GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2023-2024

Mathematical Modelling in Engineering (C003788)

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

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2023-2024

A (semester 1)	Dutch	Gent	lecture
			seminar

Lecturers in academic year 2023-2024

Van Acoleyen, Karel	WE05	lecturer-in-charge

Offered in the following programmes in 2023-2024	**crdts**	**offering**
Bachelor of Science in Computer Science	6	A

Teaching languages

Dutch

Keywords

Basic mathematical concepts, mathematical models for engineering applications, differential equations, integral transforms, vector calculus

Position of the course

Mathematics and mathematical models play a crucial role in engineering science. They allow for a quantitative approach and form the foundation for technological innovation.
This course has a twofold aim: (1) to train the students in the basic mathematical tools used in engineering; (2) to train students in constructing mathematical models.
As such, we choose to focus on the following important topics:
1. Ordinary and partial differential equations
2. Signal transforms and operations
3. Vector calculus
Geometrical and computational skills will also be further developed.

Contents

1. Analysis in 1 variable: specialisation
- ordinary differential equations
- Taylor and Fourier series
- Fourier and Laplace transform, Z transform

2. Analysis in 2 and more variables:
- limits, continuity, partial derivatives
- multiple integration
- partial differential equations: heat and wave equation

3. Geometry and analysis: vector calculus
- Vectors: scalar and vector product; fields and nabla calculus
- curves and surfaces
- line and surface integrals: theorems of Green, Gauss and Stokes

Initial competences

This course uses the content taught in Calculus, Linear Algebra and Geometry, and Scientific Computing.

Final competences

1 To expand functions in Fourier or Taylor series.
2 To perform integral transforms.

3 To solve standard types of ordinary and partial differential equations.
4 To interpret and evaluate multiple integrals.
5 To gain insight in the mathematical and physical meaning of scalar and vector potential, nabla operator, curl-free and divergence-free fields, conservative and solenoidal fields and their links.
6 To gain insight in the mathematical and physical meaning of line and surface integrals and the theorems of Green, Gauss and Stokes.
7 To evaluate line and surface integrals directly as well as using theoretical results.
8 To model and compute mathematical models for problems in engineering.

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

Because of COVID19, modified forms of work can be rolled out if this proves necessary.

Learning materials and price

Dutch syllabus, approximately 10 euro. Additional material on Ufora.

References

M R Spiegel, Vector calculus, Schaum's outline series, Mac Graw-Hill, New York

Course content-related study coaching

Assessment moments

end-of-term assessment

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

Written assessment open-book

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

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

Only Maple usage is allowed. Only exercises on the exam.

Calculation of the examination mark

written exam: 100%