COURSE SYLLABUS

University	**Alexandru Ioan Cuza University of Iaşi**	**Course title**	
Faculty	**Physics**	**Physics and Technology of Nanocomposites**	
Department	**Physics**		
Domain	**Physics**	**Course category** (FC/SC/CC[1]): SC	**Term** (1-4): 2
Level	**Postgraduate (MA)**	**Course type** (Co/El/F[2]): El	

I. Course structure

Number of hours/week				Credits	Total class hours/ semester	Total hours of individual activity	Examination type (C/Ex/CE[3])	Teaching language
Course	Seminar	Lab.	Project	**6**	**56**	**124**	**EX**	**English**
2		**2**						

II. Instructors

	Academic degree[4]	Scientific degree	Name and surname	Faculty position (tenure/ associate - organization)
Course	Associate Prof.	Dr.	ŢURA Vasile	Tenure
Seminar				
Laboratory	Associate Prof.	Dr.	ŢURA Vasile	Tenure

III. Prerequisites

Solid-state physics (undergraduate).

IV. Course objectives

Students will gain some knowledge of the main types of nanocomposite materials and their specific physical and chemical properties required in applications. Graduates will become familiar with the methods of preparation and characterization of specific physical properties of nanocomposite materials. The current state of theory and modeling of nanocomposites will be presented. At the end of the course, students will have enough understanding of the main concepts in nanocomposites physics to allow them read and understand the most important research papers in this field.

V. Course content

Course	1. Ceramic/Metal Nanocomposite Systems. Preparation technologies: mechanical alloying, sol-gel synthesis, melt spraying. Structures: particles, thin films, wires, porous systems. Applications: electrical, magnetic, optical. 2. Nanocomposites based on polymer matrix : polymer / polymer, ceramic / polymer, metal / polymer, carbon nanotube / polymer. Preparation technologies: solid mixture, solutions mixing, in-situ polymerization, polymer coatings, other coatings. Applications: mechanical, electrical, optical. 3. Natural nanocomposites: Nanocomposites synthesized biologically; Nanocomposites synthesized by mimicking natural processes; Packaging proteins. 4. Nanocomposite materials modeling: current issues. Multiscale modeling. Multi-physics modeling.
Seminar	
Laboratory	1. Structural characterization of nanocomposites: X-ray diffraction, electron microscopy. Determination of phase volumes. 2. Surface characterization: scanning electron microscopy, atomic force microscopy. 3. Characterization of porous structures. Gas and liquid permeability. 4. Electrostatic spinning method for obtaining nanofibers and nanoparticles. 5. Characterization of quasi-static and dynamic elastic properties. Mechanical testing. 6. Characterization of electrical properties of nanocomposites: electrical conductivity and permittivity, magnetic permeability.

VI. Minimal required references

[1] Ajayan P.M. (ed): *Nanocomposite Science and Technology*, Wiley Verlag GmbH, Weinheim, 2003, ISBN 3-527-30359-6.

[1] FC – fundamental course, SC – specialty course, CC – complementary course
[2] Co – compulsory, El – elective, F – facultative
[3] C – colloquium, Ex – exam, CE – colloquium AND exam
[4] Professor / Associate professor / Lecturer / Assistant professor / Teaching assistant

[2] A.D. Pomogailo and V.N. Kestelman, *Metallopolymer Nanocomposites*, Springer-Verlag Berlin Heidelberg 2005, ISSN 0933-033x.
[3] Stroscio M.A., Dutta M. (ed): *Biological nanostructures and applications of nanostructures in biology. Electrical, mechanical and optical properties*, Kluwer Academic, 2004, ISBN 0-306-48627-X.

VII. Didactic methods

Lecture. Laboratory project.

VIII. Assessment

Pre-conditions	Students should attend all lectures and laboratory classes, and deliver two presentations on topics decided in the beginning of the semester.	
Exam dates	**1st Assessment**	April
	2nd Assessment	May - June

	Assessment means and methods	**Percentage of the final grade**
Exam/Colloquium	Presentation of a specific topic	50%
Seminar		
Laboratory	Laboratory colloquium	50%