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| 1. Course title: Analysis 1 lecture | | | | | |
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| 2. Code: | | 3. Type (lecture, practice etc.): lecture | | | |
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| 4. Contact hours: 3 hoursper week | | 5. Number of credits (ECTS): 3 | | | |
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| 6. Preliminary conditions (max. 3): | | | | | |
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| 7. Announced:fall semester, spring semester, both | | | | | |
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| 8. Limit for participants: 40 | | | | | |
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| 10. Responsible teacher (faculty, institute and department):  Margit Pap PhD (Faculty of Science, Institute of Mathematics and Informatics, Department of Mathematics) | | | | | |
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| 11. Teacher(s) and percentage: | | Dr. Margit Pap | | 100 % | |
| Dr. Tímea Eisner | | 100 % | |
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| 12. Language:English | | | | | |
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| 13. Course objectives and/or learning outcomes:  **Objectives**: The lecture intends to introduce students to the basic notions of Mathematical Analysis 1: concepts of real numbers, convergence, limits of sequences and sum of series. The course helps the development of problem solving skills.  Learning outcomes: students completing the course will have *knowledge* on basic concepts and theorems of Mathematical Analysis. They will be *able* to apply the properties of these concepts. They will have a *competence* of evaluating readings in Analysis 1. Their positive *attitude* towards methods calculating limits will increase significantly. | | | | | |
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| 14. Course outline   1. **Real numbers:** constructive definition. Decimal fractions. Axioms of real numbers: field axioms, order axioms. Natural numbers, method of mathematical induction.Archimedean axiom.Partitioning axiom. Finite sets, countable sets. Countability of the set of rational numbers. 2. Cantor axioms. Bernoulli inequality. The absolute value. Intervals. Each interval contains a rational number. 3. Boundary of real sets. Upper and lower bounds and limits of sets. Powers. Highlighted inequalities: the inequality of arithmetic and geometric means, the inequalities of Cauchy- Buniakovski-Minkowski. 4. **Sequences**. Subsequences. Monotone sequences. Each sequence has a monotone subsequence. Bounded sequences**.** 5. Convergent sequences. Convergence, uniqueness theorem. Divergence, classification of divergent sequences. Three consequences of convergence. 6. Highlighted sequences: constant sequence, harmonic sequence, geometrical sequence, ; ; ;; ; the number *e*. Properties of operations with zero sequences.  1. Properties of operations with sequences. (Convergent sequences, divergent sequences) The theorem of the monotony of the limit. Sandwich theorem/squeeze theorem. The convergence of the absolute value of sequences. 2. Limits of monotone sequences, theorem of Bolzano-Weierstrass. Existence theorem of *n*-th root of a positive number. 3. Cauchy sequences. Upper and lower limit of sequences. Cesaro-Stolz theorem and its corollary. 4. **Infinite series.** Definition of series and their convergence. Absolute and conditional convergence. Cauchy’s test for convergence of series. 3 corollaries of the convergence test. Harmonic series, geometric series. Series of positive terms. Test of comparison. 5. Leibniz series. Approximation for the rate of convergence. Examples for conditionally convergent series. Operations with series 1. Convergence criterions/tests: Cauchy’s root test, D’Alambert’s fraction test. 6. Condensation principle of Cauchy. Operations with series 2: reordering of series. The theorem on reordering of absolute convergent series. Cauchy product of series. 7. Some highlighted **functions**. (Sign, absolute value, floor function/integer part function, fractional part function) Definition of Polynomials, notations. Binomial theorem. Operations of polynomials. Rational functions. Partial fraction decomposition. Power series. Cauchy-Hadamard theorem and corollaries. The notion of sum function. Operations. Transformation to a power series of other center of convergence. | | | | | |
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| 15. Mid-semester works  Attending lectures is compulsory. | | | | | |
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| 16. Course requirements and grading  Written exam is based on lectures, accessible electronic sources and lecture materials.  There is a written preliminary exam. Preliminary exam grades:  0–55% fail  56–70% acceptable  71–80% average  81–90% good  91–100% excellent  After successful preliminary exam there is an oral exam in 3 topics. The final grade is obtained from the arithmetic mean of the 4 grades, but only in case when all parts hit the acceptable measure. | | | | | |
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| 17. List of readings  Rudin, Walter. Principles of mathematical analysis. Vol. 3. New York: McGraw-Hill, 1964.  Stewart, James. Calculus: early transcendentals. Cengage Learning, 2015.  Stroyan, K. D. "A brief introduction to infinitesimal calculus." University of Iowa (2004).  Lang, Serge. Undergraduate analysis. Springer Science & Business Media, 2013. | | | | | |
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| 18. Recommended texts, further readings  Joel R. Hass, Christopher D. Heil, Maurice D. Weir. Thomas' Calculus, 14th Edition | | | | | |
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| **Date** | 14 May, 2017 | **Prepared by** |  | | |
| **Dr. Margit PAP** responsible teacher | | |
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| **Endorsed by** | | |  | | |
| Dr. László TÓTH program supervisor | | |