A COURSE SYLLABUS – DOCTORAL SCHOOL

REGARDING THE QUALIFICATION CYCLE FROM 2021 TO 2025

GENERAL INFORMATION ABOUT COURSE	
Course title	Bionanomaterials - progress in synthesis and their application
Name of the unit running the course	Doctoral School at University of Rzeszów
Type of course *(obligatory, optional)*	obligatory
Year and semester of studies	2022/2023; semester 4
Discipline	Biological sciences
Language of Course	polish
Name of Course coordinator	dr hab. Małgorzata Kus-Liśkiewicz, prof. UR
Name of Course lecturer	dr hab. Małgorzata Kus-Liśkiewicz, prof. UR
Prerequisites	Knowledge of the basics of nanomaterials syntheses, knowledge of the basics of cell functioning and methods of analysing its metabolism

BRIEF DESCRIPTION OF COURSE
(100-200 words)

To acquaint the student with information on the possibility of producing bionanomaterials. Presentation of their types and the possibility of various functionalisation. Discussion of the latest achievements in the field of application of bionanomaterials in biotechnology and biomedicine. Acquainting with legal regulations concerning the use of bionanomaterials.

COURSE LEARNING OUTCOMES AND METHODS OF EVALUATING LEARNING OUTCOMES

Learning outcome	The description of the learning outcome defined for the course	Relation to the degree programme outcomes (symbol)	Learning Format (Lectures, classes,...)	Method of assessment of learning outcomes (e.g. test, oral exam, written exam, project,...)
Knowledge (no.)	**(Knows and understands)**			
LO1	Knows and understands the methods of synthesis and modification of bionanomaterials used in biotechnology and biomedicine.	P8S_WG/1, P8S_WG/2	L, C	Project
LO2	Knows the procedures and research methodology used to analyze the potential of nanobiomaterials in relation to biological systems.	P8S_WG/3	L, C	Project
LO3	Able to analyze the results of research on the properties of the procedures used in the study of the interactions of bionanomaterials and presents his / her own opinion	P8S_UW/2, P8S_UK/1, P8S_UW/1	L, C	Project
LO4	Able to present the latest achievements in the field of material synthesis and engage in a discussion using the English-language literature,	P8S_UK/2, P8S_UK/3, P8S_UK/4 P8S_UK/5	L, C	Presentation
LO5	Ready to critically assess the selection and validity of the research used in the analysis of the impact of bionanomaterials	P8S_KK/1, P8S_KK/3	L, C	Project, presentation

	in in vitro and in vivo systems			
LO6	Ready to initiate activities aimed at disseminating knowledge about the application of bionanomaterials	P8S_KO/2	L, C	Project, presentation

LEARNING FORMAT – NUMBER OF HOURS

Semester (no.)	Lectures	Seminars	Lab classes	Internships	others	ECTS
4	5	10	—	—	—	0

METHODS OF INSTRUCTION

a lecture supported by a multimedia presentation, film presentation, flipped learning method, discussion

COURSE CONTENT

Development and prospects of created bionanomaterials and composite materials. The latest developments in synthesis and application processes. Properties of natural and synthetic composites and their influence on biological systems. Cell as an indicator of biocompatibility. Cytotoxicity, genotoxicity and immuntoxicity tests. The methodology of in vivo research used in the analysis of the impact of bionanomaterials. Techniques used to evaluate the materials produced. Norms and legal regulations concerning the use of bionanomaterials.

COURSE ASSESSMENT CRITERIA

Seminars – written project based on the knowledge obtained during the lectures. Criteria: 65% - 3.0; 75% - 3.5; 85% - 4.0; 90 – 4.5; 95-100% - 5.0.
Lecture – score obtained after presentation; criteria: 65% - 3.0; 75% - 3.5; 85% - 4.0; 90 – 4.5; 95-100% - 5.0.

TOTAL PhD STUDENT WORKLOAD REQUIRED TO ACHIEVE THE INTENDED LEARNING OUTCOMES – NUMBER OF HOURS AND ECTS CREDITS

Activity	Number of hours
Scheduled course contact hours	15
Other contact hours involving the teacher (consultation hours, examinations)	4
Non-contact hours – student`s own work (preparation for classes or examinations, project, etc.)	15
Total number of hours	34
Total number of ECTS credits	0

INSTRUCTIONAL MATERIALS

Compulsory literature:	1.Michael Giersig and Gennady B. Khomutov, Nanomaterials for application in medicine and biology, Nanotechnologia - materiały konferencyjne, 2008,: Springer 2.J. Marciniak, Biomateriały, Wyd. Politechniki Śląskiej, Gliwice 2013; 3.Adam Mazurkiewicz Biomateriały : laboratorium, Uniwersytet Technologiczno-Przyrodniczy im. Jana i Jędrzeja Śniadeckich (Bydgoszcz); 4.Bikramjit Basu, Dhirendra Katti and Ashok Kumar, Advanced biomaterials : fundamentals,

	processing and applications; 5.Zofia Knychalska-Karwan, Anna Ślósarczyk, Hydroksyapatyt w stomatologii, Kraków : Krakmedia
Complementary literature:	Research type of publications

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Date and signature of the Course lecturer

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Approved by the Head of the Department or an authorised person