GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2023-2024

High-speed Electronics (E033640)

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 2)	English	Gent	lecture practical
B (semester 2)	Dutch	Gent	

Lecturers in academic year 2023-2024

Bauwelinck, Johan	TW05	lecturer-in-charge
Torfs, Guy	TW05	co-lecturer

Offered in the following programmes in 2023-2024	crdts	offering
Bridging Programme Master of Science in Electrical Engineering(main subject Communication and Information Technology)	6	A
Bridging Programme Master of Science in Electrical Engineering(main subject Electronic Circuits and Systems)	6	A
Master of Science in Electrical Engineering (main subject Communication and Information Technology)	6	A
Master of Science in Electromechanical Engineering(main subject Control Engineering and Automation)	6	A
Master of Science in Electromechanical Engineering(main subject Electrical Power Engineering)	6	A
Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)	6	A
Master of Science in Electromechanical Engineering(main subject Maritime Engineering)	6	A
Master of Science in Electromechanical Engineering(main subject Mechanical Construction)	6	A
Master of Science in Electromechanical Engineering(main subject Mechanical Energy Engineering)	6	A
Master of Science in Electrical Engineering	6	B
Master of Science in Photonics Engineering	6	A

Teaching languages

English, Dutch

Keywords

High-speed electronics, RF electronics, broadband analog electronics.

Position of the course

Second semester, first year of the master. High-speed Electronics deals with the design and modeling of microwave circuits and building blocks to create for example transmitters and receivers for mobile communication, wireless networks, high-speed interconnects and optical links. The course builds on the acquired basic knowledge of electronic circuit analysis and analog electronics, but it confronts the designer with the challenges that originate from the high frequency at which the circuit elements and their interconnections work. This course provides insight in the underlying theory and presents practical hands-on approaches using professional design software and laboratory equipment.

Contents

- Concepts and definitions in time and frequency domain.
- Circuit analysis: matrix representations, S-parameters, power gain and stability.
- From lumped to distributed elements: high-frequency models of passive components,

transmission lines, broadband components, matching networks.
- Modeling of active components: parasitic elements, non-linear models, speed limitations.
- Low noise amplifiers: statistical properties of noise, physical noise sources, circuit representation, noise in linear circuits, LNA design.
- Power amplifiers: linear power amplifiers (A,B) , tuned class C, high-efficiency power amplifiers D,E,F.
- Oscillators: oscillation conditions, phase noise, basic oscillator circuits, resonators and dielectric resonator oscillators
- Frequency conversion: mixing basics, non-linear systems as mixers, multiplying mixers, diode mixers.
- Recent research: circuit examples for wireless networks, broadband wired networks, fast interconnects and instrumentation applications,

Initial competences

Advanced analog electronics, small signal analysis of transistor circuits, notions on electromagnetism.

Final competences

1 Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching.
2 Analyze and design of active and passive high-speed circuits

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, Practical, Independent work

Learning materials and price

Syllabus, slides and lab notes, available for free on Ufora and via VTK for a target price of 15 euro.

References

Course content-related study coaching

Assessment moments

end-of-term and continuous assessment

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

Oral assessment

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

Oral assessment

Examination methods in case of permanent assessment

Participation, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is not possible

Extra information on the examination methods

During examination period: oral open-book exam with written preparation
During semester: graded lab sessions, for which a second chance is not possible.
The lab scores obtained will also count for the second chance exam if any.

Calculation of the examination mark

Continuous assessment 30%, end-of-term assessment 70%.
If the score of the end-of-term assessment turns out to be a mark of less than 8/20, the weighted average is reduced to 7/20 (if it happens to be higher than this).