WROCŁAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

FACULTY OF Fundamental Problems of Technology

SUBJECT CARD

Course name in Polish	**Optyka kwantowa w układach półprzewodnikowych**
Course name in English	**Quantum optics in semiconductor structures**
Course language	**Polish**
Departmental course developing professional skills: 1) specialized course	
Type of course**: optional**	
Educational effects according to ZW 26/2017: P8S_WG	
Subject code **FZP9074**	

*delete as applicable

	Lecture
Number of hours of organized classes in University (ZZU)	30
Number of hours of total student workload (CNPS)	90
Form of crediting	Exam
Number of ECTS points	3
including number of ECTS points for practical (P) classes	0
including number of ECTS points for direct teacher-student contact (BK) classes	1,4

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student is able to analyze problems and find solutions using methods of mathematical analysis and linear algebra.
2. Student knows quantum mechanics and is able to apply its formalism
3. Student is able to work with literature, including papers in English

SUBJECT OBJECTIVES

C1 A student will learn the essential concepts and methods of quantum optics.
C2 A student will learn the current theoretical state-of-the-art and the most recent experimental results of quantum optics applied to semiconductor systems.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 has knowledge of the foundations of quantum optics
PEK_W02 has knowledge of the use of experimental and theoretical methods of quantum optics in semiconductor systems
PEK_W03 can use knowledge from quantum mechanics and other fields of physics to analyze problems of quantum optics

relating to skills:

PEK_U01 has skills related to the research methodology of quantum optics

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PROGRAMME CONTENT		
Form of classes - lecture		Number of hours
Lec1	Semiclassical description of the interaction of light with matter: a two-level atom driven by classical light; optical transitions and selection rules in semiconductors; coherent control of semiconductor quantum dots	6
Lec2	Quantization of the electromagnetic field; optical resonators; quantum dots in semiconductor nanocavities	4
Lec3	Coherent and squezed states	4
Lec4	Phase operators	2
Lec5	Quantum distribution functions	2
Lec6	Quantum coherence functions and interferometry; coherence functions in semiconductor systems: methods of measurement and significance	4
Lec7	Light-matter interaction: quantum description	4
Lec8	Simple laser theory; a single quantum dot laser	4
	Total hours	**30**

TEACHING TOOLS USED
N1 lecture with multimedia presentation N2 homework – solving problems

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03, PEK_U01	Homework
F2	PEK_W01, PEK_W02, PEK_W03, PEK_U01	Final test
P=0.4*F1+0.6*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

1. M. O. Scully, M. S. Zubairy, *Quantum Optics*
2. C. C. Gerry, P. L. Knight, *Wstęp do optyki kwantowej*
3. Y. Yamamoto, A. Imamoglu, *Mesoscopic Quantum Optics*

SECONDARY LITERATURE:

1. R. Tanaś, Wykłady z optyki kwantowej, http://zon8.physd.amu.edu.pl/~tanas/optkwant.pdf
2. Stanisław Kryszewski, Quantum Optics, http://iftia9.univ.gda.pl/~sjk/QO-SK.pdf

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

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