Warsaw University of Technology

COURSE OFFERED IN THE DOCTORAL SCHOOL

Code of the course	4606-ES-DEGIKLP-0281	Name of the course	Polish	**Zastosowanie nanocząstek w bioanalizie i terapiach**
			English	**Application of nanoparticles in bioanalysis and therapies**
Type of the course	specialty courses			
Course coordinator	Prof. Mariusz Pietrzak, D.Sc. Ph.D Eng.			
Implementing unit	Faculty of Chemistry	Scientific discipline / disciplines*	chemical sciences, chemical engineering; environmental, mining and energy engineering; physical sciences, biomedical engineering, materials engineering, biotechnology	

Level of education	Education of doctoral students	Semester	summer		
Language of the course	English				
Type of assessment:	Assessment with a grade	Number of hours in a semester	30	ECTS credits	2
Minimum number of participants	10	Maximum number of participants	15	Available for students (BSc, MSc)	No

Type of classes		Lecture	Auditory classes	Project classes	Laboratory	Seminar
Number of hours	in a week	1				1
	in a semester	15				15

* does not apply to the Researcher's Workshop

1. Prerequisites

Basic knowledge of general, inorganic and organic chemistry

2. Course objectives

The course entitled: Application of nanoparticles in bioanalysis and therapies consists of two parts: a lecture and a seminar. In a framework of this course PhD students get acquainted with the properties and chosen applications of various types of nanoparticles. In a first part of the lecture basics, definitions and general methods of synthesis of nanoparticles and stabilization are discussed. Subsequently, the most popular methods used for characterization of nanoparticles are shown and discussed. Next part of the lecture is dedicated to introduction of various types of nanoparticles such as: metal- and oxide-based nanoparticles, quantum dots, carbon- and polymer-based nanoparticles and discussion of their properties. Next, the most typical methods of (bio)functionalization of nanoparticles including formation of monolayers and protein-crowns are presented. The last part of the lecture concerns the application of nanoparticles in bioanalytics, including modern biotests and biosensors and application of various nanoparticles of desired properties in therapies.

The seminar is devoted to a discussion on the most typical and modern application of nanoparticles in chosen fields of bioanalysis and therapies. Students are supposed to give presentations concerning a chosen topic directly linked to the subject of this course.

3. Course content (separate for each type of classes)

Lecture

W1. Basics, definitions and general methods of synthesis.

W2. Methods for the characterization of nanoparticles.

W3. Metal- and oxide-based nanoparticles.

W4. Quantum dots, carbon-based and polymer nanoparticles.

W5. (Bio)functionalization of nanoparticles.

W6. Application of nanoparticles in bioanalytics.

W7. Application of nanoparticles in therapies.

Seminar

S1-2. Discussions on selected articles concerning the chosen subjects from the area covered by the lecture.

S3-4. Presentations given by students.

4. Learning outcomes			
	Learning outcomes description	Reference to the learning outcomes of the WUT DS	Learning outcomes verification methods*
Knowledge			
K01	the graduate knows and understands to the extent that it is possible to revise the existing paradigms - global achievements, including theoretical foundations and general issues and selected specific issues - appropriate for the represented scientific discipline, including the latest scientific achievements in the field of research	SD_W2	presentation evaluation; active participation during classes
K02	the graduate knows and understands the main development trends of the scientific discipline pursued and related research methodologies	SD_W3	presentation evaluation; test; active participation during classes
Skills			
S01	the graduate is able to make a critical analysis and evaluation of the results of scientific research, expert activity and other creative works and their contribution to the development of knowledge, in particular to assess the usefulness and possibility of using the results of theoretical work in practice	SD_U2	presentation evaluation; active participation during classes
S02	the graduate is able to communicate on specialist topics relevant to the represented scientific discipline, to the extent enabling active participation in the national and international scientific environment, including as part of international consortia of research universities	SD_U4	presentation evaluation; active participation during classes
S03	the graduate is able to initiate a debate and participate in the scientific discourse as well as provide appropriate arguments in scientific discussions and public debates on various topics	SD_U5	presentation evaluation; active participation during classes
Social competences			
SC01	the graduate is ready to recognize the importance of knowledge and scientific achievements in solving cognitive and practical problems	SD_K1	presentation evaluation; active participation during classes

*Allowed learning outcomes verification methods: exam; oral exam; written test; oral test; project evaluation; report evaluation; presentation evaluation; active participation during classes; homework; tests

5. Assessment criteria
Results of a test + evaluation of a presentation + activity

6. Literature
Basic literature:
[1] Raz Jelinek, Nanoparticles, De Gruyter, 2015 DOI: https://doi.org/10.1515/9783110330038
[2] Materials from the lecture

[3] Subash Gopinath, Nanoparticles in Analytical and Medical Devices, Elsevier, 2020
https://doi.org/10.1016/C2019-0-01803-1

Supplementary literature:

[1]] Articles from scientific databases (Scopus etc.)

7. PhD student's workload necessary to achieve the learning outcomes**		
No.	Description	Number of hours
1	Hours of scheduled instruction given by the academic teacher in the classroom	30
2	Hours of consultations with the academic teacher, exams, tests, etc.	10
3	Amount of time devoted to the preparation for classes, preparation of presentations, reports, projects, homework	15
4	Amount of time devoted to the preparation for exams, test, assessments	5
	Total number of hours	**60**
	ECTS credits	**2**

** 1 ECTS = 25-30 hours of the PhD students work (2 ECTS = 60 hours; 4 ECTS = 110 hours, etc.)