COURSE DESCRIPTION CARD - SYLLABUS

Course name

Physics of Metals and Semiconductors

Course

Field of study Technical Physics	Year/Semester 1/1
Area of study (specialization)	Profile of study general academic
Level of study Second-cycle studies	Course offered in polish
Form of study full-time	Requirements compulsory

Number of hours

Lecture 30	Laboratory classes	Other (e.g. online)
Tutorials 15	Projects/seminars	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

prof. dr hab. Ryszard Czajka

e-mail:ryszard.czajka@put.poznan.pl

tel. 61-665-3234

Faculty of Materials Engineering and Technical Physics

Piotrowo street 3, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Knowledge of experimental physics and expertise in solid physics.

Ability to solve physical problems based on own knowledge, ability to obtain information from indicated sources.

Understanding the need to expand own knowledge of the basic properties of metals and semiconductors.

Course objective

1. Providing students with expertise in the physical properties of metals and semiconductors in classical and quantum terms – atomic structure, (lecture).

2. Familiarize students with computational methods in the field of the afored topics (exercises) estimating the characteristic parameters of metals and semiconductors in macroscale and on the scale of systems with reduced size.

3. Developing students' skills in analysing results and publicly presenting the results and discussing them in the forum.

Course-related learning outcomes

Knowledge

Student:

1. has an orderly understanding of the physical properties of metals and semiconductors in the description of classical physics and quantum physics. [K2_W03].

2. is familiar with the state of the art regarding the metallic and semiconductor properties of reduced size systems. [K2_W12, K2_W13]

3. has extensive knowledge of metal and semiconductor applications and relevant nanostructures in modern technologies, in particular nanoelectronics and optoelectronics [K2_W10]

Skills

Student:

1. is able, on the basis of literature, to analyze the state of the art in the field of research on selected properties of metals and semiconductors [K2_U01, K2_U02]

2. can independently estimate which systems of metallic and/or semiconductor materials can be used for applications in the construction of electron devices, sensors of different physical sizes [K2_U07].

3. efficiently present an oral presentation in Polish with well-documented and interpreted measurement results related to metal and semiconductor K2_U04.

Social competences

Student:

1. can independently expand his knowledge on the subject of metals and semiconductors and their applications in innovative technologies and industries [K2_K04].

2. can work on the task on his own and in the team, he shows responsibility in this work [K2_K01].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Effect	Form of assessment	Assessment criteria

W01, W02, W03	Assessment of theoretical knowledge in the basic range	50.1%-70.0% (3)
	and specific (resisting e.g. from size limitations) appropriate	70.1%-90.0% (4)
	metals and semiconductors and their applications from	od 90.1% (5)
U01, U02, U03	Assessment of the ability to use own knowledge to estimate (calculation) and indicate what materials or systems of the above materials are	50.1%-70.0% (3) 70.1%-90.0% (4)
	optimal for specific applications from	from 90.1% (5)
K01, K02	Assessment of self-acquisition activity	50.1%-70.0% (3)
	knowledge related to metal and semiconductor physics	70.1%-90.0% (4)
	using a computer program	from 90.1% (5)

Programme content

1. The basics of crystallography.

2. Characteristics of metals and semiconductors.

3. Drude's electron theory and its limitations.

4. Sommerfeld's theory, Fermi's decomposition - Dirac and its consequences.

5. Description of electron states in the solid body, band structure of electron states. Filling of electron states.

6. Superconductivity

7. Crystalline network vibration, electron (hole) transport in the crystal.

8. Overview of semiconductor materials, methods of obtaining semiconductor materials.

9. Semiconductor junctions, hetero junctions, transistors, semiconductor lasers.

10. Quantum effects in semiconductor devices.

Teaching methods

1. Lecture: multimedia presentations, solving sample tasks on the board,

2. Exercises: solving tasks, discussion.

Bibliography

Basic

1. H. Ibach, H. Lűth, Solid Physics, PWN Scientific Publishing House, 1996

2. W. A. Harrison, Solid State Theory, PWN 1976

3. J.M. Ziman, Introduction to Solid State Physics, PWN, Warsaw 1977

Additional

4. I.M. Cydlikowski, Electrons and Semiconductor Holes, PWN, 1976

5. Ch. Kittel, Introduction to Solid State Physics, PWN, 1999

6. N. W. Ashcroft, N. D. Mermin, Solid State Physics, PWN 1986

Breakdown of average student's workload

	Hours	ECTS
Total workload	92	3,0
Classes requiring direct contact with the teacher	57	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	35	1,0

[1] delete or add other activities as appropriate