SUBJECT DATASHEET AND REQUIREMENTS SHEET

Last modified: 18.01.2012.

1. Nanocomposites

(Nanokompozitok)

2.	Subject code	Semester	Weekly hours lect.+sem.+lab.	Credits	Requ.	Lang.	Subject semester
	BMEGEPT0111	spring	2+0+0	3	exam.	english	1/1

3. Course leader and Department:

Name:	Position:	Department:
Dr. László Mészáros	Assistant Professor	Department of Polymer Engineering

4. Lecturers:

Name:	Position:	Department:
Dr. László Mészáros	Assistant Professor	Department of Polymer Engineering
Prof. József Karger-Kocsis	Professor	Department of Polymer Engineering

5. The subject is based on the knowledge of the following fields:

Basic knowledge of materials science. Structure – property relations.

6. Prerequisites:

There is no special prerequirement for this subject.

7. Subject program:

This course is about the polymer nanocomposites, it would focus the applied materials (nanomaterials and matrix materials), manufacturing methods, characterization, and applications. Different types of nanomaterials will be presented, that can influence the mechanical, thermal, electrical, etc. properties of the matrix materials by different ways. The major preparation routes to these materials will be discussed.

8. Topical outline:

week	**Type**			**Lecture**
	L	S	Lab	
1	2	-	-	Historical backgrounds: rubber (tyre as nanocomposite int he XIX.th century. Description of the theory of nanocomposites, first existing nancomposites, discover of fullerenes. Definitions: composites, nanoparticles, nanotechnology, nanocomposites. Theoretical background Basic concept, differences between misro and nanoscale materials, basics and fundamentals of polymer nanocomposites.

2	2	-	-	Technical background: Testing equipment and operation (electronmicroscopy: SEM, TEM; AFM; XRD; EDS)
3	2	-	-	An overview of nanomaterials. Types of nanoparticles: layered silicates: chemical composition, physical, mechanical properties problems with dispersion, surface treatments.
4	2	-	-	Nanotubes: high aspect ratio, small size, high strength and stiffness, low density, high conductivity, high flexibility, ability to withstand cross sectional and twisting distortions, ability to withstand compression without fracture.
5	2	-	-	Electrospinning. How does it work? Electrospinnable materials, application of electrospun fibers, mass production possibility
6	2	-	-	Other nanoparticles (TiO_2).
7	2	-	-	Investigate enhanced multifunctional mechanical, thermal, electrical, flammability, and ablation properties and performance of polymer nanocomposites. Testing the composites: The main characterization tests the can use for characterize the effects of the nanoreinforcement.
8	2	-	-	Possible matrix materials. Preparation of nanocomposites (solvent, melt mixing, in situ polymerization). Theoretical structure of nanocomposites.
9	2	-	-	Layered silicate nanocomposites
10	2	-	-	Nanotube reinforced nanocomposites.
11	2	-	-	Nanoscale Interpenetrating polymer networks.
12	2	-	-	Ceramic, and metal matrix nanocomposites.
13	2	-	-	Hybridization of nano and micro reinforcement.
14	2	-	-	Applications of nanocomposites, new opportunities and challenges. The status of new polymer nanocomposites, trends, and future directions.

9. Mode of education:

2 hour lectures per week.

10. Requirements:

Examination.

11. Consultation:

Staff members hold consultations during working hours by prearrangement.

12. Lecture notes, books:

1. W.A. Goddard, Handbook of nanoscience, engineering, and technology, Baca Raton, CRC Press, 2003.
2. B. Bhushan, Springer handbook of nanotechnology, Berlin, Springer-Verlag, 2004.

13. Work required completing the subject:

Students should study the subject approximately 2 hours a week.

14. The thematic was developed by:

Name:	Position:	Department:
Dr. László Mészáros	Assistant Professor	Department of Polymer Engineering