GHENT UNIVERSITY

# Course Specifications

Valid as from the academic year 2018-2019

## Mathematical Analysis II: Functions of Several Variables (E001221)

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

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|---|---|---|---|---|---|
| Credits | 4.0 | Study time | 120 h | Contact hrs | 70.0 h |

Course offerings and teaching methods in academic year 2018-2019

| | | | |
|---|---|---|---|
| A (semester 2) | Dutch | seminar: practical PC room classes | 12.5 h |
| | | lecture: plenary exercises | 7.5 h |
| | | lecture | 20.0 h |
| | | guided self-study | 30.0 h |

Lecturers in academic year 2018-2019

| | | |
|---|---|---|
| De Schepper, Hennie | TW16 | lecturer-in-charge |

| Offered in the following programmes in 2018-2019 | crdts | offering |
|---|---|---|
| Bachelor of Science in Civil Engineering | 4 | A |
| Bachelor of Science in Computer Science Engineering | 4 | A |
| Bachelor of Science in Chemical Engineering and Materials Science | 4 | A |
| Bachelor of Science in Electrical Engineering | 4 | A |
| Joint Section Bachelors of Science in Engineering | 4 | A |
| Bachelor of Science in Engineering Physics | 4 | A |
| Bachelor of Science in Electromechanical Engineering | 4 | A |
| Preparatory Course Master of Science in Biomedical Engineering | 4 | A |

### Teaching languages

Dutch

### Keywords

Differentiability, multiple integral, extrema

### Position of the course

It is the aim of the course to provide insight in the basic concepts of the theory of functions of several real variables and the application of the corresponding analysis techniques. Moreover the students acquire skills in using these techniques and applying them, as well as in the analytic and mathematical modelling of basic problems from basic sciences.

### Contents

- Differentiability: Partial derivatives, (continuously) differentiable function, The chain rule, Taylor's formula, differential
- Integration in higher dimension: Definition and way of computation, Effect of a co-ordinate transform, Problems giving rise to mathematical models with multiple integrals
- Extrema: Local and absolute extrema, Conditional extrema

### Initial competences

Mathematical Analysis I: Functions of One Variable

### Final competences

1 Having acquired insight in the mathematical, geometric and physical interpretation of the notions continuity, partial derivative, differentiability, gradient, multiple integral, Jacobian and co-ordinate transform.
2 Being able to perform the chain rules for differentiable functions.

3 Having acquired insight in local, absolute and conditional extremum problems, and being able to solve such problems.
4 Being able to carry out co-ordinate transforms in multiple integrals in two and three dimensions, including improper integrals.
5 Being able to compute (improper) integrals in two and three dimensions by subsequent integration.

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

Guided self-study, lecture, lecture: plenary exercises, seminar: practical PC room classes

Extra information on the teaching methods

During the lectures the main concepts and properties are introduced. During exercises classes basis methods for problem solving are trained.
Working classes aim at enhancing insight by tackling more theoretically oriented exercises.

Learning materials and price

Lecture notes in Dutch; additional course material electronically (Minerva) available.

References

- M R Spiegel, Theory and problems of advanced calculus, Schaum's outline series, Mac Graw-Hill, New York
- C K Cheung, T Murdoch and G E Keough, Exploring multivariable calculus with Maple, John Wiley & Sons, New York

Course content-related study coaching

Personal coaching by the lecturer as scheduled. Additional tutoring services are available.

Evaluation methods

end-of-term evaluation and continuous assessment

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

Written examination

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

Written examination

Examination methods in case of permanent evaluation

Written examination, open book examination

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

- During semester / permanent evaluation: two mandatory written tests with open book (exact dates will be announced at the start of the semester).
- During examination period: written closed-book examination in the PC-room (Maple available). The examination consists of exercises and applied theory.

Calculation of the examination mark

**Continuous assessment:**
The scores on the two tests T1 and T2 (both marked out of 20), form a weighted score of respectively 40% and 60%, thus T' = 0.4 T1 + 0.6 T2

The total result of the permanent evaluation T, is determined as follows:
- if $T' < 10$ then $T = T'$
- if $10 \leq T' < 17$ then $T = T' + 3$
- if $T' \geq 17$ then $T = 20$

**End-of-term evaluation:** written examination (marked out of 20, score E)

**Calculation of the final mark in the first examination period:**
- If $E \geq 8$ then the final mark equals $\max(0.25\ T + 0.75\ E;\ 0.1\ T + 0.9\ E) - 2A$
- If $E < 8$ then the final mark equals $E - 2A$

A sets the number of tests (T1 and T2) for which the student was illegitimately absent

(A = 0, 1 or 2). For each test in which the student did not participate, two points will be deducted from the final mark (2A = 0, -2 or -4).

**Calculation of the final mark in the second examination period (=resit):**

- If $E \geq 8$ then the final mark equals max(0.25 T + 0.75 E; E)
- If $E < 8$ then the final mark equals E