Course Specifications
Valid as from the academic year 2020-2021

Optical Materials (E024800)

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)

<table>
<thead>
<tr>
<th>Credits</th>
<th>Study time</th>
<th>Contact hrs</th>
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<tbody>
<tr>
<td>6.0</td>
<td>180 h</td>
<td>60.0 h</td>
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</tbody>
</table>

Course offerings and teaching methods in academic year 2021-2022

A (semester 1)
- English
- Gent
- Lecture
  - 30.0 h
- Project
  - 1.25 h
- Seminar: practical PC room classes
  - 7.5 h
- Seminar: coached exercises
  - 20.0 h

O (semester 1)

Lecturers in academic year 2021-2022

- Neyts, Kristiaan
- Danckaert, Jan

OFFERED IN THE FOLLOWING PROGRAMMES IN 2021-2022

<table>
<thead>
<tr>
<th>Programme</th>
<th>crds</th>
<th>offering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridging Programme Master of Science in Photonics Engineering</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electrical Engineering (main subject Communication and Information Technology)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electromechanical Engineering (main subject Maritime Engineering)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electromechanical Engineering (main subject Mechanical Construction)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>European Master of Science in Photonics</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Photonics Engineering</td>
<td>6</td>
<td>A, O</td>
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</table>

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

(Approved)
• 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
Lecture, project, seminar: coached exercises, seminar: practical PC room classes

Extra information on the teaching methods
lectures about theory
work sessions: guided exercises, PC practicum, literature study with presentation and report

Learning materials and price
English syllabus (identical to syllabus at VUB).

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.

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
Report

Possibilities of retake in case of permanent evaluation
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.

(Approved)
The calculation of the final score can differ, due to the COVID19 context, especially if one or more evaluations cannot be organised on campus or can not be organised at all.