Course Specifications

Valid as from the academic year 2020-2021

Electromagnetic-aware High Frequency Design (E033021)

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 67.5 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	English	Gent	lecture: plenary exercises	25.0 h
			lecture	30.0 h
			practicum	5.0 h
			excursion	7.5 h
B (semester 1)	Dutch		excursion	7.5 h
			practicum	5.0 h
			guided self-study	55.0 h

Lecturers in academic year 2020-2021

Rogier, Hendrik	TW05	lecturer-in-charge
Vande Ginste, Dries	TW05	co-lecturer

Offered in the following programmes in 2020-2021	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
European Master of Science in Photonics	6	A

Teaching languages

Dutch, English

Keywords

multi-port, microwave circuits, circuit models, EMC, signal and power integrity, interference, norms

Position of the course

- Insight in circuit and EMC concepts
- Application of the concepts to interconnections and IC-packages
- Familiarise students with EMC norms

Contents

- Black box models for multi-port circuits: Concept of port and port impedance and S-parameters, Passivity and lossless properties of multi-port circuits, Multi-port applications and measurements
- Extraction of circuit models of multi-port circuits: Circuit models for multi-port circuits, Parameter extraction for transfer function models, Parameter extraction for physical models
- Circuit properties of interconnections and IC-packages: Models for reflection, transmission and attenuation, Crosstalk and differential versus even mode, Measurements on interconnections and IC-packages
- Non-linear termination of interconnections: Circuit models for non-linear terminations, Circuit simulation techniques
- Concepts for EMC in circuits: Emission, immission and interference, Routes for an EMC problem
- Intra-system interference: Concepts of ground, earth, and reference, Static and dynamic noise margin, Modelling of the power supply circuit, Switching noise
- Inter-system interference: Radiative sources, Shielding (cables, connectors, houding), Conductive sources, Filtering for conductive interference
- EMC norms and certification: Emission and immission norms, certification process

Initial competences

Having succesfully completed the courses on "Applied Electromagnetics" or "Electromagnetism II" or having acquired the final competences provided by these courses in any other way.

Final competences

1 Analyse microwave circuits based on impedance, admittance and scattering matrices.
2 Synthesize filters and matching networks.
3 Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity.
4 Be familiar with EMC norms.

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, excursion, lecture, practicum, self-reliant study activities, lecture: plenary exercises, online lecture, online lecture: plenary exercises, online lecture: response lecture, online seminar: coached exercises

Extra information on the teaching methods

Classroom lectures: Mix of on-campus and online teaching; Flipped classroom with interactive contact sessions; Scored exercises as homework; Classroom problem solving sessions; Lab sessions

Learning materials and price

syllabus + handouts with notes

References

David M. Pozar, Microwave Engineering, third edition, John Wiley & Sons, 2004
Jasper Goedbloed, Electromagnetic Compatibility, Prentice Hall 1992, ISBN 0-13-249293-8, 381 pp
Prentice Hall, 2nd edition: 2010
Introduction to Electromagnetic Compatibility
C. R. Paul
ISBN: 978-0-471-75500-5
John Wiley & Sons, Inc., 2nd edition: 2006
Signal and Power Integrity -- Simplified
E. Bogatin
ISBN: 978-0-13-234979-6

Course content-related study coaching

Evaluation methods

end-of-term evaluation and continuous assessment

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

Written examination, open book examination, oral examination

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

Written examination, open book examination, oral examination

Examination methods in case of permanent evaluation

Skills test, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Extra information on the examination methods

During examination period:
Part EMC:
Written closed-book exam
- Theory + theoretical excercises
- Questions about EMC norms in the context of the Certification Lab visit

Part Circuit theory:
A) Oral open-book exam, without preparation
- Theory

B) Standard: Written open-book exam
- Exercises
B) If on-campus exam is impossible: Multiple-choice exam via Ufora, open book.

During semester: Graded lab sessions, Graded exercises as homework.
Second chance: Possible in adapted form

Calculation of the examination mark

Evaluation throughout semester as well as during examination period. Special conditions: 1/2 Exam Circuit theory (1/6 theory exam + 1/6 exercise exam + 1/6 scored exercises as homework) + 3/8 Exam EMC + 1/8 Lab reports+Certification Lab visit. However, at least 4/10 must be obtained for each part (part theory, part excercises and part project/lab). If this is not the case, the total score drops to the lowest score of all the separate parts.