GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Analysis II (C003575)

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

Credits 8.0 **Study time 200 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 2)	Dutch	Gent	seminar
			lecture

Lecturers in academic year 2024-2025

Vernaeve, Hans	WE16	lecturer-in-charge

Offered in the following programmes in 2024-2025	**crdts**	**offering**
Bachelor of Arts in Moral Sciences	8	A
Bachelor of Arts in Philosophy	8	A
Bachelor of Science in Mathematics	8	A

Teaching languages

Dutch

Keywords

Functions of several real variables, differential calculus, integral calculus, differential equations, Fourier series.

Position of the course

This course contributes to the objectives of the bachelor study program by offering a well-founded and at the same time widely applicable introduction to functions of two or three real variables and differential equations and Fourier series. It consists of "broad basic knowledge", and it supplies knowledge and skills that are useful and often indispensable in many domains. Students get gradually familiarized with the methods and the typical reasoning for mathematical analysis with several real variables. Completeness or depth has not always been aimed at and geometric considerations are applied on intuitive grounds, sometimes tacitly. To some extent, the course "Differential Geometry" may be complementary. The theory is inextricably linked to exercises aiming at self-activation.

Contents

Part 1:
Functions of several real variables: norm and distance on R^n, sequences, limits, continuity.
Differentiability, partial and directional derivatives, higher order partial derivatives, generalisation to vector valued functions, the Jacobian matrix, chain rule, mean value theorem, Taylor expansion.
Gradient, divergence, curl and Laplacian: definition and meaning, expressions in cylindrical and spherical coordinates.
Inverse function theorem, implicit function theorem.
Smooth curves, parametrisations, line integrals of scalar and vector fields, conservative vector fields.
Riemann integrals of functions of two and of three variables, transformations of coordinates, polar coordinates, cylindrical coordinates, spherical coordinates, Green's theorem.
Smooth surfaces, surface integrals of scalar and vector fields, Stokes' theorem and divergence theorem of Gauss.
Maxima and minima of a function: extrema, saddle points, the Hessian matrix and the method of Lagrange multipliers.

Part 2:
Linear differential equations.
Fourier series.
The Riemann–Stieltjes integral.
Differential equations: autonomous and non-autonomous equations, existence and unicity of solutions (Picard theorem), systems of linear differential equations, qualitative theory of differential equations: slope fields, phase portraits and classification of equilibria of linear planar systems.

Initial competences

A working knowledge of analysis of functions of one real variable is assumed.

Final competences

1 The student understands how a number of concepts in analysis that are used in physics (such as a number of standard vector fields, integrals defined on, possibly curved, higher dimensional surfaces, ...) can be mathematically defined, and understands that the abstract definition coincides with geometric intuition.
2 The student understands in detail the proofs used to construct the theory of real analysis in several variables.
3 The student can solve an elementary problem from real analysis in several variables or from vector calculus, e.g. originating from physics, by a thoughtful application of the acquired 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

Seminar, Lecture

Extra information on the teaching methods

Theory: oral presentation supplemented with slides.
Excercises: seminar; group work.

Study material

Type: Syllabus

Name: Analysis II - Differential equations and supplements to real analysis
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Number of Pages : 65
Oldest Usable Edition : 2023-2024
Available on Ufora : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : No
Additional information: PDF file, free to be used and printed

Type: Syllabus

Name: Vector analysis
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Number of Pages : 115
Oldest Usable Edition : 2024-2025
Available on Ufora : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : No
Additional information: PDF file, free to be used and printed

References

Apostol, Tom M. Calculus. 2. *Multivariable Calculus and Linear Algebra, with Applications to Differential Equations and Probability.* 2nd ed. New York (N.Y.): John

Wiley, 1969.
Apostol, Tom M. Mathematical Analysis. 2nd ed. Reading (Mass.): Addison-Wesley, 1974.

Course content-related study coaching

The lecturers and assistants are available before and after classes. If this is insufficient, also a more elaborate individual question session is possible (after appointment by mail).

Assessment moments

end-of-term assessment

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

Written assessment with open-ended questions

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

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

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 relate different parts of the theory. 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%