GHENT UNIVERSITY

Course Specifications

From the academic year 2016-2017 up to and including the

Analysis I (C003574)

Course size (nominal values; actual values may depend on programme)

Credits	6.0	Study time	180 h
Contact hrs	67.5 h		

Course offerings and teaching methods in academic year 2018-2019

A (semester 1)	Dutch	seminar: coached exercises	22.5 h
		lecture	45.0 h

Lecturers in academic year 2018-2019

Vindas Diaz, Jasson	WE16	lecturer-in-charge

Offered in the following programmes in 2018-2019	crdts	offering
Bachelor of Arts in Philosophy	6	A
Bachelor of Science in Physics and Astronomy	6	A
Bachelor of Science in Mathematics	6	A

Teaching languages

Dutch

Keywords

Functions of a real variable, differential calculus, integral calculus, linear differential equations

Position of the course

This course contributes to the goals of the bachelor study program by offering a well-founded and at the same time widely applicable introduction to functions of one real variable. It consists entirely of ‘broad basic knowledge’, and it supplies knowledge and skills that are useful and often indispensable in many other domains. Students get gradually familiarized with the typical methods and the reasoning for mathematical analysis. Exhaustive completeness has not been aimed at. Every single subject has been selected on the basis of its usefulness, and all treated results come with proofs. The content of the proofs is mathematical rigorous, but often rephrase into informal words. The theory is intrinsically linked to exercises aiming also at self-activity.

Contents

Rational, real and complex number fields. Real sequences, Bolzano-Weierstrass theorem. Limits of functions. Continuity, Bolzano, Weierstrass and Heine theorems. Differentiability. Mean value theorem. Monotonicity. l’ Hospital’s rule. C1 functions. Higher order derivatives. Lower integral, upper integral, (Riemann) integral. Darboux criterion. Fundamental Theorems of Calculus I and II. Integration by parts, change of variables. Taylor formula with an integral as remainder. Primitives. Exponential function, power functions, hyperbolic functions; logarithmic and inverse hyperbolic functions. Sine, cosine, tangent and their inverses. Practical integration techniques. Complex series, Cauchy, d’Alembert and Raabe convergence rules. Cauchy’s integral test. Leibniz’ rule for alternating series. Uniform convergence of sequences and series, Weierstrass M-test. Complex power series. Convergence disc, termwise differentiation and integration, Abel’s limit theorem. Taylor series. Binomial series. Dirichlet’s singular integral. Fourier series of piecewise differentiable functions. First order linear differential equations. Second order linear differential equations with variable coefficients, existence theorem, reduction of order, variation of parameters. Second order linear differential equations with constant coefficients, method of undetermined coefficients.

Initial competences

Final objectives of secondary education.

Final competences

The student should be able to assess an elementary (theoretical or practical) problem of real analysis in one variable, e.g. originating from physics, to reason about its solution, and to find a solution via the learned methods.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, seminar: coached exercises

Extra information on the teaching methods

Theory: oral presentation supplemented with didactical applets.

Learning materials and price

Syllabus “Analysis I” (approximate price €10.00), annually revised.

References

Apostol, T. M. Calculus I. One-variable calculus, with an introduction to linear algebra. 2nd ed. New York (N.Y.): Blaisdell, 1967.
Apostol, Tom M. Mathematical Analysis. 2nd ed. Reading (Mass.): Addison-Wesley, 1974.
Rudin, W., Principles of mathematical analysis. McGraw-Hill, 1976.
Spivak, M., Calculus. London: Benjamin, 1973.

Course content-related study coaching

Besides regular support by the appointed lecturers, consultation hours and permanent availability before and after classes.

Evaluation methods

end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

Written evaluation in two parts, theory and exercises. In the theory part, knowledge and skills acquired will be tested, as well as the ability to interconnect different subjects. In the exercise part, the acquired skills will have to be applied. In view of the basic character of this course, emphasis will be on routine exercises.

Calculation of the examination mark

Periodic evaluation 100%.