SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-Bolyai University, Cluj-Napoca
1.2 Faculty	of Physics
1.3 Department	Department of the Condensed Matter Phyiscs and Advanced Technologies
1.4 Field of study	Applied Engineering Science
1.5 Study cycle	Master
1.6 Study programme / Qualification	Biomaterials

2. Information regarding the discipline

2.1 Name of the discipline	Polymers and composite materials						
2.2 Course coordinator	Assoc. Prof. Lucian Baia (PhD)						
2.3 Seminar coordinator	Assoc. Prof. Lucian Baia (PhD)						
2.4. Year of study	1	2.5 Semester	2	2.6. Type of evaluation	E	2.7 Type of discipline	C

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28

Time allotment:	hours
Learning using manual, course support, bibliography, course notes	36
Additional documentation (in libraries, on electronic platforms, field documentation)	40
Preparation for seminars/labs, homework, papers, portfolios and essays	44
Tutorship	3
Evaluations	3
Other activities:	-

3.7 Total individual study hours	126
3.8 Total hours per semester	182
3.9 Number of ECTS credits	7

4. Prerequisites (if necessary)

4.1. curriculum	• Fundamental knowledge about the atomic and molecular physics, and solid state physics
4.2. competencies	• Adequate use of the fundamental knowledge of atomic and molecular physics, thermodynamics and solid state physics • Adequate use of the equipments involved in the polymers and composites research

5. Conditions (if necessary)

5.1. for the course	• Course hall with table, video- projector and adequate software • At least two students should be present
5.2. for the seminar /lab activities	• Laboratories possess adequate equipments for performing the proposed lab works

6. Specific competencies acquired

Professional competencies	**C1.** Use of the main physics and biomaterials laws and principles that operate at different dimensional scales. **C4.** Individual planning and implementation of the experimental investigations and assessing of the obtained results from the perspective of their uncertainty. **C5.** Ability to communicate complex scientific ideas, conclusions derived from experimental investigations or results obtained during a scientific project. **C6.** Ability to use equipments and experimental techniques in limited or interdisciplinary domains from biomaterials field.
Transversal competencies	**CT1.** Achievement of the proposed professional tasks in an efficient and responsible way keeping in mind the effective laws and deontological rules **CT2.** Applying the work methods that conduct to efficient results in a multidisciplinary team on diverse levels.

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Getting the theoretical notions and practical abilities related to both morphological and structural characteristics of the polymers as well as their mechanical, electrical and diffusion properties from the applications perspective
7.2 Specific objective of the discipline	• Learning of the theoretical notions related to both morphological and structural characteristics of the polymers as well as their mechanical, electrical and diffusion properties • Getting practical abilities regarding the finding of the morphological and structural particularities of the polymers and composite materials • Learning about the large variety of applications of polymers and composite materials, including the ability of identifying the material type that could be used for a given application

8. Content

8.1 Course	Teaching methods	Remarks
1. Introductory notions, concepts and evolution in the polymers and composite materials domain.		4 hours
2. Structure of polymeric chain. Configuration and conformation. Molecular mass. Dimension of polymeric chain. Amorphous phase. Crystalline phase. Classification. Liquid crystals polymers.		4 hours
3. Mechanical properties of polymers.		4 hours

4. Electrical properties of polymers.	Lecture, presentation	4 hours
5. Ficks diffusion law. Diffusion coefficient of solute. Free volume in polymers. Free volume theory and molecular theory of the polymers diffusion. Polymer-solvent interaction. Swelling thermodynamic model. Flory-Huggins theory.		4 hours
6. Dielectric properties of materials. Piezoelectric, ferroelectric, pyroelectric behaviour. Applications.		4 hours
7. The future of composite materials. Smart composite materials.		4 hours

Bibliography

1. L. H. Sperlimg, Introduction to physical poymer science, third edition, John iley & Sons Inc. 2001
2. D. D. L. Chung, Composite Materials: Science and applications-Fuctional materials for modern technologies, Springer, London, 2003.
3. M. Alexandre, P. Dubois, Polymer layered silicate nanocomposites: preparation, properties and uses of a new class of materials (Review), Mater. Sci. Engineering, 28, 2001, 1-63.
4. P. Chakraborty, Metal nanoclusters in glasses as non-linear photonic materials (Review), J. Mater. Science, 33, 1998, 2235-2249.
5. L. V. Interrante, M. J. Hampden-Smith, (eds.), Chemistry of advanced materials, John-Wiley & Sons New York, 1998.
6. L. A. Pilato, M. J. Mihno, Advanced composite Materials, Verlag, Berlin, 1994.
7. V. M. Shalaev, M. Moskovits, Nanostructured Materials: Clusters, composites and thin films, Published by the Am. Chem. Society, 1997.
8. E. Purcell, Electricity and Magnetism, McGraw-Hill College, 1984
9. V. Simon, Fizica biomaterialelor, Ed. Presa Universitară Clujeană, 2002.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Structural analysis of composites with glass matrix and metallic nanoparticles by means of IR and Raman spectroscopy.	Lecture, debate, presentation	6 hours
2. Finding the morphological and physical properties (shape, dimensions, density of metallic nanoparticles, etc.) of the dispersed phase by means of UV-vis spectroscopy.		8 hours
3. Structural analyses of porous composite materials, untreated and heat-treated, with the help of vibrational spectroscopic techniques.		6 hours
4. Morphological analyses of porous composite materials, untreated and heat-treated, by means of sorption measurements and electronic microscopy.		8 hours

Bibliography

1. P. Chakraborty, Metal nanoclusters in glasses as non-linear photonic materials (Review), J. Mater. Science, 33, 1998, 2235-2249.
2. V. M. Shalaev, M. Moskovits, Nanostructured Materials: Clusters, composites and thin films, Published by the Am. Chem. Society, 1997.
3. L. Baia, M. Baia, W. Kiefer, J. Popp, S. Simon, Structural and morphological properties of silver nanoparticles-phosphate glass composites, Chemical Physics, 327, (2006), 63-69.
4. J. M. Chalmers, Peter R. Griffiths, (eds.): Handbook of vibrational spectroscopy, vol. 1-5, J. Wiley & Sons, Chichester, 2002.

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The content of the teaching line is in agreement with other activities taught in other national and international university canters. In order to fit the teaching line with the market requirements its content was synchronized.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	- correctness of the knowledge - completeness of the knowledge - logical coherence of the presentation	- final evaluation	45
		- intermediate evaluation	30
10.5 Seminar/lab activities	- capacity to apply the learned knowledge - ability to work with the acquired knowledge	- oral evaluation	25
10.6 Minimum performance standards			
➢ To be present at minimum 75% of laboratories ➢ The passing of the master student is closely related to the knowledge of the following notions: particularities that define the polymers and composites structure, the most important mechanical and electrical properties of these materials and the applications where they are mainly involved.			

Date	Signature of course coordinator	Signature of seminar coordinator
22.09.2012	Assoc. Prof. Lucian Baia (PhD)	Assoc. Prof. Lucian Baia (PhD)

Date of approval

Signature of the head of department

Prof. Romulus Tetean (PhD)