

**DOCTORAL SCHOOL OF WROCLAW UNIVERSITY OF SCIENCE AND  
TECHNOLOGY**

SUPERVISOR/TEAM/ DECLARING/CONDUCTING COURSE: Dorota Zając  
**DEPARTMENT: Chemical Department**  
**SCIENTIFIC DISCIPLINE: Chemical Sciences**

**COURSE CARD**

**Course name in Polish: Nanostruktury- materiały precyzyjne.**  
**Course name in English: Nanostructures - precision materials**  
**Course language Polish / ~~English~~\***

**University-wide general course type\*:**

**The course is intended for all PhD students: YES / NO**

- ~~1) BASIC COURSE~~  
**2) SPECIALIST COURSE**  
~~3) SEMINAR~~  
~~4) HUMANISTIC COURSE~~  
~~5) LANGUAGE~~

**Subject code: NCQ100111W**

\* delete as applicable

	Lecture	Foreign language course	Seminar	Mixed forms
Number of hours of organized classes in university (ZZU)	30			
Grading	Exam	Exam	Oral presentation	Exam, inspection, evaluation classes
Number of ECTS points	<b>0</b>			

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. Knowledge of organic chemistry, physical chemistry and polymer chemistry

**COURSE OBJECTIVES**

- C1. Knowledge of modern techniques for the production and design of materials at the nanoscale and their applications  
 C2 To familiarize a PhD student with imaging methods of nanomaterials  
 C3 To familiarize a PhD student with current development trends and the latest discoveries in the field of materials science and nanotechnology

**PROGRAM CONTENTS**

<b>Form of classes – lecture (Lec)</b>		Number of hours
Lec 1,2	Characterization and division of nanomaterials	4
Lec 3,4	Technologies for obtaining nanomaterials: e.g. bottom up, top down, CVD, CVC, sol-gel	4

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Lec 5,6	Characteristics of the structure and surface of nanomaterials - discussion of techniques and imaging methods (eg SEM / TEM / AFM / XRD)	4
Lec 7	Discussion of specific nanomaterials. Characteristics, method of synthesis of quantum dots, polymer nanoparticles, nanotubes	2
Lec 8,9	Discussion of specific nanomaterials. Characteristics, method of synthesis of metallic nanoparticles, fullerenes. The most important fullerenes reactions	4
Lec 10	Opportunities and dangers of nanotechnology	2
Lec 11,12	The use of nanomaterials in medicine, electrical engineering, pharmacy, cosmetics	4
Lec 13,14	Recent achievements in nanotechnology - work based on data available in scientific databases (Web of Science)	4
Lec 15	Exam	2
	Total hours:	<b>30</b>

<b>Form of classes – foreign language course (Lng)</b>		Number of hours
Lng1		
Lng2		
Lng3		
..		
	Total hours:	

<b>Form of classes – seminar (Sem)</b>		Number of hours
Sem1		
Sem2		
Sem3		
...		
	Total hours:	

<b>Form of classes – mixed forms (mix)</b>		Number of hours
Mix1		
Mix2		
Mix3		
...		
	Total hours	

<b>TEACHING TOOLS USED</b>
N1. Lecture with audiovisual media. N2. N3.

<b>ACHIEVED SUBJECT LEARNING OUTCOMES</b>		
Type of learning outcome	Code of learning outcome	Assessment of learning outcome

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Knowledge Range and depth - completeness of the cognitive perspective and dependence	P8S_WG	Has knowledge about methods of fabrication and design of materials at the nanoscale as well as current and prospective applications of nanomaterials
Knowledge Universal	P8U_W	Knows the regulatory aspects of nanomaterials and limitations related to their production and storage
Skills Use of knowledge - problems solved and tasks performed	P8S_UW	He knows the methods and techniques of imaging nanomaterials
Skills		
Skills		
...		
Social competence		
Social competence		
...		

**PRIMARY AND SECONDARY LITERATURE**

**PRIMARY LITERATURE:**

- [1] Z. Florjańczyk, St. Penczka (red.), Chemia polimerów, Oficyna Wydawnicza Politechniki Warszawskiej, 1998
- [2] W.D. Callister, Materials science and engineering: An introduction, Wiley, 1999
- [3] H.S. Malvaed, Nanostructured materials and nanotechnology, Academic Press, 2002
- [4] B.R. Eggins, Biosensors: an Introduction, Springer-Verlag, 2013
- [5] D.R. Thévenot, K. Toth, R.A. Durst, G.S. Wilson, Electrochemical biosensors: recommended definitions and classification, Biosens. Bioelectron., 2001, 16, 121-131

**SECONDARY LITERATURE:**

- [1] Optical properties and spectroscopy of nanomaterials - Jin Zhng Zhang, published by World Scientific Publishing Co. Pte. Ltd.
- [2] T. S. Sreeprasad, A. K. Samal and T. Pradeep, NANO REVIEWS, vol 2, (2011).
- [3] Physical Properties of Nanomaterials, Juh Tzeng Lue, Encyclopedia of Nanoscience and Nanotechnology, Volume X: Pages (1-46).
- [4] Nanomaterials – An introduction to synthesis, properties and application, Environmental Engineering and Management Journal, 2008, Vol. 7, No.6, 865-870.

**SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)**

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