Course Syllabus

I. General Information

Course name in English	Application of nanomaterials
Course name in Polish	Zastosowanie nanomateriałów
Programme	Bioanalytical Technologies
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	MSc
Form of studies (full-time, part-time)	full-time
Discipline	Biological sciences
Language of instruction	English

Course coordinator/person responsible	dr Anna Borówka

Type of class *(use only the types mentioned below)*	Number of teaching hours	Semester	ECTS Points
lecture	30	III	6
classes	30	III	

Course pre-requisites	Inorganic chemistry, organic chemistry, physical chemistry

II. Course Objectives

C 1 – To acquaint students with the methods of synthesis of nanostructured materials
C 2 – To familiarize students with characterization techniques used in nanomaterials and nanostructures
C 3 – To inform students about applications of nanomaterials in the biomedical and environmental fields

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
KNOWLEDGE: Graduate		
W_01	knows the specific terminology used in biotechnology and materials engineering	K_W01
W_02	has advanced knowledge of biochemistry and materials engineering necessary for practical use in various branches of industry	K_W02
W_03	knows the fundamental principles of H&S and ergonomics	K_W07
SKILLS: Graduate		
U_01	applies advanced techniques and research tools in the life sciences	K_U01
U_02	uses statistical methods for analysis and verification of experimental results	K_U04

U_03	can evaluate the environmental threats related with applied technology	K_U12
U_04	collects and interprets experimental data and on that basis formulates appropriate conclusions	K_U14
SOCIAL COMPETENCIES: Graduate		
K_01	understands the benefits and risks of the materials engineering products use	K_K02
K_02	is taking care on entrusted laboratory equipment, is able to gauge danger resulting from applied research methods	K_K03
K_03	acts in accordance with the principles of occupational health and safety	K_K05

IV. Course Content

Lecture:
1: Nanomaterials and nanotechnology. Classification of nanomaterials.
2: Nanocharacterization techniques: SEM, TEM, AFM, XRD, SAXS.
3: Spectroscopic techniques: UV-Vis spectroscopy, FTIR, Raman scattering.
4: Adsorption techniques.
5: Synthesis methods for fabrication of inorganic nanoparticles.
6: Synthesis methods for obtaining of organic and hybrid nanoparticles.
7: Nature materials.
8: Magnetic nanomaterials. 3D bioprinting.
9: Applications of nanomaterials and techniques.
10: Nanomaterials for protein analysis.
11: Carbon and organic materials for biomedical applications.
12-13: Nanostructures for drug delivery applications.
14: Nanomaterials for biodiagnostic.
15: Nanotechnology in improving medical devices.
Lab classes:
Synthesis of nanomaterials.
Characterization of obtained samples using adsorption and spectroscopic methods.
Application of nanomaterials in drug release.

V. Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
KNOWLEDGE			
W_01	Conventional lecture Discussion	Written test	Evaluated written test/test
W_02	Conventional lecture Discussion	Written test	Evaluated written test/test
W_03	Laboratory classes	Observation	Observation report
SKILLS			
U_01	Laboratory classes	Observation and Report	Report printout
U_02	Laboratory classes	Observation and Report	Report printout
U_03	Practical classes	Test of practical skills	Rating card
U_04	Laboratory classes	Observation and Report	Report printout

SOCIAL COMPETENCIES			
K_01	Laboratory classes	Observation	Observation report
K_02			
K_03			

VI. Grading criteria, weighting factors

Lecture
100% grade from the exam
Lab classes
80% grades from the written test, 10% reports, 10% work during classes

Mark	Evaluation criteria	
Very good (5)	the student realizes the assumed learning outcomes at a very good level	the student demonstrates knowledge of the education content at the level of 95-100%
overgood (4.5)	the student accomplishes the assumed learning outcomes an over good level	the student demonstrates knowledge of the education content at the level of 85-94 %
Good (4)	the student accomplishes the assumed learning outcomes at a good level	the student demonstrates knowledge of the education content at the level of 75-84%
Quite good (3.5)	the student accomplishes the assumed learning outcomes at a quite good level	the student demonstrates knowledge of the education content at the level of 65-74%
sufficient (3)	the student accomplishes the assumed learning outcomes at a sufficient level	the student demonstrates knowledge of the education content at the level of 55-64%
insufficient (2)	the student accomplishes the assumed learning outcomes at an insufficient level	the student demonstrates knowledge of the education content below the level of 55%

VII. Student workload

Form of activity	Number of hours
Number of contact hours (with the teacher)	70 (60 + 10 individual consultation)
Number of hours of individual student work	80

VIII. Literature

Basic literature
1. I. Bhushan, V.K. Singh, D.K. Tripathi, Nanomaterials and Environmental Biotechnology, Springer, 2020. 2. X. Wang, X. Chen, Novel Nanomaterials for Biomedical, Environmental and Energy Applications, Elsevier, 2018. 3. O. de Oliveira, Jr, F. Marystela, F. de Lima Leite, A. L. Da Róz, Nanocharacterization Techniques, 1st Edition, Elsevier, 2017.
Additional literature
1. Current scientific articles. 2. A.R. Unnithan, A.R.K. Sasikala, Ch. Park, Ch. Kim, Biomimetic Nanoengineered Materials for Advanced Drug Delivery, 1st Edition, Elsevier, 2019.