mathematical analysis; abstract measure theory and the theory of differentiation in Banach spaces.  2. Acquisition of knowledge on the rudiments of the Fourier analysis: convergence of Fourier series and Fourier transform. |
| **Learning outcomes** | After the course a PhD student we be able to:  1. understand and apply notions, theorems and methods of abstract measure theory and the differential calculus in Banach spaces: effects W1, U2, K3;  2. understand and study problems in function spaces with the use of the Fourier analysis methods – effects W2, U1, K1-K3  3. apply the acquired knowledge in order to study various problems in concrete mathematical problems: effects U1, K1-K3 |
| **Assessment methods** | Effects W1, U2, W2 – oral examination  effects U1, K1-K3…. – presentation  The final evaluation is based on:  Exam - 80%  Presentation - 20% |
| **Prerequisites** | The contents of the master degree course on the differential and integral calculus |
| **Course content with delivery methods** | Lecture  1. Abstract measure theory: construction of measure, Borel measure, Haar and Hausdorff measures; product measures; the general Fubini theorem.  2. Measurable functions and mappings, measurability and strong measurability of vector-valued functions; abstract theory of integration.  3. Differentiability of mappings between Banach spaces; the Lusternik Theorem on submanifolds; elements of the calculus of variations. The Radon-Nikodym theorem. The Rademacher theorem.  Presentation  Compactness in function spaces: Ascoli-Arzela, Riesz-Kolmogorov or Kondraschov theorems |
| **Basic reference materials** | 1. W. Ziemer, Modern Real Analysis, Springer GTM 278, 2017.  2. E. Lieb, M. Loss, Analysis, Graduate Studies in Mathematics 134, AMS, 2002  3. W. Rudin, Analiza rzeczywista i zespolona, PWN 1987 |
| **Other reference materials** |  |
| **Average student workload outside classroom** | 10 h |
| **Comments** |  |
| **Last update** |  |