

STUDY COURSE DESCRIPTION FORM		
Name of the course		Code
Nanotechnology in transport engineering		
Name of the doctoral school		Year /Semester
Poznan University of Technology Doctoral School	
Specialty/Discipline		Type (obligatory, elective):
Civil engineering and transport		elective
No. of hours		No. of credits
Lectures: 4 Classes: - Laboratories: - Seminars: -		1
Cycle of study: Third-cycle studies (Polish Qualifications Framework level eight)	Form of study: Full-time	Assessment: (written exam, presentation, etc.) Brainstorm creative activity
Responsible for the course/lecturer: dr hab. inż. Jarosław Kałużny e-mail: jaroslaw.kaluzny@put.poznan.pl phone : +48 61 665 2049 Faculty of Civil and Transport Engineering Poznan University of Technology Piotrowo street 3, 60-965 Poznan, Poland		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge: Basic knowledge in material engineering, physics, mathematics and subjects related to the mechanical engineering	
2	Skills: Ability to define and test hypothesis related to research problems	
3	Social competencies: Ability to think and act in a creative way	
Objectives of the course: Interdisciplinary thinking for creative engineering solutions		
Educational results (Study outcomes)		
Knowledge:		
P8S_WK	a person who graduated from doctoral school knows and understands basic conditions of knowledge transfer to the economic and social sphere as well as commercialization of the results of scientific activities and know-	SzD_W07
P8S_WG	a person who graduated from doctoral school knows and understands key developmental trends of science disciplines in which education takes place at the doctoral school,	SzD_W02
Skills:		

P8S_UW	<p>a person who graduated from doctoral school can use the knowledge from different branches of science to creatively identify, formulate and to innovatively solve complex problems or to execute research tasks in particular:</p> <ul style="list-style-type: none"> - define the aim and subject of scientific research, form a research hypothesis, - develop research methods, techniques and tools and use them creatively, - draw conclusions on the basis of research results, 	SzD_U01	
P8S_UO	a person who graduated from doctoral school can plan and implement individual and team research projects, also in the international community,	SzD_U09	
Social competencies:			
P8S_KK	a person who graduated from the doctoral school is ready to acknowledge the importance of knowledge in solving cognitive and practical problems	SzD_W03	
P8S_KO	fulfilling the social obligations of researchers and creators	SzD_K04	
Compulsory literature:			
Bhushan B. Springer Handbook of Nanotechnology			
Additional literature:			
<p>Nouailhat A. An Introduction to Nanoscience and Nanotechnology; free pdf available at: http://elibrary.bsu.az/books_250/N_229.pdf any other free downloadable books found in google under "nanotechnology books"</p>			
COURSE DESCRIPTION			
	General issues	Specific issues	No. of hours
1	Basics	<ul style="list-style-type: none"> • Nanotechnology: definitions, reasons to be, history; comparison of a bee and an aircraft and the advantages of hierarchical structures in nature • General physics principles related to nanotechnology; review • Carbon nanomaterials and their unique properties • Nanomaterials characterization, case studies (electron microscopy, spectroscopy, etc.) 	1
2	Applications	<ul style="list-style-type: none"> • Nanomaterials in lubrication • Nanocomposites 	1
3	Environment	<ul style="list-style-type: none"> • Nanotechnology in nature and bionics • Nanomaterials characterization, case studies (electron microscopy, spectroscopy, etc.) 	1
4	Brainstorm	<ul style="list-style-type: none"> • Your application of nanomaterials for a revolutionary device, technology, etc. 	1
Assessment methods of educational results			
Brainstorm creative activity			

STUDENT'S WORKLOAD	
Activity	Hours
Participation in lectures, classes, seminars and laboratories	4
Contact hours with lecturers	4
Self-study	6
Exam	1
TOTAL	15
TOTAL NUMBER OF ECTS POINTS FOR THE COURSE	1