

FACULTY OF CHEMISTRY					
SUBJECT CARD					
Name of subject in English:	NANOENGINEERING Seminar & Project				
Main field of study (if applicable):	Chemical and Process Engineering				
Specialization (if applicable):	Chemical Nanoengineering				
Profile:	academic				
Level and form of studies:	1st/2nd level, full-time				
Kind of subject:	obligatory				
Subject code:	ICC025009				
Group of courses:	NO				
	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)					30
Number of hours of total student workload (CNPS)					60
Form of crediting					crediting with grade
For group of courses mark (X) final course					
Number of ECTS points					2
including number of ECTS points for practical (P) classes					2
including number of ECTS points for direct teacher-student contact (BK) classes					1
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.					
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: PEK_W01 – knows the current trends and discoveries in nanotechnology and nanoengineering; PEK_W02 – understand what are the real perspectives of nanotechnologies development; related to skills: After the course, the student: PEK_U01 – is able to search for information in international scientific journals; PEK_U02 – is able to analyze the information from a scientific paper; PEK_U03 – is able to prepare a synthetic, comprehensive slides of scientific quality; PEK_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: PEK_K01 – is able to discuss the current trends in nanotechnologies; PEK_U02 – is able to present the arguments for the large scale applications of nanotechnologies; PEK_U03 – is able to take part and argue in discussions about the environmental and health consequences of nanotechnologies development.					
PROGRAMME CONTENT					
Seminar					Number of hours

Proj 1	Introduction to nanoengineering: nanoscale fabrication, top-down and bottom-up approaches: nanolithography and self-assembly.	2
Proj 2	Synthesis techniques, processes, microstructural control, and unique physical properties of materials in nanodimensions	2
Proj 3	Nanoscale detection methods.	2
Proj 4	Molecular electronics. Nanotechnology in integrative systems. Nanotechnology in magnetic systems	2
Proj 5	Quantum mechanics in nanoelectronics, Wave mechanics, the Schroedinger equation, free and confined electrons, band theory of solids	2
Proj 6	Biomimetic systems: nanomotors, lipid vesicles. Nanobiotechnology.	2
Proj 7	Nanofluidics. Mechanical behavior of nanostructures. Nanoactuators.	2
Proj 8	Specific role of molecular interactions and signal pathways at nanoscale.	1
Proj 9	Chemical principles involved in synthesis, assembly, and performance of nanostructured materials and devices.	2
Proj 10	Classical and statistical thermodynamics of small systems: chemical and physical interactions, transport of matter, diffusion.	2
Proj 11	Characterization tools of nanomaterials and nanostructures.	2
Proj 12	0D, 1D, and 2D nanosolids: nanotubes, nanowires, nanodots. Nanoparticles and nanocomposites.	2
Proj 13	Nanoscale optoelectronics. Nanowires, quantum dots, thin films, electrical transport, electron emission properties, optical properties. Optical tweezers.,	2
Proj 14	Carbon-based nanomaterials. Supramolecular chemistry. Liquid crystals. Colloid and polymer chemistry. Surface modification and functionalization. Catalysis.	2
Proj 15	Biomolecules: structure/function relation. Principles of biochemistry tailored to nanotechnologies. Nanomedicine .	2
Proj 16	Broad implications of nanotechnology. Problems in miniaturization: scaling laws, nanoscale physics.	1
	TOTAL	30

TEACHING TOOLS USED

- N1. Diaporama presentations.
 N2. Review of recent articles published in relevant 'nano' oriented scientific journals.
 N3. Invited presentations of scientists and industrial staff working in the domains of nanotechnology.
 N4. Analysis of the potential master thesis subjects.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
P	PEK_U03, PEK_U04	30' presentation on a chosen aspect/application of nanotechnology or nanoengineering will be graded.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] Scientific journals from the field of nanosciences.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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