COURSE DESCRIPTION CARD - SYLLABUS

Course name
Nanotechnology and biomaterials - biomaterials and nanomaterials for medical applications [S1IFar2>NiBbindzwm]

Course

Field of study
Pharmaceutical Engineering

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other
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 of biology, physics, general, organic and inorganic chemistry. He should have the ability to obtain information from literature, databases and other properly selected sources and be ready to cooperate within a team. Understanding the need for further education, understanding the need to expand one's competences.

Course objective

Obtaining basic knowledge in the field of nanomaterials and biomaterials (including nanotechnology). Learning the basics of designing new materials with application potential in the field of pharmacy and medicine. The main goal of laboratory exercises is to familiarize students with methods of preparing nanomaterials, biocomposites and biomaterials. It will be crucial for students to learn analyzes that allow them to assess the functional properties of the obtained materials.

Course-related learning outcomes

Knowledge:
1. Has knowledge of general, organic and inorganic chemistry enabling the understanding and

description of phenomena and processes related to nanomaterials and the production of biomaterials.[K_W3]
2. Has structured, theoretically based general knowledge in the field of general, organic and inorganic chemistry, enabling the understanding, description and study of phenomena and chemical processes related to nanomaterials and biomaterials (including polymer composites).[K_W4]
3. 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.[K_W6]
4. Has knowledge of basic techniques, methods for characterizing and identifying nanoparticles and biomaterials. Knows the physicochemical properties of nanomaterials (including polymeric materials) for use in broadly understood medicine.[K_W7]
5. Has knowledge of the basic concepts and terminology used in nanotechnology.[K_W9]
6. Has knowledge of the development of nanotechnology, nanomaterials technology (including polymeric biomaterials) and the research methods used therein, as well as the impact of nanotechnology on the development of various industries in the country and around the world.[K_W14]

Skills:
1. Can obtain information from literature, databases and other sources related to nanotechnology, also in a foreign language, integrate it, interpret it, draw conclusions and formulate opinions.[K_U1]
2. Has the ability to self-study.[K_U24]
3. Has able to plan and organize work individually and in a team.[K_U25]
4. Can synthesize nanomaterials, biomaterials and polymeric materials for pharmaceutical applications with the use of basic laboratory techniques.[K_U12]
5. Complies with health and safety rules related to the work performed and is able to assess the risks resulting from unit operations in nanotechnology.[K_U22]

Social competences:
1. Student understands the need for further education and improving his professional and personal competences.[K_K1]
2. 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.[K_K3]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Full-time assessment - the knowledge acquired during the lecture is verified in the form of a written assessment after the end of the lecture series. The assessment consists of 5 open questions. Passing threshold: 50% of points. The issues will be sent to students by e-mail using the university e-mail system or presented during a lecture. If it is not possible to conduct the exam in a stationary form, the knowledge will be verified in the form of an online test (10 closed questions) using the eKursy platform.
Laboratory: Skills during laboratory classes are verified on the basis of a test on theoretical issues, consisting of 3-5 questions. Theoretical issues for all exercises are provided during the organizational meeting. Passing threshold: 50% of points. Additionally, reports containing a description of the experiment and the calculations performed are assessed. If it is not possible to verify the knowledge in a stationary form, this assessment will be performed using the eKursy platform based on an oral answer or a test (consisting of 5 open questions).

Programme content

The program covers the following topics:
1. Fundamentals of nanotechnology.
2. Nanomaterials.
3. Biomaterials.
4. Methods of obtaining nanomaterials and biomaterials.
5. Methods of analysis of biomaterials and nanomaterials.
6. Polymeric biomaterials.
7. Applications of biomaterials.

Course topics

The lecture covers the following topics:
1. Introduction to nanotechnology. Nanotechnology in everyday life and in medicine.
2. Methodological basis of nanotechnology - classification and characterization of nanomaterials.
3. Nanometals. Nanoceramics. Nanocoatings. Nanofibers. Nanotubes. Nanocomposites. Powder nanomaterials.
4. Methods of obtaining nanomaterials.
5. Types of biomaterials: metallic, ceramic, polymer, carbon, composite. Criteria for the selection of materials in medicine.
6. Examples of applications of biomaterials in medicine and pharmacy, with particular emphasis on polymeric biomaterials.
Exercises:
As part of laboratory exercises, students will prepare biomaterials and nanocomposites. Then, they will determine the basic physicochemical and functional properties of the obtained materials.

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, „Nanomateriały. Wybrane zagadnienia”, Wydawnictwo Politechniki Poznańskiej, Poznań 2001
4. 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. 4.O. A. Geoffrey , L. Cademartiri, „Nanochemia, Podstawowe koncepcje”, PWN, Warszawa 2016
4. M. Jurczyk, J. Jakubowicz, „Bionanomateriały”, Wydawnictwo Politechniki Poznańskiej, Poznań 2008

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00