

## Optical Materials (E024800)

**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 2025-2026**

A (semester 1)

English

Gent

seminar

lecture

**Lecturers in academic year 2025-2026**

Beeckman, Jeroen

TW06

lecturer-in-charge

Danckaert, Jan

VUB

co-lecturer

Ussembayev, Yera

TW06

co-lecturer

**Offered in the following programmes in 2025-2026**

	<b>crdts</b>	<b>offering</b>
<a href="#">Bridging Programme Master of Science in Photonics Engineering</a>	6	A
<a href="#">Master of Science in Electrical Engineering (main subject Communication and Information Technology )</a>	6	A
<a href="#">Master of Science in Electromechanical Engineering(main subject Control Engineering and Automation)</a>	6	A
<a href="#">Master of Science in Electromechanical Engineering(main subject Electrical Power Engineering)</a>	6	A
<a href="#">Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)</a>	6	A
<a href="#">Master of Science in Electromechanical Engineering(main subject Maritime Engineering)</a>	6	A
<a href="#">Master of Science in Electromechanical Engineering(main subject Mechanical Construction)</a>	6	A
<a href="#">Master of Science in Electromechanical Engineering(main subject Mechanical Energy Engineering)</a>	6	A
<a href="#">Master of Science in Photonics Engineering</a>	6	A

**Teaching languages**

English

**Keywords**

microscopic, anisotropy, non-linearity, optical properties

**Position of the course**

Introducing the microscopic origin of optical phenomena and transferring concepts from microscopic to macroscopic descriptions. Illustrating optical properties like anisotropy, non-linearity and variation by means of electric, elastic, acoustic or magnetic effects in basic components. All lectures are held in Gent, co-lecturer from VUB: Jan Danckaert.

**Contents**

- Introduction: Introduction
- Properties of linear isotropic materials: examples, microscopic theory, definitions
- Light propagation in anisotropic dielectrics: polarisation, propagation, matrix formalism, reflection
- Properties of linear anisotropic dielectrics: tensors, types of materials, optical activity
- Modification of optical properties: microscopic theory, electro- photo- elasto-acousto- magneto- optic effects
- Liquid crystals: types of ordering, switching behavior Non-linear optical materials: second-order effects, phase-relations, OPO, material examples

## Initial competences

bachelor in applied physics or bachelor in electrotechnical engineering

## Final competences

- 1 Understand and explain the microscopic and macroscopic theory of linear (isotropic and anisotropic) optical materials and light propagation.
- 2 Understand and explain mechanisms for modifying the optical properties of materials: electric, magnetic, elastic and acoustic methods, including liquid crystals.
- 3 Understand and explain basic non-linear optical effects
- 4 Solve exercises that are based on linear (isotropic and anisotropic) optical materials, modification of optical properties and liquid crystals.
- 5 Calculate the propagation of light based and the change in polarization with the Jones calculus.
- 6 Make written and oral reports about an optical phenomenon or device

## 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

lectures about theory  
work sessions: guided exercises, PC practicum, literature study with presentation and report

## Study material

Type: Syllabus

Name: Course notes for Optical Materials

Indicative price: € 7

Optional: no

Language : English

Number of Pages : 200

Available on Ufora : Yes

Online Available : No

Available in the Library : No

Available through Student Association : Yes

## References

- Optical Waves in Crystals, A. Yariv and P. Yeh, John Wiley and Sons, New York
- Introduction to Complex Mediums for Optics and Electromagnetics, Weiglhofer and Lakhtakia, SPIE press, Bellingham

## Course content-related study coaching

Help with solving exercises and with the PC practicum.

## Assessment moments

end-of-term and continuous assessment

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

Oral assessment, Written assessment open-book

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

Oral assessment, Written assessment open-book

## Examination methods in case of permanent assessment

Assignment

## Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

## Extra information on the examination methods

During examination period:

1. theory exam: closed-book exam with oral examination;
- 2, problem solving exam: the syllabus can be used.

During semester:  
graded project reports; graded oral presentation. Frequency: 1 computerpracticum (written report): 10%, week 10. 1 literature study (written report and oral presentation): 20%, week 12.

**Calculation of the examination mark**

Special conditions: In the exam period: 70%. During the lecturing time: 10% + 20%. The scores obtained during the lecturing time are transferred to the second exam session.