COURSE DESCRIPTION CARD - SYLLABUS

Course name
Introduction to materials science [S1ETI1>WdNoM]

Course

Field of study
Education in Technology and Informatics

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
26

Laboratory classes
0

Other (e.g. online)
0

Tutorials
30

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of physics and mathematics at the level of the first year of study. The ability to solve elementary problems in physics based on the acquired knowledge, the ability to obtain information from indicated sources. Understanding the need to expand your competences, readiness to cooperate within the team.

Course objective

1. Provide students with basic knowledge of quantum and modern physics, with particular emphasis on solid state physics in the scope specified by the program content appropriate for the field of study 2. Developing students" skills to solve simple problems in quantum physics, modern physics, crystallography and semiconductor physics based on the knowledge obtained during lectures

Course-related learning outcomes

Knowledge:
1. define the basic concepts of solid state physics and materials engineering within the scope of the curriculum content specific to the field of study and provide simple examples of their application in the surrounding world [k1_w01, k1_w02, k1_w16, k1_w17]

2. formulate and explain the basic problems of solid state physics within the scope of the program content appropriate for the field of study, define the basic limitations and scope of their applicability, and provide examples of application to describe phenomena in the surrounding world [k1_w02, k1_w16, k1_w17]
3. explain the purpose of creating and the meaning of solid state models, including semiconductors and can provide a description of these phenomena [k1_w02, k1_w16, k1_w17]

Skills:
1. apply the basic concepts of solid state physics and materials engineering within the scope of the curriculum content appropriate for the field of study [k1_u01, k1_u02, k1_u04, k1_u16]
2. use the understanding of the indicated sources of knowledge in polish and english and obtain

Social competences:
1. actively engage in solving the problems posed, independently develop and expand their competences [k1_k01, k1_k03, k1_k05, k_k09]
2. follow basic ethical principles [k1_k02]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
W1 written / oral exam 3 50.1% -70.0%
4 70.1% -90.0%
5 from 90.1%
W2 written / oral exam 3 50.1% -70.0%
4 70.1% -90.0%
5 from 90.1%
W3 written / oral exam 3 50.1% -70.0%
4 70.1% -90.0%
5 from 90.1%
U1 Colloquium 3 50.1% -70.0%
4 70.1% -90.0%
5 from 90.1%
U2 Colloquium 3 50.1% -70.0%
4 70.1% -90.0%
5 from 90.1%
K1 assessment of activity during accounting exercises
3 the student shows moderate commitment to solving problems of modern physics, encouraged to look for a solution based on the acquired knowledge
4 the student is committed to solving problems of modern physics, looking for a solution based on the acquired knowledge
5 the student shows great commitment to solving problems of modern physics, independently looks for a solution based on the acquired knowledge, looks for additional sources of knowledge useful to solve the problem, looks for solutions in non-standard situations
K2 conversation about the rules of taking an exam and passing a test
3 the student understands the advisability of taking exams and tests independently
4 the student understands the advisability of taking exams and tests independently
5 the student understands the advisability of taking exams and tests independently

Programme content

Course relates to the description of the structure of materials on a macroscopic, microscopic and nanoscopic scale. Description of crystal structures, chemical bonds, molecular interactions and basic properties of materials.

Course topics

1. Elementary quantum problems
Schrödinger equation, free particle motion, potential well, linear harmonic oscillator, hydrogen-like atom

2. Crystalline structure of bodies
Unit cell, lattice planes and directions, symmetry elements, crystallographic systems and Bravais lattices, Miller indices
3. The imperfections of the crystal lattice
Point and line defects of the crystal lattice, edge and screw dislocations, stress field and dislocation energy
4. Classification of materials
Classification based on the nature of atomic bonds, metals, ceramics, polymers, composites, engineering and functional plastics
5. Structure of materials
Structure and transformation of phases, structure of solid phases, microstructure
6. Study of the crystal structure
X-ray, neutron and electron diffraction, Laue equation, Bragg"s law, inverse lattice, Ewald structure, study of crystal surfaces
7. Crystal bonds
Forces of attraction, valence, ionic and metallic crystals, crystals with hydrogen and molecular bonding
8. Lattice vibrations
Vibrations of one-dimensional chain with the same atoms, vibrations of a one-dimensional chain with two types of atoms, generation of phonons, acoustic phonons, optical phonons
9. Specific heat of solids
Classic model of specific heat, Einstein and Debye model of specific heat,
Debye temperature, specific heat of metals
10. Band structure of solids
Adiabatic and single-electrode approximation, approximation of strongly bound electrons, approximation of weakly bound electrons, formation of energy bands, Brillouin zone, effective mass
11. Elements of statistical physics
Classical and quantum statistics, phase space, decomposition function, Fermi-Dirac distribution for electrons, allocation of energy bands

Teaching methods

1. Lecture: multimedia presentation, solving example tasks on the blackboard,
2. Exercises: problem solving, discussion.

Bibliography

Basic
1. E.Kelly, G.W.Groves, Krystalografia i defekty kryształów, PWN Warszawa 1980
2. C.Kitell, Wstęp do fizyki ciała stałego, PWN Warszawa 1998
3. L.V.Azaroff, Struktura i własności ciał stałych, WNT Warszawa 1964
4. J.F.Nye, Własności fizyczne kryształów, PWN Warszawa 1962
Additional
1. M.Kozielski, M.Kozielska, Wybrane zagadnienia z fizyki, Wyd. Politechniki Poznańskiej 1996
2. J.Massalski, Fizyka dla inżynierów tom 2, WNT Warszawa 1977

Breakdown of average student's workload

	Hours	ECTS
Total workload	111	4,00
Classes requiring direct contact with the teacher	65	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	50	2,00