COURSE DESCRIPTION CARD - SYLLABUS

Course name
Modern achievements of nanoscience and nanoengineering

Course

Field of study
Education in Technology and Informatics

Year/Semester
1/2

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

Projects/seminars
15

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
dr hab. Arkadiusz Ptak, prof. PP

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Responsible for the course/lecturer:

Prerequisites

Knowledge of basic issues of physics, including quantum mechanics, and basic knowledge of nanotechnology in the scope of the curriculum content implemented at the first-cycle studies in the field of Education in Technology and Informatics. The ability to solve elementary problems in science and technology with the use of appropriate models; the ability to make qualitative and quantitative analysis of experimental results; the ability to formulate conclusions based on the results obtained; the ability to obtain information from the indicated sources. Understanding the need to expand one's competences, demonstrating responsibility for one's own work, readiness to cooperate as part of a team.

Course objective

1. To provide students with up-to-date knowledge about the specific properties of materials in the nanometer scale and their current or anticipated use in science, industry and medicine.

2. To acquaint students with modern measurement methods and techniques used in nanoscience.

3. To acquaint students with the newest technologies of nanostructure production.

4. To develope students' skills in solving research and technical problems related to nanoscience and nanoengineering based on the acquired knowledge.

5. To shape students' self-education and teamwork skills.

Course-related learning outcomes

Knowledge

1. The student can define the concepts of nanoscience and nanoengineering, explain the specificity of the nanometer scale in relation to other size scales [K2_W01, K2_W14, K2_W15].

2. The student is able to list and characterize the most important contemporary methods of testing materials in the nanometer scale [K2_W07, K2_W12, K2_W16].

3. The student is able to list and describe the commonly used technologies of nanomaterials production [K2_W016].

4. The student is able to list and characterize the basic types of nanomaterials and give examples of their current and anticipated applications [K2_W15].

Skills

The student is able to:

1. make a comparison and selection of an appropriate method of material characterization in the micro and nanometer scale [K2_U09, K2_U10, K2_U13];

2. choose, from the known technologies of producing nanostructures, optimal to obtain a nanomaterial with the desired properties [K2_U12, K2_U20, K2_U22];

3. prepare a presentation in Polish on a topic related to nanoscience and nanoengineering, in particular on the latest achievements of nanoscience and applications of nanoengineering products [K2_U05];

4. use the indicated sources of knowledge and acquire knowledge from other sources, including the resources of Internet [K2_U03, K2_U04].

Social competences

The student acquires competences allowing for:

1. engaging in solving given tasks, self-development and broadening of one's competences [K2_K01, K2_K04, K2_K06];

2. fulfilling the duties entrusted as part of the division of work in a team, showing joint responsibility for the results of the team's work [K2_K03];

3. noticing the social and environmental effects of the development of nanotechnology, as well as understanding the need to provide reliable information to the society about these issues [K2_K02, K2_K05, K2_K07].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcome (symbol)	Method of assessment	Assessment criteria	
W01-04	written / oral exam	3	50.1%–70.0%
		4	70.1%–90.0%
		5	from 90.1%
U01-04, K01-03	projects		as above

Programme content

1. INTRODUCTION: historical outline, basic concepts of nanoscience and nanoengineering (reminding and extending the existing knowledge of students).

2. Contemporary methods of nanoscale materials research, with particular emphasis on modeling and computer simulations.

3. Modern technologies for producing nanostructures.

4. Basic types of nanostructures and their properties.

5. Applications and safety of nanoproducts.

6. The main problems and challenges of nanoscience and nanoengineering.

Teaching methods

1. Conversational lecture: multimedia presentation, simulation demonstrations, examples given on the blackboard, solving research problems.

2. Project: individual student's project work, discussion.

Bibliography

Basic

1. Nanoscale Science and Technology, red. R. W. Kelsall, I. W. Hamley, M. Geoghegan, 2008.

2. Nanomateriały inżynierskie konstrukcyjne i funkcjonalne, red. M. Lewandowska, K. Kurzydłowski, Wydawnictwo Naukowe PWN, Warszawa 2016.

3. Nanochemia. Podstawowe koncepcje, L. Cademartiri, G. A. Ozin, Wydawnictwo Naukowe PWN, Warszawa 2011.

Additional

1. Nanoscience: Nanotechnologies and Nanophysics, C. Dupas, Ph. Houdy, M. Lahmani (Eds), Springer-Verlag, Berlin 2007

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,0
Classes requiring direct contact with the teacher	50	
Student's own work (literature studies, preparation for exam, projects preparation) [1]	30	

[1] delete or add other activities as appropriate