Zał. nr 5 do ZW 78/2023

Attachment no. 4. to the Program of Studies

FACULTY of Chemistry

SUBJECT CARD

Name of subject in Polish Nanomateriały
Name of subject in English Nanomaterials
Main field of study (if applicable): Advanced Nano and Biomaterials - MONABIPHOT
Specialization (if applicable): ……..
Profile: academic
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code W03ANB-SM2011W, W03ANB-SM2011S
Group of courses NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				15
Number of hours of total student workload (CNPS)	50				25
Form of crediting (Examination / crediting with grade)					
For group of courses mark (X) final course					
Number of ECTS points	2				1
including number of ECTS points for practical classes (P)					1
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1,3				0,7

*delete as not necessary

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. General chemistry
2. Basics of physics
3. Basics of biology

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SUBJECT OBJECTIVES

C1 To provide students with a general knowledge on the synthesis of nanomaterials
C2 To provide students with a general knowledge on the chemical and physical properties of nanomaterials
C3 To provide students with a general knowledge on the applications of nanomaterials
C4 To provide students with a general knowledge on the challenges and dangers of the applications of nanomaterials

SUBJECT EDUCATIONAL EFFECTS

related to knowledge:
PEU_W01student knows the differences in the properties of nanomaterials and bulk materials

PEU_W02 student knows the methods of the synthesis of nanomaterials
PEU_W03 student knows the lithographic techniques used to produce nanomaterials
PEU_W04 student knows methods of characterization of nanomaterials – structural investigations and optical spectroscopies and microscopies of a single nanoparticle, nanomanipulation
PEU_W05 student knows the properties and applications of plasmonic nanomaterials
PEU_W06 student knows the properties and applications of metal nanoparticles
PEU_W07 student knows the properties and applications of quantum dots
PEU_W08 student knows the properties and applications of carbon nanomaterials
PEU_W09 student knows the properties and applications of lanthanide-doped nanomaterials
PEU_W10 student knows the properties and applications of 2D nanomaterials
PEU_W11 student knows the properties and applications of nanofibers and composite nanomaterials
PEU_W12 student knows the processes in self-assembly of nanomaterials
PEU_W13 student knows the methods of bioconjugation and functionalization of nanomaterials
PEU_W14 student knows and understands the dangers of the applications of nanomaterials

related to skills:
PEU_U01 - Can name and define concepts in the field of nanomaterials and search for information on nanomaterials from available sources.
PEU_U02- Can name methods of synthesis of colloidal nanomaterials.
PEU_U03- Can name and compare the physical methods of synthesis of nanomaterials.
PEU_U04- Has language skills in the field of nanoparticle characterization methods.
PEU_U05- Is able to recognize, name and define plasmonic nanomaterials
PEU_U06- Is able to recognize, name and define metal nanoparticles
PEU_U07- Can recognize, name and define properties and applications of quantum dots
PEU_U08- Is able to recognize, name and define properties and applications of carbon nanomaterials
PEU_U09- Can recognize, name and define properties and applications of 2D nanomaterials
PEU_U10 - Is able to recognize, name and define properties and applications of nanoparticles with lanthanides
PEU_U11 - Is able to recognize, name and define properties and applications of nanofibers and nanocomposites
PEU_U12 - Can name and define methods for self-assembly of nanoparticles
PEU_U13 - Can name methods of nanoparticles functionalization
PEU_U14 - Can identify the dangers and prospects of nanomaterials applications

related to social competences:
PEU_K01 student is ready to critically evaluate his/her knowledge and received content

PROGRAMME CONTENT

	Lecture	**Number of hours**
Lec 1	Introduction to nanomaterials, definitions, nanomaterials vs. bulk materials, general methods of nanomaterials preparation	2
Lec 2	Synthesis of nanomaterials, colloidal nanoparticles	2
Lec 3	Physical techniques for nanomaterials preparation	2

Lec 4	Characterization of nanomaterials – structural investigations and optical spectroscopies and microscopies of a single nanoparticle	2
Lec 5	Plasmonic nanoparticles: synthesis, properties and applications	2
Lec 6	Metal nanoparticles: nanoclusters, heterostructures	2
Lec 7	Quantum dots: synthesis, properties, applications	2
Lec 8	Carbon nanomaterials: synthesis, properties, applications	2
Lec 9	2D nanomaterials (TMD, graphene etc.)	2
Lec 10	Lanthanide-doped nanomaterials: synthesis, properties, applications	2
Lec 11	Biology-inspired nanomaterials	2
Lec 12	Self-assembly of nanoparticles	2
Lec 13	Functionalization of nanomaterials, bioconjugation	2
Lec 14	Perspectives, challenges and dangers in the applications of nanomaterials. Nanotoxicology.	2
Lec 15	Exam	2
	Total hours	30

Seminar		**Number of hours**
Semin 1	Introduction to presentation of nanomaterials and recent discoveries in nanotechnology	2
Semin 2	Presentations of students on nanomaterials	2
Semin 3	Presentations of students on nanomaterials	2
Semin 4	Presentations of students on nanomaterials	2
Semin 5	Presentations of students on nanomaterials	2
Semin 6	Presentations of students on nanomaterials	2
Semin 7	Evaluation	1
	Total hours	15

TEACHING TOOLS USED
N1. Multimedia presentation N2. Discussion during lectures and seminars

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1 (lecture)	PEU W01-14	exam
P2 (seminar)	PEU U01-14	student presentation

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] Paras N. Prasad, Nanophotonics, Wiley-Interscience, 2004 [2] K. D. Sattler, Handbook of nanophysics, CRC Press, 2011 [3] Paras N. Prasad, Introduction to Nanomedicine and Nanobioengineering, Wiley, 2012 [4] C. Louis, O. Pluchery, Gold Nanoparticles for physics, chemistry and biology, Imperial College Press 2012 [5] Challa S. S. R. Kumar, Biofunctionalization of Nanomaterials. Wiley 2005
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
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