Wrocław University of Science and Technology
Doctoral School

COURSE CARD

1. Basic information

Course name in English:	Nanophotonics seminar	
Course name in Polish:	Seminarium nanofotoniki	
Number of hours:	15	
Type of course:	Elective course	
Form of course:	seminar	
Code of course:		
Course leader:	Dr hab. inż. Joanna Olesiak-Bańska, prof. uczelni, dr hab. inż. Lech Sznitko, prof. uczelni	
Faculty of the course leader:	W3 Faculty of Chemistry	
Email address of the course leader:	Joanna.olesiak-banska@pwr.edu.pl	
Scientific discipline(s) assigned to the course (doctoral students representing the marked disciplines can participate in the course):	Architecture and urban planning	☐
	Automation, electronic, electrical engineering and space technologies	☒
	Information and communication technology	☐
	Biomedical engineering	☒
	Chemical engineering	☒
	Civil engineering, geodesy and transport	☐
	Materials engineering	☒
	Mechanical engineering	☒
	Environmental engineering, mining, and energy	☒
	Mathematics	☒
	Chemical sciences	☒
	Physical sciences	☒
	Management and quality studies	☐

2. Objectives

The objectives of the course:

- To provide students with a general knowledge on photonics and light-matter interaction
- To provide students with a knowledge on nanotechnology and advanced materials
- To provide students with a trends in nanomaterials and photonic materials characterization using spectroscopy and microscopy techniques
- To provide students with the knowledge on chemistry in nanoscale

3. Content

Detailed information about the course content, including topics and form of classes.

No.	Topic	Number of hours	Form of classes

1	**Introduction to nanophotonics**		lecture
2	**Light in nanoscale**		lecture
3	**Photoactive materials and nanomaterials**		lecture
4	**Semiconductor nanomaterials in photonics**		seminar
5	**Plasmonic materials in photonics**		seminar
6	**Nanomaterials for nonlinear optics**		seminar
7	**Methods of characterization of optical properties of nanomaterials**		seminar
8	**Advanced laser spectroscopy of nanomaterials**		seminar
9	**Chirality in the nanoscale**		seminar
10	**Metamaterials and nanocomposites**		seminar
11	**Photonic crystals**		seminar
12	**Organic lasers and nanolasers**		seminar
13	**Self-assembly in nanophotonics**		seminar
14	**Application of nanophotonics in biology and medicine**		seminar
15	**Biomolecules (DNA, proteins) in nanophotonics**		seminar

4. Prerequisites

List of prerequisites relating to knowledge, skills and other competences for course participants.

1. General chemistry
2. Basics of physics and optics
3. Basics of spectroscopy

5. Learning outcomes

List of learning outcomes at level 8 of the Polish Qualifications Framework assigned to the course (mark the learning outcomes in the last column).

Symbol	Learning outcome	
	KNOWLEDGE. Doctoral student knows and understands:	
SzD_W3	the main trends in the development of the scientific or artistic disciplines covered in the curricula;	☒
SzD_W4	research methodology;	☐
SzD_W5	the rules for the dissemination of scientific results, including in open access mode;	☐
SzD_W6	the fundamental dilemmas of modern civilization;	☐
SzD_W7	the legal and ethical conditions of scientific activity;	☐
SzD_W8	the economic and other relevant conditions of scientific activity;	☐
SzD_W9	basic principles of knowledge transfer to the economic and social spheres and commercialisation of results of scientific activity and know-how related to these results.	☒
	SKILLS. Doctoral student is able to:	

SzD_U2	use knowledge from different fields of science or art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, in particular: - define the purpose and subject of scientific research, formulate a research hypothesis, - develop research methods, techniques and tools, and use them creatively, - draw conclusions on the basis of scientific research; critically analyse and evaluate the results of scientific research, expertise and other creative work and their contribution to knowledge development; transfer the results of scientific activities to the economic and social spheres;	☒
SzD_U3	communicate on specialised topics to the extent that they enable an active participation in the international scientific community;	☒
SzD_U4	disseminate research results, including in popular forms;	☒
SzD_U5	initiate debates and participate in a scientific discourse;	☒
SzD_U6	be able to speak a foreign language at B2 level of the Common European Framework of Reference for Languages to a level that enables them to participate in the international scientific and professional environment;	☒
SzD_U7	plan and implement an individual or collective research or creative activity, including in an international environment;	☐
SzD_U8	independently plan and act for one's own development and inspire and organize the development of others;	☐
SzD_U9	plan classes or groups of classes and implement them using modern methods and tools.	☐
	SOCIAL COMPETENCES. Doctoral student is ready to:	
SzD_K3	fulfilling the social obligations of researchers and creators, initiate public interest activities, thinking and acting in an entrepreneurial way;	☒
SzD_K4	maintaining and developing the ethos of research and creative environments, including: - carrying out scientific activities in an independent manner, - respecting the principle of public ownership of research results, taking into account the principles of intellectual property protection.	☐

6. Evaluation

Short description of the method(s) used to evaluate the learning outcomes assigned to the course, e.g., exam, test, report, presentation, etc.

PhD student will be evaluated via presentation on the topic related to nanophotonics. In the evaluation the following issues will be taken into account:
scientific content of the presentation
quality of presentation (how it was delivered by the student, how (s)he answered questions from the audience etc.)
quality of slides (how clear, informative and attractive for the audience are the slides

7. Teaching methods

Short description of the teaching methods used during the course, e.g., multimedia presentation, discussion, literature studies, developing written documents, own work, etc.

Multimedia presentation, Discussions during the seminar, Literature studies, Students' presentations.

8. Literature

List of primary and secondary literature used to prepare the course and including additional knowledge for participants, e.g., books, textbooks, research papers, standards, web pages, etc.

[1] Paras N. Prasad, Nanophotonics, Wiley-Interscience, 2004
[2] K. D. Sattler, Handbook of nanophysics, CRC Press, 2011
[3] B. E. A. Saleh, M. Carl Teich "Fundamentals of Photonics" John Wiley & Sons, Inc. 2007
[4] R. L. Sutherland, "Handbook of nonlinear optics" Marcel Dekker, Inc. 2003
[5] L. Novotny B. Hecht, "Principles of Nano-Optics", Cambridge (2006)

9. Other remarks

Additional remarks, comments, (e.g., language of the course)

The course is conducted in English.