COURSE DESCRIPTION CARD - SYLLABUS

Course name
Nanomaterials for applications in biomedicine

Course

Field of study
Bioinformatics

Year/Semester
3/6

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

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

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

Basic knowledge of general and inorganic chemistry, physical chemistry, physics, organic chemistry and biochemistry. Knowledge of the basic equipment and reagents used in the chemical laboratory and the ability to perform chemical calculations. Ability to use basic laboratory techniques. In addition, the student should understand the need for further education and improving their professional and personal competences.

Course objective

Knowledge related to the basics of nanotechnology and the basics of designing new materials for pharmaceutical and biotechnological purposes, as well as trends in the use of nanostructures for biomedical purposes. The practical aim is to familiarize students with the methods of manufacturing and physicochemical assessment of nanomaterials used in modern biology, medicine and pharmacy.

Course-related learning outcomes

Knowledge

K_W03 Student has knowledge of physics useful for understanding and describing physical phenomena related to nanotechnology.

K_W04 Student has knowledge of chemistry useful in formulating and solving simple tasks in the field of nanotechnology, covering the basic concepts and laws of chemistry, organic chemistry and biochemistry.

K_W08 Student has knowledge of selected groups of bioactive compounds, nanomaterials and their biochemical properties, and their impact on cells and living organisms.

K_W15 Student has knowledge of the basics of designing nanotechnological processes and methods of their implementation, taking into account the equipment and processes used.

K_W16 Student has knowledge of modern analysis methods allowing for the assessment of the properties and structure of biomaterials and nanomaterials.

K_W19 Student has knowledge of the techniques and methods of synthesis of biomaterials and biologically active compounds.

K_W20 Student has knowledge of nanotechnology development trends.

Skills

K_U02 Student, based on general knowledge, explains the basic phenomena related to nanotechnology, distinguishes between the types of nanoparticle production, can characterize various forms of nanomaterials, using theories used to describe them, methods and experimental techniques

K_U03 Student applies basic techniques, equipment and laboratory apparatus in the synthesis, isolation and purification of chemical compounds, including biomolecules and biologically active compounds used in nanotechnology and the synthesis of biomaterials.

Social competences

K_K01 Student understands the need for lifelong learning and improving their competences.

K_K03 Student is able to properly define priorities for the implementation of a task set by himself or others, has the habit of supporting help and remedial actions, is responsible for the safety of his own work and that of others, knows how to act in emergency situations.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

The knowledge acquired during the lectures is verified in the form of a written exam at the end of the lectures. Passing threshold: 50% of points. Exam issues will be presented during lectures.

Laboratory:

As part of the laboratory classes, student's skills are verified on the basis of a test on theoretical issues, which consists of 3-5 questions. For each of the exercises, the student receives a list of theoretical issues. Passing threshold: 50% of points. Additionally, reports containing a description of the course of the experiment and the calculations made are subject to evaluation.

Programme content

Basics of nanomaterials - concepts, definitions, properties. Development directions, concepts and possibilities of applying nanotechnology in science, technology and medicine. Methodological basis of nanotechnology - methods of obtaining, classification and characterization of nanostructures. Nanometals. Nanoceramics. Nano-coatings. Nanofibers. Nanotubes. Nanocomposites. Powder nanomaterials. Methods of obtaining nanomaterials. Preparation and classification of nanostructures. Characteristics of nanostructures. Social effects of the development and application of nanotechnology and its development in Poland. Progress in medicine, requirements for materials as regards their properties, biocompatibility, biocompatibility. Overview of specific nanomaterials for applications in medicine, dentistry and veterinary medicine. Polymers for applications in medicine and pharmacy (star polymers, dendrimers, molecular brushes). Selection of materials for implants and their applications and behavior under the influence of the environment of living organisms. Influence of physiological and biological environments on the degree of degradation of bionanomaterials. Nanotechnology in the process of discovery and research of a pharmaceutically active substance and the development of a drug form. Drug delivery systems (polymeric, viral) - definition, types and classifications. Nanotechnology in gene therapy - progress and challenges. Polymer materials for pharmaceutical applications, polymer hydrogels used in pharmacy and medicine. Applications of polymer nanoparticles, metal complexes, liposomes (methods of synthesis, properties, application). Nanosensors.

Teaching methods

Practical laboratory classes, multimedia presentations

Bibliography

Basic

1. Z. Floriańczyk, S. Penczek, Chemia Polimerów, t.III, Polimery naturalne i polimery o specjalnych właściwościach, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2001

2. J. Marciniak, Biomateriały, Wyd. Politechniki Śląskiej, Gliwice, 2002

3. W. Kelsall, I.W. Hamley, M. Geoghegan; "Nanotechnologie", pod red. R., Wydawnictwo Naukowe PWN, 2009

4. Sokół J.L. Nanotechnologia w życiu człowieka. Economy and Managment 2012;1:18-29.

Additional

1. A. Zejc, M. Gorczyca (red.), „Chemia leków”, Wydawnictwo Lekarskie PZWL, Warszawa 2004.

2. Geoffrey O. A., Cademartiri L. (2016) Nanochemia. Podstawowe koncepcje, Wydawnictwo Naukowe PWN, Warszawa

3. Songjun Li, Jagdish Singh, He Li, and Ipsita A. Banerjee; "Biosensor Nanomaterials" Wiley-VCH, 2011

4. de Villiers M.M., Aramwit P., Kwon G.S. (2009) Nanotechnology in Drug Delivery, Springer AAPS

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	20	0,5

[1] delete or add other activities as appropriate