GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2018-2019

High Speed Photonic Components (E030630)

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	Study time	Contact hrs
4.0	120 h	67.5 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	English	Gent	group work	2.5 h
			guided self-study	15.0 h

Lecturers in academic year 2020-2021

Morthier, Geert	TW05	lecturer-in-charge
Verschaffelt, Guy	VUB	co-lecturer

Offered in the following programmes in 2020-2021	crdts	offering
Bridging Programme European Master of Science in Photonics	4	A
European Master of Science in Photonics	4	A

Teaching languages

English

Keywords

modulation, optical pulses, optical switching

Position of the course

To acquire a thorough understanding of the dynamics of laser diodes . To acquire an overview of the field as well as the necessary insight and skills to be able to do research or follow-up research in the field. Partly taught at UGent and partly at VUB.

Contents

- Introduction: Components, General approximations, Applications
- Laser diode desciptions: Longitudinal equations, Rate equation descriptions, Non-linear material properties
- Laser diode modulation and noise: Small signal modulation, large signal modulation, Linewidth and intensity noise, External feedback, Experimental characterisation
- Non-linear laser dynamics: bifurcations, Chaos and its characterisation
- Mode locking and short pulse generation: Mode locking theory, Q-switching and self-pulsations, Characterisation of short pulses
- All-optical flip-flops: Flip-flops based on DFB lasers, Flip-Flops based on ring or disk lasers

Initial competences

wave propagation theory, laser theory, notions of noise.
This course relies heavily on several competences acquired in the course Lasers. It is not adviced to take this course without first having taken the course Lasers (or having acquired a thorough knowledge about lasers).

Final competences

1 Being able to use the rate equations for the derivation of large and small signal dynamic behaviour.
2 Being able to derive the different noise characteristics from the rate equations.
3 Understanding the different methods for the generation of short laser pulses.
4 Understanding the influence of external reflections on the laser diode behaviour.
5 Understand the context of sicentific or technical documents in the field of photonics and further investigate unclear parts independently.
6 Acquire sufficient knowledge to perform research in the domain of laser dynamics.

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, group work, lecture

Learning materials and price

lecture notes (jointly with VUB)

References

- Petermann, K.; Laser Diode modulation and noise
- Agrawal, G.P.; Long wavelegnth semiconductor lasers
- San Miguel M. and Toral R.; Stochastic effects in physical systems, arXiv:cond-mat/9707147v1, 14 july 1997

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

Oral examination

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

Oral examination

Examination methods in case of permanent evaluation

Report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

During examination period: oral closed-book exam, written preparation. During semester: graded project reports; graded team work.

Calculation of the examination mark

Special conditions: 1 computer exercise and 1 paper. Final score depenss half on the marks for these exercises (1/4th per exercise).