

FACULTY OF CHEMISTRY					
SUBJECT CARD					
Name of subject in English:	Modern spectroscopy				
Main field of study (if applicable):	Chemistry and Engineering of Materials				
Specialization (if applicable):	Advanced nano and biomaterials				
Profile:	academic				
Level and form of studies:	2nd level, full-time				
Kind of subject:	obligatory				
Subject code:	CHC024067				
Group of courses:	NO				
	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
Number of hours of total student workload (CNPS)	90				
Form of crediting	Exam				
For group of courses mark (X) final course					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1				
<b>PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES</b> 1. General chemistry 2. Basics of physics 3. Basics of physical chemistry					
<b>\SUBJECT OBJECTIVES</b> C1 To provide students with a general knowledge on the modern spectroscopy C2 To provide students with a knowledge on spectroscopic setups and techniques C3 To provide students with a trends in materials characterization using spectroscopic techniques					
<b>SUBJECT EDUCATIONAL EFFECTS</b> <b>related to knowledge:</b> PEK_W01 student knows the basic definitions of spectroscopy, especially optical spectroscopy PEK_W02 student knows the light sources applied in spectroscopy PEK_W03 student knows the modern setups applied in spectroscopic measurements PEK_W04 student knows the time-resolved spectroscopies and techniques such as TCSPC PEK_W05 student knows advanced time-resolved spectroscopies and techniques such as pump-probe PEK_W06 student knows the selected aspects of nonlinear optical spectroscopy PEK_W07 student knows the spectroscopic techniques such as Hyper-Rayleigh PEK_W08 student knows the Hyper-Raman spectroscopy PEK_W09 student knows the infrared spectroscopies PEK_W10 student knows new techniques such as CARS and SERS PEK_W11 student knows techniques of Raman and IR microspectroscopy PEK_W12 student knows techniques of chiral materials investigations PEK_W13 student knows new modulation spectroscopy techniques PEK_W14 student knows new trends in spectroscopy <b>related to skills:</b> PEK_U01 – Student can define basic terms of spectroscopy and knows literature about modern spectroscopy,					

<p>knows how to search for information about spectroscopic techniques.</p> <p>PEK_U02 - Student can name light sources and define elements crucial to construct light sources.</p> <p>PEK_U03 - Student can name advanced equipment required for building spectroscopic set-ups.</p> <p>PEK_U04 – Student can define basic terms from time-resolved spectroscopy</p> <p>PEK_U05 – Student can define time-resolved spectroscopic techniques</p> <p>PEK_U06 – Student can define terms from nonlinear optical spectroscopy.</p> <p>PEK_U07 - Student can analyze applications of nonlinear optical spectroscopy</p> <p>PEK_U08 – Student can name nonlinear optical spectroscopy techniques</p> <p>PEK_U09 – Student knows the literature about modern IR spectroscopy</p> <p>PEK_U10 – Student can describe principles of CARS and SERS</p> <p>PEK_U11 – Student can distinguish between techniques of Raman and IR microspectroscopy</p> <p>PEK_U12 – Student can name the applications of circular dichroism spectroscopy</p> <p>PEK_U13 – Student can name the applications of modulation spectroscopy</p> <p>PEK_U14 – Student can search for information about new trends in spectroscopy</p>		
<b>PROGRAMME CONTENT</b>		
<b>Lectures</b>		<b>Number of hours</b>
Lec 1	<b>Introduction to modern spectroscopy.</b> Definitions.	2
Lec 2	<b>Light sources in laser spectroscopy.</b>	2
Lec 3	<b>Modern spectroscopy setups.</b>	2
Lec 4	<b>Time-resolved techniques part 1.</b> Techniques like TCSPC.	2
Lec 5	<b>Time-resolved techniques part 2.</b> Techniques like pump-probe.	2
Lec 6	<b>Nonlinear spectroscopy part 1.</b> Multiphoton absorption, z-scan technique, saturable absorption spectroscopy.	2
Lec 7	<b>Nonlinear spectroscopy part 2.</b> Hyper-Rayleigh spectroscopy.	2
Lec 8	<b>Nonlinear spectroscopy part 3.</b> Hyper-Raman spectroscopy.	2
Lec 9	<b>Modern infra-red spectroscopy.</b> Ultrafast spectroscopy, 2D-IR	2
Lec 10	<b>Raman scattering spectroscopy.</b> Resonant spectroscopy, micro-Raman, SERS, CARS	2
Lec 11	<b>Raman and IR imaging techniques.</b>	2
Lec 12	<b>Chiral spectroscopy – circular dichroism.</b>	2
Lec 13	<b>Modulation spectroscopy.</b> Examples of light-, magnetic field, electric field stimulated spectroscopies.	2
Lec 14	<b>New trends in modern spectroscopy.</b>	2
Lec 15	<b>Colloquium</b>	2
	<b>sum</b>	30
<b>TEACHING TOOLS USED</b>		
N1. Multimedia presentation		
N2. Discussions during the lectures		
<b>EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT</b>		
<b>Evaluation</b> (F – forming (during semester), P – concluding (at semester end))	<b>Educational effect number</b>	<b>Way of evaluating educational effect achievement</b>
F1 (lecture)	PEK-W1-W14	colloquium

P (colloquium)		
<b>PRIMARY AND SECONDARY LITERATURE</b>		
<b><u>PRIMARY LITERATURE:</u></b>		
[1] H.Abramczyk, Spektroskopia laserowa, skrypt PWr, 2011		
[2] W. Demtröder, Spektroskopia laserowa. Wydawn. Naukowe PWN, 1993		
<b><u>ADDITIONAL LITERATURE:</u></b>		
[3] A. Corney, Atomic and laser spectroscopy. Oxford Classic Texts in the Physical Sciences, 2006		
[4] S. Svanberg, Atomic and Molecular Spectroscopy. Springer, 2004		
[5] J.M. Hollas, Modern Spectroscopy, 2004		
[6] Joseph R. Lakowicz, Principles of Fluorescence Spectroscopy , Springer, 2006		
[7] Max Diem, Introduction to Modern Vibrational Spectroscopy Wiley, 1993		
[8] Michael D. Fayer ed., Ultrafast Infrared Vibrational Spectroscopy, CRC press 2013.		
<b>SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)</b>		
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