# KARTA PRZEDMIOTU

**Nazwa przedmiotu:** ***Engineering of crystal Materials for Optics (WTCNOCSI-EoCMfO)***
**Nazwa w języku polskim:**
**Nazwa w jęz. angielskim:** ***Engineering of crystal Materials for Optics***

## Dane dotyczące przedmiotu:

**Jednostka oferująca przedmiot:** Wydział Nowych Technologii i Chemii
**Przedmiot dla jednostki:** Wydział Nowych Technologii i Chemii
**Cykl dydaktyczny:** Semestr zimowy 2026/2027
**Koordynator przedmiotu cyklu:** dr hab. Noureddine Bennis

**Domyślny typ protokołu dla przedmiotu:**

Zaliczenie na ocenę

**Język wykładowy:**

angielski

**Skrócony opis:**

In the main part of this course we shall study the propagation in crystal materials which light can penetrate without appreciable weakening. In greater part of this course we assume that medium is homogenous, non-conducting and magnetically isotropic, but allow electrical anisotropy. With the obtained formulas we will analyze in detail what we see through a cleavage calcite crystal. A detailed survey will be given of optical compensators such as Babinet, and Soleil. Other linear polarizers exploit the birefringent properties of crystals such as quartz and calcite, will be presented in view of the optic design.

**Opis:**

Wykład /metoda słowna z wykorzystaniem prezentacji multimedialnych.
1. Anisotropic Polarizability / 2 godz
2. Fresnel's Equation and index Ellipsoid / 2 godz
3. Optical classification of anisotropic media / 2 godz
4. Light propagation in uniaxial crystals / 2 godz.
5. Reflection and refraction in interfaces between isotropic medium and a uniaxial crystal / 2 godz
6. Calcite experiment and double refraction: Examples / 2 godz.
7. Polarization of light / 2 godz.
8. Polarizing Beam-splitters. Various Types of Plane Polarizers / 2 godz.
9. Optical compensators: Babinet, and Soleil / 2 godz.

Laboratoria / The purpose of the experiments is to impart an intuitive understanding of the interaction between light and crystals and,thus,of optical crystallography. This will help to prepare the student for the introduction of optical indicatrices
1. Ellipsometric measurement of the polarization transfer function of an optical crystal material / 3 godz
2. Characterization of polarized light using Quarter and Half Wave Plates / 3 godz
3. Optical anisotropy measurement methods / 3 godz
4. Optical activity measurement / 3 godz

**Literatura:**

podstawowa:
1. Optics, by E. Hecht, 5th Edition (Adelphl Edition)
2. Introduction to Modern Optics, by Fowles (Dover Book)
3. Polarized Light, Third Edition 3rd Edition, Kindle Edition by Dennis H. Goldstein

uzupełniająca:
1. Hanbook of Optics, Fundamentals, Techniques and Design (second Edition) McGraw-Hill, INC
2. Fundamentals of Photonics (Third Edition) Bahaa E. A. Saleh 2019 by John Wiley & Sons, Inc

**Efekty uczenia się:**

Symbol / Efekty uczenia się / Odniesienie do efektów kierunku
W1 / A more comprehensive treatment of general problem of reflection and refraction at oblique incidence on air dielectric interface / K_W03,
W2 / Capacity to identify, formulate, and solve engineering problems / K_W13
W3 / Capacity to use the techniques, skills, and modern engineering tools necessary for engineering practice / K_W12
W4 / Capacity to identify, formulate, and solve engineering problems / K_W14
U1 / Ability to recognize the number of optical retarders and explain how they manipulate the light / K_U03, K_U05
U2 / Capacity to apply knowledge of mathematics, science, and engineering / K_U09
U3 / Ability to build an optical setup to carry out the measurements and interpret the results in the context of knowledge related with optical properties of crystal materials / K_U07
U4 / Student has the ability to self-learning / K_U06
K1 / Can work and interact in a group / K_K03
K2 / Understands the importance of optical crystals for the development of science and industry / K_K02, K_K05

**Metody i kryteria oceniania:**

The course ends with a pass written and oral. Laboratory - an exercise requires the positive ratings from test before starting the exercise, exercise execution and devotion written report of the exercises. Completion of the course requires positive assessments of laboratory exercises and to pass a written test containing open-ended questions.
Achieving effects W1, W2, W3, W4, U1, U2 and K1 is verified during the final test, and the results W3, U3 and U4 and K2 are checked during the execution of laboratory exercises.
score 2 – less than 50% of correct answers.
score 3 – 50 ÷ 60% of correct answers.
score 3,5 – 61 ÷ 70% of correct answers.
score 4 – 71 ÷ 80% of correct answers.
score 4,5 – 81 ÷ 90% of correct answers.
score 5 – more than 91% of correct answers.
Student receives 5 if possess the knowledge, skills and competences foreseen learning outcomes, and also shows interest in the subject, in a creative approach to assigned tasks and show independence in acquiring knowledge, is persistent in overcoming difficulties and

systematic work.
Student receives 4 if possess the knowledge and skills curriculum provided a good level. Able to solve the tasks and problems of medium difficulty.
Student receives 3 if possess the knowledge and skills provided the curriculum sufficiently. Isolated solves problems and problems with a low degree of difficulty. His knowledge and skills are noticeable gaps that can complement but under the guidance of a teacher. Student receives 2 if does not possess the knowledge, skills and competences necessary requirements.
The final evaluation consists of the evaluation obtained on exam and laboratories and the commitment and approach to student learning.

**Forma studiów**

stacjonarne

**Rodzaj studiów**

I stopnia

**Rodzaj przedmiotu**

wybieralny

**Przedmioty wprowadzające**

Fizyka - Nature and Properties of Light, Basic Geometrical Optics. In addition, student should be able to use algebra, plane geometry, and trigonometry.
Matematyka - Knowledge of mathematical analysis of functions of several variables and differential and integral calculus for this type of functions
Podstawy inżynierii fotonicznej - fundamental properties of light propagation and interaction with matter under the approximations of geometrical optics and scalar wave optics

**Programy**

kierunek: inżynieria materiałowa, specjalność: inżynieria fotoniczna

**Forma zajęć liczba godzin/rygor**

W 18/+; L 12/+

**Autor**

dr hab. Noureddine Bennis

**Bilans ECTS**

Lp. Aktywność Obciążenie w godz.
1. Udział w wykładach 18
2. Udział w laboratoriach 12
3. Udział w ćwiczeniach
4. Udział w seminariach
5. Samodzielne studiowanie tematyki wykładów 30
6. Samodzielne przygotowanie do laboratoriów 30
7. Samodzielne przygotowanie do ćwiczeń
8. Samodzielne przygotowanie do seminarium
9. Realizacja projektu
10. Udział w konsultacjach
11. Przygotowanie do egzaminu
12. Przygotowanie do zaliczenia 10
13. Udział w egzaminie
godz.; ECTS
Sumaryczne obciążenie pracą studenta: 100; 4,0
Zajęcia z udziałem nauczycieli: 1+2+3+4+9+13: 30; 2,0
Zajęcia powiązane z działalnością naukową: 70; 3,0

## Dane dotyczące przedmiotu cyklu:

**Domyślny typ protokołu dla przedmiotu cyklu:**

Zaliczenie na ocenę