SYLLABUS

1. Date despre program

1.1 Institution of higher education	West University of Timisoara
1.2 Faculty	Faculty of Physics
1.3 Department	Department of Physics
1.4 Field	Physics
1.5 Study cycle	Master
1.6 Study programme / Qualification	ADVANCED RESEARCH METHODS IN PHYSICS / according to COR: physicist (211101); gymnasium teacher (232201 -according to the law); research assistant (248102); referent specialist in education (235204); analyst (213101).

2. Information on the course

2.1 Course title			**Advanced methosd in optical spectroscopy**				
2.2 Lecturer instructor			Assoc. Prof. Marius Ștef, PhD				
2.3 Seminar / Laboratory instructor			Carla Schörnig, PhD student				
2.4 Year of study	II	2.5 Semester	1	2.6 Examination type	E	2.7 Course type	DS, Ob

3. Estimated time of study (hours per semester of didactic activities)

3.1 Number of hours per week	4	of which: 3.2 lecture	2	3.3 seminar/laboratory	2
3.4 Total hours from the curriculum	56	of which: 3.5 lecture	28	3.6 seminar/laboratory	28
Distribution of the allocated amount of time:					ore
Study of literature, course handbook and personal notes					22
Supplementary documentation at library or using electronic repositories					14
Preparing for laboratories, homework, reports etc.					14
Exams					4
Tutoring					14
Other activities……					-

3.7. Total number of hours of individual study	68
3.8. Total number of hours on semester	150
3.9. Number of credits (ECTS)	6

4. Prerequisites (if is the case)

4.1 curriculum	• Complements of Theoretical Physics; • Complements of Solid State Physics; • Complements of Atom and Molecule Physics.
4.2 competences	• General skills: the ability to accumulate basic knowledges; correct use of terminology in Physics; basic PC operation skills; the ability to work in a team; • Professional competences: identification and appropriate use of the main physical laws and principles; solving simple physics problems.

5. Requirements (if is the case)

5.1 for lecture	• blackboard, videoprojector, laptop.
5.2 for the seminar / laboratory	• blackboard, videoprojector, computers (2 students/computer); • Experimental setup for the study of the phenomena addressed.

6. Objectives of the discipline - expected learning outcomes to the formation of which the completion and promotion of the discipline contribute

Knowledge	- To know the advanced notions in the field of Physics, which involves a critical understanding of theories and principles; - To know the language specific to the field; - To know physical phenomena and interpret them by formulating hypotheses and operationalizing key concepts and the appropriate use of laboratory equipment; - To know the constructive and operating principles of the equipment for obtaining and characterizing materials and to explain how to use it.
Skills	- To compare the theoretical results provided by the specialized literature with those of an experiment carried out within a professional project; - To describe physical systems using specific theories and tools (experimental and theoretical models, algorithms, schemes, etc.); - To apply the principles and laws of physics in solving theoretical or practical problems, under conditions of qualified assistance. - To characterize the specific properties of some materials taking into account the field in which they are used; - To use experimental techniques for obtaining and characterizing materials; - To identify the most appropriate methods to develop new materials with well-defined properties.
Responsibility and autonomy	- Participate in some concrete physics experiments; - To critically analyze a specialized report, scientific communication with a medium degree of difficulty in the field of physics; - To be autonomous in the context of handling laboratory equipment, including in situations requiring an interdisciplinary approach; - To autonomously use information sources and resources for communication and assisted professional training (Internet portals, specialized software applications, databases, online courses, etc.) both in Romanian and in a language of international circulation.

7. Content

7.1 Lecture Metode de predare: Expunere, prezentare, exemple etc. Suporturi de curs (inclusiv) pe e-learning/google classroom		Observații
1.	Introduction in optical spectroscopy (2h)	[1]
2.	Physical quantities used in optical spectroscopy (2h)	[1]
3.	Radiation sources in optical spectroscopy, monochromators and detectors (2h)	[1,2]
4.	Measuring and analyzing optical absorption spectra (2h)	[1-3]
5.	The study of emission spectra (2h)	[2]
6.	Quantum yield. Case study. (2h)	[1-3]
7.	The lifetime of excited states (2h)	[1-4]
8.	Raman spectroscopy (2h)	[1]
9.	Fourier transform spectroscopy (2h)	[2]
10.	Optical spectroscopy of rare earth ions (2h)	[1,2]
11.	Optical spectroscopy of transition metal ions (2h)	[1-3]
12.	Optical spectroscopy of color centers (2h)	[8]
13.	Judd-Ofelt analysis (2h)	[8-11]
14.	Laser spectroscopy (2h)	[1,2]
7.2 Laboratory		Observații
1.	Safety regulations (2h)	
2.	Presentation of laboratory equipment and devices (2h)	[1-3]
3.	Measuring, processing and analyzing UV-VIS absorption spectra. Beer-Lambert law (4h)	[1]
4.	The influence of impurity concentration on the spectroscopic properties of rare-earth doped fluorite crystals (4h)	[1-3]
5.	Measuring, processing and analysis of FTIR absorption spectra for CaF_2:ErF_3 crystals (4h)	[1-3]
6.	Measurement and analysis of emission and excitation spectra of rare-earth doped fluorite crystals (4h)	[1-3]
7.	Spectral deconvolution (Gauss, Lorentz, Voigt) (4h)	[1,2]
8.	Optical characterization of F centers in ionic crystals. Determination of the concentration of F centers in crystals (4h)	[1-3]

References

1. M. Ștef, "*Notițe de curs*", https://physics.uvt.ro/~stef/spectroscopie/
2. J.G. Sole, L.E. Bausa, D. Jaque, "*An introduction to the Optical Spectroscopy of Inorganic Solids*", John Wiley & Sons Ltd., England 2005;
3. N.V. Tkachenko, "*Optical spectroscopy. Methods and Instrumentation*", Elsevier, Amsterdam, Boston 2006;
4. N. M. Avram, "*Fizica Atomului şi Moleculei*", Univ. Timişoara, 1986
5. B. H. Brandsen, C. J. Joachain, "*Fizica atomului si a moleculei*", Ed. Tehnica, Buc.,1998
6. N.M.Avram, M.Prosteanu, "*Spectroscopie și laseri*", Univ.Timișoara,1989
7. Peter F. Bernath, "*Spectra of Atoms and Molecules*", Oxford University Press, 1995;
8.Demtroder W., "*Laser Spectroscopy. Basic Concept and Instrumentation*", Springer, Berlin, 1988
9. Josesph R. Lakowicz, "*Principles of Fluorescence Spectroscopy*", Springer, 2006.
10. B. Henderson, R. Bartram, "*Crystal-Field Engineering of Solid-State Laser Materials*", Cambridge University Press, 2000

11. W. Fowler, *Physics of color centers*, Acad. Press, 19688. B. Henderson, R. Bartram, "Crystal-Field Engineering of Solid-State Laser Materials", Cambridge University Press, 2000

8. Corroboration of the contents of the discipline with the expectations of representatives of the epistemic community, professional associations and representative employers in the field related to the program

Knowing and understanding the specific phenomena of the discipline, training and developing the practical skills of handling laboratory equipment, performing experiments, processing experimental data and interpreting the results correctly and completely, practicing the spirit of teamwork and the ability to organize and investigation, cultivating a scientific environment based on values, professional ethics and quality, are just a few arguments that motivate the usefulness of this discipline for training a future physicist.

9. Assessment

Activity	9.1 Assessment criteria	9.2 Assessment methods	9.3 Weight of the final grade
9.4 Lecture	Knowledge testing	Grid test	50%
9.5 Seminar / laboratory	Presence, activity		50%
9.6 Minimum performance standard: Grade 5			
• Students to know the basic terminology; • Students to prepare a laboratory report by identifying and using the main physical laws and principles from a real context (problem); • Students to interpret the results of experimental measurements or theoretical calculations, by using appropriate numerical or statistical methods.			

Discipline holder
Conf. univ. dr. Marius Ștef

Date of approval in the department

Head of department
Conf. univ. dr. Nicoleta Ștefu