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| **Institute of Applied Mathematics**  | Semester 1. of the curriculum 2023-24-1  |
| Name of the subject:  | Code of the subject:  | Credits:  | Weekly hours:  |
|   | lec  | sem  | lab  |
| **Analysis**  | NMXAN1EMNF  | 4  | full-time  | 2  | 1  | 0  |
| Responsible person for the subject: Dr. VAJDA István  | Classification: senior lecturer  |
| Subject lecturer(s):   |
| Prerequisites:  |   |   |
| Way of the assessment:  | mid-term grade  |   |   |
| **Course description**  |
| Goal:  | Our goal is to introduce the fundamental concepts of functional analysis and Lebesgue integration. These concepts are crucial in the modern study of probability theory, (partial) differential equations, and quantum theory, for instance.   |
| Course description:  | The problem of the measure. Lebesgue integral, convergence theorems. Lebesgue and Riemann integrals. Study of Hilbert spaces with orthogonal systems, duality.  |
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| **Lecture schedule**  |
| Education week  | Topic  |
| 1.  | Introduction to measure theory  |
| 2.  | Exterior measure and Lebesgue measure of Rdℝd  |
| 3.  | Measurable functions and their properties  |
| 4.  | Lebesgue integral   |
| 5.  | Convergence theorems: Fatou lemma, Monotone convergence theorem and Lebesgue’s dominated theorem   |
| 6.  | 1st midterm exam  |
| 7.  | General measures and the Lebesgue Lp-spaces  |
| 8.  | Differentiation: absolute continuous functions  |
| 9.  | Functions of bounded variations  |
| 10.  | Introduction to Hilbert spaces, normed spaces  |
| 11.  | Geometry of Hilbert spaces, inner product spaces  |
| 12.  | Duality, orthogonal basis of L2 spaces, integral operators, kernels  |
| 13.  | 2nd midterm exam  |
| 14.  | Resit exam  |
| **Mid-term requirements**  |
| Conditions for obtaining a mid-term grade/signature  | One needs to accomplish at least 50% of the weekly home assignments. There will be two written midterms.  |
| **Assessment schedule**  |
| **Education week**  | Topic  |
| **6.**  | Material of the first 5 education weeks  |
| **13.**  | Material covered after the first midterm  |
| **14.**  | One of the above  |
| **Method used to calculate the *mid-term grade*** (to be filled out only for subjects with mid-term grades)  |
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| Achieved result  | Grade  |
| 89%-100%  | excellent (5)  |
| 76%-88<%  | good (4)  |
| 63%-75<%  | satisfactory (3)  |
| 51%-62<%  | pass (2)  |
| 0%-50<%  | fail (1)  |

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| **Type of the replacement**  |
| Type of the replacement of written test/mid-term grade/signature  | At the last week of the semester one can have a resit exam. In the first ten days of the examination period, there is a midterm grade retake exam.  |
| **Type of the exam** (to be filled out only for subjects with exams)  |
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| **Calculation of the exam mark** (to be filled only for subjects with exams)  |
|   |
| **​​Final grade calculation methods:​**  |
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| **References**  |
| Obligatory:  | E. Stein: Real Analysis  |
| Recommended:  | Rynne and Youngson: Linear Functional Analysis  |
| Other references:  |   |