

# POLITECHNIKA KRAKOWSKA IM. TADEUSZA KOŚCIUSZKI

## KARTA PRZEDMIOTU

obowiązuje studentów rozpoczynających studia w roku akademickim 2019/2020

Wydział Inżynierii Materiałowej i Fizyki

Kierunek studiów: Fizyka Techniczna w Języku Angielskim

Profil: Ogólnoakademicki

Forma studiów: stacjonarne

Kod kierunku: FTja

Stopień studiów: II

Specjalności: Computer modelling (modelowanie komputerowe w języku angielskim)

### 1 INFORMACJE O PRZEDMIOCIE

|                                         |                                           |
|-----------------------------------------|-------------------------------------------|
| NAZWA PRZEDMIOTU                        | Optical properties of different materials |
| NAZWA PRZEDMIOTU<br>W JĘZYKU ANGIELSKIM | Optical properties of different materials |
| KOD PRZEDMIOTU                          | WIMiF FTJA oHS F10 19/20                  |
| KATEGORIA PRZEDMIOTU                    | Przedmioty wybieralne                     |
| LICZBA PUNKTÓW ECTS                     | 3.00                                      |
| SEMESTRY                                | 2                                         |

### 2 RODZAJ ZAJĘĆ, LICZBA GODZIN W PLANIE STUDIÓW

| SEMESTR | WYKŁAD | ĆWICZENIA | LABORATORIUM | LABORATORIUM<br>KOMPUTERO-<br>WE | SEMINARIUM | PROJEKT |
|---------|--------|-----------|--------------|----------------------------------|------------|---------|
| 2       | 30     | 0         | 0            | 15                               | 0          | 15      |

### 3 CELE PRZEDMIOTU

**Cel 1** Cel przedmiotu 1 Target 1: To present and teach students characteristics of optical properties of the solid state matter.

**Cel 2** Cel przedmiotu 2 Target 2: To present and teach students characteristics of optical properties of the soft matter.

**Cel 3** Cel przedmiotu 3 Target 3: To present and teach students principles of interaction of light with condensed matter and different processes of energy absorption.

**Cel 4** Cel przedmiotu 4 Target 4. To present newest scientific and technological achievements

## 4 WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I INNYCH KOMPETENCJI

1 Wymaganie 1 Skills and Competences Knowledge on mathematics and physics at the level of first grade technical university studies

## 5 EFEKTY KSZTAŁCENIA

**EK1 Wiedza** Efekt kształcenia 1 K\_W07b Wiedza has extensive and systematised knowledge in the field of modern solid body physics and material engineering including semiconductors, magnetic and ferroelectric materials, mesogens, intercalated and thin-layer materials P7U\_W

**EK2 Umiejętności** Efekt kształcenia 2 K\_U01b Umiejętności is able to acquire information from technical literature, databases and other sources (also in a foreign language), to make critical selection, interpretation and integration with previous knowledge, can pursue course of self-study P7U\_U

**EK3 Umiejętności** Efekt kształcenia 3 K\_U03b Umiejętności is able to use English (or any other foreign language) at upper intermediate level (B2) which is sufficient for communication and reading technical literature, technical documentations, articles and academic textbooks

**EK4 Kompetencje społeczne** Efekt kształcenia 4 K\_K01 Kompetencje społeczne is able to study and broaden knowledge also including elements of other engineering and non-engineering faculties, can conduct creative seminars and training courses, is able to help co-workers by indicating reliable sources of technical information P7U\_K

## 6 TREŚCI PROGRAMOWE

| WYKŁAD |                                                        |                  |
|--------|--------------------------------------------------------|------------------|
| LP     | TEMATYKA ZAJĘĆ<br>OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH | LICZBA<br>GODZIN |

| WYKŁAD    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| LP        | TEMATYKA ZAJĘĆ<br>OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | LICZBA<br>GODZIN |
| <b>W1</b> | Treści programowe 1 Basic Properties: Simple materials coefficient of refraction and extinction. Maxwell laws and their solutions. Kramers Kronig relations for dielectric coefficients. Advanced Propertie:Fundamental absorption rules. Infrared reflection. Influence of impurities. Electrooptics. Types of electro-absorption processes. Magnetic field influence. Excitons: Optical absorption in crystal semiconductors and insulators, creation of excitons. Lifetime of an exciton. (Large radii orbital excitons) Wannier- Mott and Frenkel Exciton. Excitons in amorphous semiconductors. Models of refractive index: Moss, Herve -Vandamme and other relations of bandgap and temperature for semiconductors, Gladstone Dale formula for oxide glasses. Wemple di Domenico semiempirical relation. Connection of the refracting index to the group index and its application. Simple Swanepel method of measuring n. Photonic Crystals: Photonic Crystals (PC). Nanotechnology of PC. Ways of tuning PC response: by changing refraction of PC elements and by inducing structural changes. Application of photonic crystals. Glasses. Methods of obtaining glasses. Optical properties and their dependence on physcial factors like temperature and stress. Methods of coloring glasses. Rare earth dopants and metal dopants. Applications. X ray storage phosphors, ferroelectric transparent ceramics, fibres industry etc. Photonic Glasses and their characteristics. Nonlinear optical effects. Structural changes induced by nonlinear excitations. Chalcogenide Glasses. Changes induces by interation with the lighth: change of sample volume, electron excitation and hole creation. Other examples. | 30               |

| PROJEKT   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| LP        | TEMATYKA ZAJĘĆ<br>OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH                                                                                                                                                                                                                                                                                                                                                                                                                                                          | LICZBA<br>GODZIN |
| <b>P1</b> | Treści programowe 1 Applications of different methods how to calculate optical properties: Fresnel equations for one and multistack samples. Calculating optical properties from the data of thin films. Kramers-Kronig relations. How to use Swanepoel method for the transmission data for unifrom and nonuniform thickness samples. Simple Monte Carlo method for two dimensional system with bubbles of different refractive index. Calculating optical paths for a continuously changing refractive index. | 15               |

| LABORATORIUM KOMPUTEROWE |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| LP                       | TEMATYKA ZAJĘĆ<br>OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH                                                                                                                                                                                                                                                                                                                                                                                                                                           | LICZBA<br>GODZIN |
| <b>K1</b>                | Treści programowe 1 Different examples how to calculate optical properties: Fresnel equations for one and multistack samples. Calculating optical properties from the data of thin films. Kramers-Kronig relations. How to use Swanepoel method for the transmission data for unifrom and nonuniform thickness samples. Simple Monte Carlo method for two dimensional system with bubbles of different refractive index. Calculating optical paths for a continuously changing refractive index. | 15               |

## 7 NARZĘDZIA DYDAKTYCZNE

N1 Narzędzie 1 Presentations

N2 Narzędzie 2 Computer programmes modelling

N3 Narzędzie 3 Individual project

N4 Narzędzie 4 Discussion

## 8 OBCIĄŻENIE PRACĄ STUDENTA

| FORMA AKTYWNOŚCI                                                                                 | ŚREDNIA LICZBA GODZIN<br>NA ZREALIZOWANIE<br>AKTYWNOŚCI |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| <b>Godziny kontaktowe z nauczycielem akademickim, w tym:</b>                                     |                                                         |
| Godziny wynikające z planu studiów                                                               | 60                                                      |
| Konsultacje przedmiotowe                                                                         | 10                                                      |
| Egzaminy i zaliczenia w sesji                                                                    | 0                                                       |
| <b>Godziny bez udziału nauczyciela akademickiego wynikające z nakładu pracy studenta, w tym:</b> |                                                         |
| Przygotowanie się do zajęć, w tym studiowanie zalecanej literatury                               | 10                                                      |
| Opracowanie wyników                                                                              | 10                                                      |
| Przygotowanie raportu, projektu, prezentacji, dyskusji                                           | 10                                                      |
| <b>SUMARYCZNA LICZBA GODZIN DLA PRZEDMIOTU WYNIKAJĄCA Z<br/>CAŁEGO NAKŁADU PRACY STUDENTA</b>    | <b>100</b>                                              |
| SUMARYCZNA LICZBA PUNKTÓW ECTS DLA PRZEDMIOTU                                                    | 3.00                                                    |

## 9 SPOSOBY OCENY

### OCENA FORMUJĄCA

F1 Ocena Lecture attendance

F2 Ocena 2 Active participation in computer laboratory

F3 Ocena 3 Report on individual project

F4 Ocena 4 Exam results

### OCENA PODSUMOWUJĄCA

P1 Ocena 1 All partial notes must be positive. Average of the all partial notes.

### KRYTERIA OCENY

| EFEKT KSZTAŁCENIA 1 |                                                                                                                                        |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| NA OCENĘ 2.0        | Student has a very poor knowledge.                                                                                                     |
| NA OCENĘ 3.0        | Student has knowledge of more than 50 % of required scope and less than 60%                                                            |
| NA OCENĘ 3.5        | Student has knowledge of more than 60 % of required scope and less than 70%                                                            |
| NA OCENĘ 4.0        | Student has knowledge of more than 70 % of required scope and less than 80 %                                                           |
| NA OCENĘ 4.5        | Student has knowledge of more than 80 % of required scope and less than 90%                                                            |
| NA OCENĘ 5.0        | Student fulfill all the conditions at excellent level.                                                                                 |
| EFEKT KSZTAŁCENIA 2 |                                                                                                                                        |
| NA OCENĘ 2.0        | Student cannot use technical literature                                                                                                |
| NA OCENĘ 3.0        | Student can use technical literature but needs a lot of help and explanation                                                           |
| NA OCENĘ 3.5        | Student can use technical literature, needs guidance to interpret the equiared knowledge and cannot pursue course of self-study        |
| NA OCENĘ 4.0        | Student fullfils all the required conditions at satisfactory level.                                                                    |
| NA OCENĘ 4.5        | Student fullfils all the required conditions, some minor shortcomings are acceptable.                                                  |
| NA OCENĘ 5.0        | Student can work efficiently without any help                                                                                          |
| EFEKT KSZTAŁCENIA 3 |                                                                                                                                        |
| NA OCENĘ 2.0        | Student has poor command of English and does not understand articles wwritten in English                                               |
| NA OCENĘ 3.0        | Studen has basic command of English but has much diificulty in communication and reading texts.                                        |
| NA OCENĘ 3.5        | Student is able to use English to understand main ideas in technical literature                                                        |
| NA OCENĘ 4.0        | Student exhibits satisfactory level of English knowledge, some errors in speach are present                                            |
| NA OCENĘ 4.5        | Students Students has good konwledge of English, can communicate but is not very fluent                                                |
| NA OCENĘ 5.0        | Students has very good konwledge of English, speaks fluetntly and can discuss technical problems                                       |
| EFEKT KSZTAŁCENIA 4 |                                                                                                                                        |
| NA OCENĘ 2.0        | Student does not fulfill the required conditions                                                                                       |
| NA OCENĘ 3.0        | Students fullfils conditions at basic level                                                                                            |
| NA OCENĘ 3.5        | Students fullfils conditions more than at the basic level, uses foreign literature and can explain merits of the scientifique articles |

|              |                                                                                                                    |
|--------------|--------------------------------------------------------------------------------------------------------------------|
| NA OCENĘ 4.0 | Students fulfills all the conditions mentioned at satisfactory level and takes active part in scietifique analysis |
| NA OCENĘ 4.5 | Students fulfills all the conditions mentioned very well, some minor shortcomings accepted                         |
| NA OCENĘ 5.0 | Students fulfills excellently all the conditions required                                                          |

## 10 MACIERZ REALIZACJI PRZEDMIOTU

| EFEKT KSZTAŁCENIA | ODNIESIENIE DANEGO EFEKTU DO SZCZEGÓŁOWYCH EFEKTÓW ZDEFINIOWANYCH DLA PROGRAMU | CELE PRZEDMIOTU            | TREŚCI PROGRAMOWE | NARZĘDZIA DYDAKTYCZNE | SPOSOBY OCENY  |
|-------------------|--------------------------------------------------------------------------------|----------------------------|-------------------|-----------------------|----------------|
| EK1               | K_W07b                                                                         | Cel 1 Cel 2<br>Cel 3 Cel 4 | W1 P1 K1          | N1 N2 N3 N4           | F1 F2 F3 F4 P1 |
| EK2               | K_U01b                                                                         | Cel 1 Cel 2<br>Cel 3 Cel 4 | W1 P1 K1          | N1 N2                 | F1 F2 F3 F4 P1 |
| EK3               | K_U03b                                                                         | Cel 1 Cel 2<br>Cel 3 Cel 4 | W1 P1 K1          | N1 N2 N3 N4           | F1 F2 F3 F4 P1 |
| EK4               | K_K01                                                                          | Cel 1 Cel 2<br>Cel 3 Cel 4 | W1 P1 K1          | N1 N2 N3 N4           | F1 F2 F3 F4 P1 |

## 11 WYKAZ LITERATURY

### LITERATURA PODSTAWOWA

- [1 ] **R. Swanepoel** — *J.Phys.E. Sci.Instrum. 16,1214 1983*, Miejscowość, 2013, J.Phys.E. Sci.Instrum. 16,1214 1983
- [2 ] **J. Singh** — *Optical Properties of Condensed Matter*, Chichester, 2006, Wiley
- [3 ] **O. S. Heavens** — *Optical Properties of thin solid films*, Dover, 1991, Dover Publication

## 12 INFORMACJE O NAUCZYCIELACH AKADEMICKICH

### OSOBA ODPOWIEDZIALNA ZA KARTĘ

dr hab. Agnieszka Chrzanowska (kontakt: [agnieszka.chrzanowska@pk.edu.pl](mailto:agnieszka.chrzanowska@pk.edu.pl))



**OSOBY PROWADZĄCE PRZEDMIOT**

1 dr hab. Agnieszka Chrzanowska (kontakt: [agnieszka.chrzanowska@pk.edu.pl](mailto:agnieszka.chrzanowska@pk.edu.pl))

**13 ZATWIERDZENIE KARTY PRZEDMIOTU DO REALIZACJI**

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(miejsowość, data)

(odpowiedzialny za przedmiot)

(dziekan)

**PRZYJMUJĘ DO REALIZACJI** (data i podpisy osób prowadzących przedmiot)

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