

Course code																																							
Type and description	CC – Core Curriculum for the Materials Engineering Discipline																																						
ECTS credit	2																																						
Course name	Reaserch Methods of Materials Science																																						
Course name in Polish	Metody badań materiałów																																						
Language of instruction	English																																						
Course level	8 PRK																																						
Course coordinator	Dr hab. Michał Puchalski																																						
Course instructors	Dr inż. B. Januszewicz																																						
Delivery methods and course duration	<table><tr><td></td><td>Lecture</td><td>Tutorials</td><td>Laboratory</td><td>Project</td><td>Seminar</td><td>Other</td><td>Total of teaching hours during semester</td></tr><tr><td>Contact hours</td><td></td><td></td><td>15</td><td></td><td></td><td>0</td><td>15</td></tr><tr><td>E-learning</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td></td></tr><tr><td>Assessment criteria (weightage)</td><td>0,00</td><td></td><td></td><td></td><td></td><td>0,00</td><td></td></tr></table>								Lecture	Tutorials	Laboratory	Project	Seminar	Other	Total of teaching hours during semester	Contact hours			15			0	15	E-learning	No	No	No	No	No	No		Assessment criteria (weightage)	0,00					0,00	
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Course objective	<p>Objective of the course</p> <p>The objective of the course is to enable the acquisition of knowledge including the principle of work and application of selected measurement methods applied in material engineering.</p>																																						
Learning outcomes	<p>Doctoral student on completion of the course:</p> <p>1. knows and understands the principle of functioning and the area of application of research methods applied in materials engineering W1_P8S_EG</p> <p>2. is able to develop methods, techniques and research tools for assessing the physical structure of materials and creatively plan their application U1_P8S_UW</p> <p>3. is able to critically analyze and evaluate the results of tests on the properties of engineering materials U1_P8S_UW</p>																																						
Assessment methods	<p>Methods of verifying of learning outcomes</p> <p>Learning outcome 1- written colloquium</p> <p>Learning outcomes 2, 3 – laboratory report</p> <p>Final mark consist of:</p> <p>Written colloquium score - 80%.</p> <p>Laboratory report - 60%.</p>																																						
Prerequisites																																							
Course content with delivery methods	<p>Laboratory</p> <p>1. Determination of crystalline structure of materials and nanomaterials by using of X-ray diffractometer.</p> <p>2. Analysis of topography of materials by using of atomic force microscope.</p> <p>3. Investigation of the morphology of materials by using of a high resolution scanning electron microscope.</p> <p>4. Evaluation of thermal phase transition of polymeric materials by using of differential scanning calorimetry</p>																																						

	5. Analysis of the chemical composition of materials surface by the using of X-ray microanalysis.
Basic reference materials	<ol style="list-style-type: none"> 1. A. Foster, W. Hofer, Scanning Probe Microscopy: Atomic Scale Engineering by Forces and Currents, Springer, 2006 2. A.R. Clarke, C.N. Eberhardt, Microscopy techniques for materials science, CRC Press LLC, 2000 3. K. Sikorski, Quantitative X-ray Microanalysis Beyond the Resolution of the Method, OWPW, 2009 4. W.M. Groenewoud Characterisation of Polymers by Thermal Analysis, Elsevier, 2001 5. M. Birkholz, Thin Film Analysis by X-Ray Scattering, WILEY-VCH Verlag GmbH & Co. 2006
Other reference materials	<ol style="list-style-type: none"> 1. Scanning Probe Microscopy: Training Notebook, Digital Instruments Veeco Metrology Group, 1999 2. N. Yao, Z. L. Wang, HANDBOOK OF MICROSCOPY FOR NANOTECHNOLOGY, Kluwer Academic Publishers, 2005 3. M. Puchalski, P.J. Kowalczyk, Z. Klusek, W. Olejniczak. „The applicability of global and surface sensitive techniques to characterization of silver nanopartilces for Ink-Jet printing technology” in „Silver nanoparticles” David Pozo Perez Ed., In-Tech, 2010 4. M. Puchalski, P. Dabrowski, W. Olejniczak, P. Krukowski, P. Kowalczyk, K. Polański. „The study of nanoparticles of silver by means of SEM, EDX, STM” Materials Science – Poland, Vol. 25, 2007, 473 – 478.
Average student workload outside classroom	10 hour
Comments	
Last update	