

FACULTY OF CHEMISTRY

SUBJECT CARD**Name of subject in Polish** Nanoinżynieria Seminarium + Projekt**Name of subject in English** Nano-engineering Seminar + Project**Main field of study (if applicable):** Chemical Nano-Engineering**Specialization (if applicable):****Profile:** academic**Level and form of studies:** 2nd level, , full-time**Kind of subject:** obligatory**Subject code****Group of courses** NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)		18			
Number of hours of total student workload (CNPS)		60			
Form of crediting	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*	crediting with grade*
For group of courses mark (X) final course					
Number of ECTS points		2			
including number of ECTS points for practical classes (P)		2			
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)		1.4			

*delete as not necessary

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Bases of physics and chemistry.
2. Introductory notions in material science.
3. Basic information on programming and computer simulations.
4. Basic knowledge about potential applications of nanotechnologies.

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SUBJECT OBJECTIVES

C1 . Analysis of current trends in nanotechnology and nanoengineering.

C2 . Update on the newest discoveries in nanotechnology and nanoengineering.

SUBJECT EDUCATIONAL EFFECTS**related to knowledge:**

After the course, the student:

PEU_W01 – knows the current trends and discoveries in nanotechnology and nanoengineering;
 PEU_W02 – understand what are the real perspectives of nanotechnologies development;
related to skills:
 After the course, the student:
 PEU_U01 – is able to search for information in international scientific journals;
 PEU_U02 – is able to analyze the information from a scientific paper;
 PEU_U03 – is able to prepare a synthetic, comprehensive slides of scientific quality;
 PEU_U04 – is able to give the presentation and give quality answers to the questions in the discussion following presentation.
related to social competences:
 After the course, the student:
 PEU_K01 – is able to discuss the current trends in nanotechnologies;
 PEU_K02 – is able to present the arguments for the large scale applications of nanotechnologies;
 PEU_k03 – is able to take part and argue in discussions about the environmental and health consequences of nanotechnologies development.

PROGRAMME CONTENT		
Seminar		Number of hours
CI1	<p>Introduction to nanoengineering: nanoscale fabrication, top-down and bottom-up approaches: nanolithography and self-assembly.</p> <p>Synthesis techniques, processes, microstructural control, and unique physical properties of materials in nanodimensions</p> <p>Nanoscale detection methods.</p> <p>Molecular electronics. Nanotechnology in integrative systems.</p> <p>Nanotechnology in magnetic systems</p> <p>Quantum mechanics in nanoelectronics, Wave mechanics, the Schroedinger equation, free and confined electrons, band theory of solids</p> <p>Biomimetic systems: nanomotors, lipid vesicles. Nanobiotechnology.</p> <p>Nanofluidics. Mechanical behavior of nanostructures. Nanoactuators.</p> <p>Specific role of molecular interactions and signal pathways at nanoscale.</p> <p>Chemical principles involved in synthesis, assembly, and performance of nanostructured materials and devices.</p> <p>Classical and statistical thermodynamics of small systems: chemical and physical interactions, transport of matter, diffusion.</p> <p>Characterization tools of nanomaterials and nanostructures.</p> <p>0D, 1D, and 2D nanosolids: nanotubes, nanowires, nanodots. Nanoparticles and nanocomposites.</p> <p>Nanoscale optoelectronics. Nanowires, quantum dots, thin films, electrical transport, electron emission properties, optical properties. Optical tweezers., Carbon-based nanomaterials. Supramolecular chemistry. Liquid crystals.</p> <p>Colloid and polymer chemistry. Surface modification and functionalization.</p> <p>Catalysis.</p> <p>Biomolecules: structure/function relation. Principles of biochemistry tailored to nanotechnologies. Nanomedicine .</p> <p>Broad implications of nanotechnology. Problems in miniaturization: scaling laws, nanoscale physics.</p>	

	Total hours	18

TEACHING TOOLS USED
<p>N1. Diaporama presentations.</p> <p>N2. Review of recent articles published in relevant ‘nano’ oriented scientific journals.</p> <p>N3. Invited presentations of scientists and industrial staff working in the domains of nanotechnology.</p> <p>N4. Analysis of the potential master thesis subjects.</p> <p>.</p>

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
P	PEU_W01, PEU_W02, PEU_U01, PEU_U02, PEU_U03, PEU_U04, PEU_K01, PEU_K02, PEU_K03	30’ presentation on a chosen aspect/application of nanotechnology or nanoengineering will be graded.

PRIMARY AND SECONDARY LITERATURE
<p><u>PRIMARY LITERATURE:</u></p> <p>[1] Scientific journals from the field of nanosciences.</p>
<p>SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)</p> <p>Bogdan KUCHTA e-mail: bogdan.kuchta@univ-amu.fr</p>