COURSE DESCRIPTION CARD - SYLLABUS

Course name
Nanotechnology and biomaterials [S1IFar1>NiB]

Course

Field of study
Pharmaceutical Engineering

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
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The student should have basic knowledge in the field of general and inorganic chemistry, organic chemistry and biochemistry. The student should also have the ability to search information from literature, scientific databases and other properly selected sources, and show willingness to team- working. Understanding the necessity of training, understanding the need to extend one"s competences.

Course objective

Obtaining basic knowledge in the field of nanotechnology and biomaterials (including polymeric materials) and the basics of designing new materials for pharmaceutical purposes. The aim of the laboratory exercises is to familiarize students with the methods of producing and physico-chemical assessment of nanomaterials, including biomaterials and polymer composites.

Course-related learning outcomes

Knowledge:
k_w03 - has knowledge of physics, general, organic and inorganic chemistry enabling the understanding and description of phenomena and processes related to nanotechnology and the production of biomaterials.

k_w04 - has an ordered, theoretically founded general knowledge in the field of general, organic and inorganic chemistry, allowing for the understanding, description and study of chemical phenomena and processes related to nanotechnology and obtaining biomaterials (including polymer biomaterials).
k_w06 - knows the principles of environmental protection related to chemical production and the management of raw materials, materials in the production technology of nano and biomaterials (including polymeric biomaterials).
k_w07 - has knowledge of basic techniques, methods for the characterization and identification of nanoparticles and biomaterials. he knows the physicochemical properties of nanomaterials and biomaterials (including polymeric materials) for pharmaceutical use.
k_w09 - has knowledge of the basic concepts and terminology used in nanotechnology.
k_w14 - has knowledge about the development of nanotechnology, biomaterials technology (including polymeric biomaterials) and the research methods used in it, as well as the impact of nanotechnology and biomaterials on the development of various industries in the country and in the world.

Skills:
k_u01 - can obtain information from literature, databases and other sources related to the technologies of recycling of foamed materials, also in a foreign language, integrate them, interpret them, draw conclusions and formulate opinions.
k_u04 - has the ability to self-study.
k_u08 - is able to plan and organize work individually and in a team
k_u12 - can synthesize nanomaterials, biomaterials and polymeric materials for pharmaceutical applications with the use of basic laboratory techniques.
k_u22 - complies with health and safety rules related to the work performed and is able to assess the risks resulting from unit operations in nanotechnology.

Social competences:
k_k05 - the student understands the need for further education and improving his professional and personal competences.
k_k10 - is aware of the importance and understanding of non-technical aspects and effects of engineering activities, including its impact on the environment and the related responsibility for decisions made.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: Full-time credit - the knowledge acquired during the lecture is verified in the form of a written exam at the end of the lecture cycle. The exam consists of 10-20 test questions and 5-10 open-ended questions. Passing threshold: 50% of points. Examination issues will be sent to students by e-mail using the university"s e-mail system. If it is not possible to conduct the exam in a stationary form, the state of knowledge will be verified in the form of an on-line test (10-20 closed questions and 5-10 open questions) using the eKursy platform.
Laboratory: Laboratory skills are verified on the basis of a theoretical test consisting of 3-5 questions. Theoretical issues for all exercises are handed over during the organizational meeting. Passing threshold: 50% of points. Additionally, reports containing a description of the course of the experiment and the calculations made are subject to evaluation. If it is not possible to verify the state of knowledge in the stationary form, this assessment will be performed using the eKursy platform on the basis of an oral answer or test (consisting of 5-10 closed questions and 5-10 open questions).

Programme content

The lecture covers the following topics:
1. Definitions of nanotechnology and its basic concepts. History of nanotechnology development, directions of development and possible applications in science, industry, medicine and pharmacy. Nanotechnology in everyday life.
2. Methodological basis of nanotechnology - classification and characterization of nanostructures. Nanometals. Nanoceramics. Nano-coatings. Nanofibers. Nanotubes. Nanocomposites. Powder nanomaterials.
3. Methods of obtaining nanomaterials used in medicine and pharmacy as well as phenomena and processes at the nanoscale.

4. Characteristics and research methods of nanostructures.
5. Examples of nanomaterials applications in medicine and pharmacy.
6. Types of biomaterials: metallic, ceramic, polymer, carbon, composite. Criteria for the selection of materials in medicine.
7. Biocompatibility of materials and main criteria for the production of biocompatible materials
8. Examples of applications of biomaterials in medicine and pharmacy, with particular emphasis on polymeric biomaterials.
Exercises
As part of the laboratory exercises, students will carry out a synthesis and examine the properties of selected bimaterials / nanomaterials. The obtained materials will be used to obtain composite materials and the functional properties of the final materials will be determined.

Teaching methods

1. Lecture: multimedia presentation
2. Laboratory: practical classes using chemical reagents and research equipment

Bibliography

Basic
1. A. Zieliński, „Nanotechnologia w medycynie i kosmetologii”, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2018
2. K. Żelechowska, „Nanotechnologia w praktyce”, PWN, Warszawa 2016
3. M. Jurczyk, J. Jakubowicz, „Bionanomateriały”, Wydawnictwo Politechniki Poznańskiej, Poznań 2008
4. O. A. Geoffrey , L. Cademartiri, „Nanochemia, Podstawowe koncepcje”, PWN, Warszawa 2016
5. J.F. Rabek, „Współczesna wiedza o polimerach”, tom 1 i 2 PWN, Warszawa 2019
Additional
1. J. Rabek „Polimery”, PWN, Warszawa 2013
2. A. Prociak, G, Rokicki, J. Ryszkowska „Materiały poliuretanowe”, PWN, Warszawa 2014
3. M. Jurczyk, „Nanomateriały. Wybrane zagadnienia”, Wydawnictwo Politechniki Poznańskiej, Poznań 2001

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,20
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	0,80