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>
</tr>
</thead>
<tbody>
<tr>
<td>6.0</td>
<td>180 h</td>
<td>60.0 h</td>
</tr>
</tbody>
</table>

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)

<table>
<thead>
<tr>
<th>Language</th>
<th>Teaching method</th>
<th>Study time</th>
<th>Contact hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>seminar: practical PC room</td>
<td>7.5 h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>classes lecture</td>
<td>30.0 h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>project</td>
<td>1.25 h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>seminar: coached exercises</td>
<td>20.0 h</td>
<td></td>
</tr>
</tbody>
</table>

Gent

Lecturers in academic year 2020-2021

Neyts, Kristiaan

Danckaert, Jan

TW06

VUB

Lecturer-in-charge

Co-lecturer

Offered in the following programmes in 2020-2021

<table>
<thead>
<tr>
<th>Programme</th>
<th>crds</th>
<th>offering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridging Programme European Master of Science inPhotonics</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electrical Engineering (main subject Communication andInformation Technology)</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electromechanical Engineering (main subject Control Engineering andAutomation)</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 Nuclear Fusion and Engineering Physics</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>European Master of Science in Nuclear Fusion and Engineering Physics</td>
<td>6</td>
<td>A</td>
</tr>
</tbody>
</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

(Approved)
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. 

_The calculation of the final score can differ, due to the COVID19 context, especially if one or more evaluations can not be organised on campus or can not be organised at all._

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