COURSE DESCRIPTION CARD - SYLLABUS

Course name
Nanotechnology and biomaterials - nanotechnology in medicine and pharmacy [S1IFar2>NiBnwmif]

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

dr inż. Przemysław Bartczak
przemyslaw.bartczak@put.poznan.pl

Lecturers

Prerequisites

The student should have basic knowledge of general, organic and inorganic chemistry and biology. He should also 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 nanotechnology (including polymer materials). Learning the basics of designing new materials for medical and pharmaceutical purposes. The aim of laboratory exercises is to familiarize students with methods of production and physico- chemical evaluation of nanomaterials (including polymer composites) and biomaterials (obtained using 3D printing).

Course-related learning outcomes

Knowledge:
1. 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_W3]

2. 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 biomaterials).[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 (including polymeric biomaterials).[K_W6]
4. Has knowledge of basic techniques, methods for the characterization and identification of nanoparticles and biomaterials. He knows the physicochemical properties of nanomaterials (including polymeric biomaterials) for pharmaceutical use.[K_W7]
5. Has knowledge of the basic concepts and terminology used in nanotechnology.[K_W9]
6. 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.[K_W14]

Skills:
1. Can obtain information from literature, databases and other sources related to the technologies of recycling of polymer materials, also in a foreign language, integrate them, interpret them, draw conclusions and formulate opinions.[K_U1]
2. Has the ability to self-study.[K_U24]
3. Is 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 lecture covers the following topics:
1. Definitions of nanotechnology and its basic concepts. History of nanotechnology development, directions of development and possibilities of application in science, industry and pharmacy. Nanotechnology in everyday life.
2. Classification and characterization of nanostructures.
3. Methods of obtaining nanomaterials used in medicine and pharmacy, as well as phenomena and processes at the nanoscale.
4. Characterization of nanostructures (research methods).
5. Biocompatibility of materials and main criteria for the production of biocompatible materials.
6. Examples of applications of biomaterials in medicine and pharmacy.
Exercises:

As part of laboratory exercises, students will synthesize 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. During laboratory classes, students learn the principles of operation of the AFM laboratory.

Course topics

none

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. K. Schmidt-Szałowski, M. Szafran, J. Sentek, E. Bobryk, Technologia chemiczna. Przemysł nieorganiczny, PWN, Warszawa 2012
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. M. Jurczyk, „Nanomateriały. Wybrane zagadnienia”, Wydawnictwo Politechniki Poznańskiej, Poznań 2001
4.O. A. Geoffrey , L. Cademartiri, „Nanochemia, Podstawowe koncepcje”, PWN, Warszawa 2016
5. 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