

## Signals and Systems (E702010)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size (nominal values; actual values may depend on programme)  
Credits 6.0 Study time 180 h Contact hrs 60.0 h

Course offerings in academic year 2020-2021

A (semester 1) Dutch Gent

Lecturers in academic year 2020-2021

Beyens, Jan TW05 lecturer-in-charge  
Tonesi, Cristina TW05 co-lecturer

Offered in the following programmes in 2020-2021

	crdts	offering
Bachelor of Science in Engineering Technology (main subject Chemical Engineering Technology)	6	A
Bachelor of Science in Engineering Technology (main subject Civil Engineering Technology)	6	A
Bachelor of Science in Engineering Technology (main subject Electromechanical Engineering Technology)	6	A
Bachelor of Science in Engineering Technology (main subject Electronics and ICT Engineering Technology)	6	A
Bachelor of Science in Engineering Technology (main subject Information Engineering Technology)	6	A
Linking Course Master of Science in Electrical Engineering Technology (main subject Automation)	6	A
Linking Course Master of Science in Electrical Engineering Technology (main subject Electrical Engineering)	6	A
Linking Course Master of Science in Electronics and ICT Engineering Technology (main subject Electronics Engineering)	6	A
Linking Course Master of Science in Electronics and ICT Engineering Technology (main subject Embedded Systems)	6	A
Linking Course Master of Science in Electronics and ICT Engineering Technology (main subject ICT)	6	A
Linking Course Master of Science in Chemical Engineering Technology	6	A
Linking Course Master of Science in Electromechanical Engineering Technology	6	A
Linking Course Master of Science in Information Engineering Technology	6	A
Preparatory Course Master of Science in Chemical Engineering Technology	6	A

Teaching languages

Dutch

Keywords

Vector calculus, line integrals, series, signals, systems, Laplace transform, Fourier transform, convolution

Position of the course

This course consists of two parts:

- 1) to provide insight in some basic concepts and mathematical tools related to vector calculus, integral transforms and series. The subjects are chosen primarily to answer the needs of a course in engineering.
- 2) to increase the level of abstraction acquired in previous courses (maths, physics, electricity, mechanics, ...). This will be done using simple conceptual mathematic

methods used to describe the interaction between LTI-systems and signals.  
This course is interdisciplinary.

## Contents

### 1) vector analysis and series

Vector analysis: derivative and integration of vector functions; gradient, curl, divergence, laplacian: properties, calculus and applications. Line integrals: definition, computation, applications, Green's theorem and corollaries, conservative vector fields and potentials. Series: notions of convergence, criteria of convergence. Series of functions: general concepts, Taylor series, Fourier series and applications.

### 2) analysis of signals and systems

Classification of signals and systems

Linear time-invariant systems in continuous time: response, convolution, eigenfunctions.

Laplace transform and solving linear differential equations with constant coefficients.

Fourier analysis of signals and systems, sampling

## Initial competences

Maths (complex numbers, limits, differentiation, integration, differential equations, functions, linear algebra, vector calculus), Physics, Electricity and Mechanics (dynamics).

## Final competences

- 1 Correlate different scientific and technical disciplines with each other.
- 2 Explain fundamental concepts of vector analysis.
- 3 Compute line integrals.
- 4 Predict the convergence of numerical and function series.
- 5 Construct Taylor-and Fourier series.
- 6 Classify signals and systems and apply basic operations on them.
- 7 Analyse the interaction between signals and systems through convolution.
- 8 Analyse the interaction between signals and systems in a complex frequency domain (Laplace-transform).
- 9 Analyse signals and systems in continuous time through Fourier theory.

## 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: coached exercises, online lecture, online seminar: coached exercises

## Extra information on the teaching methods

Lecture: 36 hrs

Plenary exercises: 24hrs

## Learning materials and price

Syllabus in Dutch (ca. 10 euro)

Handbook Signals and Systems, Schaum's Outline Series (ca. 20 euro)

Slides (Ufora)

## References

Frank Ayres Jr., Differential Equations, Schaum's Outline Series.

Lothar Papula, Wiskunde voor het hoger technisch onderwijs, Academic Service.

Murray R. Spiegel, Schaum's Outline of Laplace Transforms.

Murray R. Spiegel, Advanced Calculus, Schaum's Outline Series.

Linear Systems and Signals, B.P. Lathi, Oxford Press

Signals and Systems, analysis using transform methods and Matlab, M.J. Roberts, Mc Graw-Hill

Signals and Systems (2nd ed), Haykin & Van Veen, John Wiley & Sons

## Course content-related study coaching

The lecturer is available during or in between lectures; there is assistance during the exercise-sessions. Individual assistance is provided on demand (by appointment).

## 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

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

Extra information on the examination methods

NPE and second chance NPE: written examination (closed book) on vector calculus and series

PE1 en PE2: written examination (closed book) on signal and system analysis.

The use of a formularium is allowed.

Unlawfully absence (second chance) NPE: marks NPE = 0

Calculation of the examination mark

First examination Period: Total =  $NPE \cdot 1/3 + PE1 \cdot 2/3$

Second examination Period: Total =  $NPE \cdot 1/3 + PE2 \cdot 2/3$

When the student scores less than 8/20 for at least one of the two components (Part 1: vector calculus and series, Part 2: Signal and system analysis), he/she can no longer pass the entire course unit. If the total score is a mark of ten or more out of twenty, then this is reduced to the highest failing mark (9/20).