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				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. General chemistry
2. Basics of physics
3. Basics of physical chemistry

\SUBJECT OBJECTIVES

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

SUBJECT EDUCATIONAL EFFECTS

related to knowledge:

PEK_W01student 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

related to skills:

PEK_U01 – Student can define basic terms of spectroscopy and knows literature about modern spectroscopy,

knows how to search for information about spectroscopic techniques.
PEK_U02 - Student can name light sources and define elements crucial to construct light sources.
PEK_U03 - Student can name advanced equipment required for building spectroscopic set-ups.
PEK_U04 – Student can define basic terms from time-resolved spectroscopy
PEK_U05 – Student can define time-resolved spectroscopic techniques
PEK_U06 – Student can define terms from nonlinear optical spectroscopy.
PEK_U07 - Student can analize applications of nonlinear optical spectroscopy
PEK_U08 – Student can name nonlinear optical spectroscopy techniques
PEK_U09 – Student knows the literature about modern IR spectroscopy
PEK_U10 – Student can describe principles of CARS and SERS
PEK_U11 – Student can distinguish between techniques of Raman and IR microspectroscopy
PEK_U12 – Student can name the applications of circular dichroism spectroscopy
PEK_U13 – Student can name the applications of modulation spectroscopy
PEK_U14 – Student can search for information about new trends in spectroscopy

PROGRAMME CONTENT

	Lectures	**Number of hours**
Lec 1	**Introduction to modern spectroscopy.** Definitions.	2
Lec 2	**Light sources in laser spectroscopy.**	2
Lec 3	**Modern spectroscopy setups.**	2
Lec 4	**Time-resolved techniques part 1.** Techniques like TCSPC.	2
Lec 5	**Time-resolved techniques part 2.** Techniques like pump-probe.	2
Lec 6	**Nonlinear spectroscopy part 1.** Multiphoton absorption**,** z-scan technique, saturable absorption spectroscopy.	2
Lec 7	**Nonlinear spectroscopy part 2.** Hyper-Rayleigh spectroscopy.	2
Lec 8	**Nonlinear spectroscopy part 3.** Hyper-Raman spectroscopy.	2
Lec 9	**Modern infra-red spectroscopy.** Ultrafast spectroscopy, 2D-IR	2
Lec 10	**Raman scattering spectroscopy**. Resonant spectroscopy, micro-Raman, SERS, CARS	2
Lec 11	**Raman and IR imaging techniques.**	2
Lec 12	**Chiral spectroscopy – circular dichroism.**	2
Lec 13	**Modulation spectroscopy.** Examples of light-, magnetic field, electric field stimulated spectroscopies.	2
Lec 14	**New trends in modern spectroscopy.**	2
Lec 15	**Colloquium**	2
	sum	30

TEACHING TOOLS USED

N1. Multimedia presentation
N2. Discussions during the lectures

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 (lecture)	PEK-W1-W14	colloquium

P (colloquium)		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] H.Abramczyk, Spektroskopia laserowa, skrypt PWr, 2011
[2] W. Demtröder, Spektroskopia laserowa. Wydawn. Naukowe PWN, 1993

ADDITIONAL LITERATURE:

[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.

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

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