

## FISA DISCIPLINEI Syllabus

### 1. Information about the program

1.1. University	West University of Timisoara
1.2. Faculty	PHYSICS
1.3. Department	PHYSICS
1.4. Study direction	PHYSICS
1.5. Study cycle	MASTER
1.6. Study program / qualification	PHYSICS AND TECHNOLOGY OF ADVANCED MATERIALS / according to COR: Analyst - 251201; Research assistant in physics - 211103; Physicist - 211101; Teacher - 233002;

### 2. Subject matter information

2.1. Subject matter	Optical spectroscopy of advanced materials						
2.2. Subject teacher	Lector dr. Marius Ștef						
2.3. Subject applications teacher (seminar / laboratory)	Lector dr. Marius Ștef						
2.4. Study year	2	2.5. Semester	3	2.6. Assessment type	E	2.7. Subject type	Op. PTAM2305

### 3. Study time distribution

3.1. Nr. of hours/week	4	In which: 3.2 course	2	3.3. seminar/laboratory	2
3.4. Total hours in educational plan	56	In which: 3.5 course	28	3.6. seminar/laboratory	28
<b>Time distribution:</b>					<b>hours</b>
Study after lecture notes, bibliography or notes					22
Additional documentation in the library, electronic specialty platforms/ field					14
Seminar / laboratory preparations, homework, portfolio and essays					14
Tutoring					4
Exams					14
Other activities...					-
3.7. Total number of personal study hour					68
3.8. Total number of hours in semester					56
3.9. Number of credits					6

### 4. Preconditions (where appropriate)

4.1. curriculum	<ul style="list-style-type: none"> <li>• Complements of solid state physics and statistical physics</li> <li>• Bazele spectroscopiei și laserilor</li> <li>• Fizica atomului și moleculei</li> </ul>
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	<ul style="list-style-type: none"> <li>• Optică</li> </ul>
4.2. Competences	<ul style="list-style-type: none"> <li>•</li> </ul>

### 5. Conditions (where appropriate)

5.3 for course	<ul style="list-style-type: none"> <li>• laptop</li> <li>• projector</li> </ul>
5.4 for seminar/lab	<ul style="list-style-type: none"> <li>• laptop</li> <li>• projector</li> <li>• experimental set-up</li> </ul>

### 6. Specific skills gained

Professional competences	<ul style="list-style-type: none"> <li>• Capacity of analyze and synthesize (adaptability to new situation, realization of synthesis and comparisons, correlations and propinquity).</li> <li>• Basic knowledge (thermodynamics of crystallization)</li> <li>• Basic knowledge necessary to profess (presentation, dialog)</li> <li>• Knowledge of foreign languages (English)</li> <li>• Theoretical understanding (of evolution of basic concepts in physics of crystallization)</li> <li>• Deep understanding (of basic notions, of physical parameters)</li> <li>• Experimental skills (the understanding of experiments)</li> <li>• Computational skills (PC uses for research, data acquisition)</li> <li>• Culture in Physics domain</li> <li>• Bibliography investigation</li> <li>• Learning skills</li> <li>• Skills for team working</li> <li>• The capacity to transfer the acquired knowledge in practical applications</li> <li>• Capacity to plan and organize experimental or theoretical applications</li> <li>• Capacity of solving characteristic problems for real physical systems.</li> <li>• Capacity of critical evaluations and auto evaluation.</li> <li>• Capacity of communication inside a group</li> </ul>
Transversal competences	<ul style="list-style-type: none"> <li>• Effective use of information sources, communication resources and training assistance (Internet portals, specialized software, data bases, online courses, etc..) both in romanian and in a foreign language (english).</li> </ul>

### 7. Course Objectives

7.1 Main Objective	<ul style="list-style-type: none"> <li>• OG: Students to identify the specific concepts and phenomena ia a given context and to apply these knowledge in the analysis and interpretation of experimental data.</li> </ul>
7.2 Specific objectives	O.c1: Students to define the specific notions of this discipline and to

	<p>describe the phenomena</p> <p>O.ap2: Students to use correct laboratory equipment to perform measurements.</p> <p>O.ap3: Students to process experimental data using software packages and correctly interpret the experimental results.</p> <p>O.ap5: Students to develop their organizational capacity</p> <p>O.at6: Students to develop their spirit of teamwork.</p> <p>O.at7: Students to appreciate and cultivate a scientific environment based on values and quality</p>
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## 8. Table of content

8.1. Course	Teaching methods	Remarks, details
1. Introduction optical spectroscopy. (2 hr.)	Exposure, introductory conversation, heuristic conversation, illustration using analogies	The lecture will be interactive, conducting learning being facilitated by engaging students in conversation episodes - to catching the attention, for updating of some knowledge acquired at university courses and systematization / fixing the new knowledge (OG and O.c1).  Students will develop their ability in of analysis and synthesis,  Students will use correctly the the terminology in physics in writing and oral communication.  Students will become familiar with a scientific environment based on values and quality (O.at7)
2. Crystal growth methods (4h)		
3. Study of absorption spectra of Erbium-doped fluorite crystals (2 hr.)		
4. Emission spectra of Erbium doped fluorite crystals (2 hr.)		
5. Judd-Ofelt theory. Applications for the Er <sup>3+</sup> ion doped CaF <sub>2</sub> crystals (4 hr.)		
6. Judd-Ofelt theory. Applications for the Er <sup>3+</sup> ion doped BaF <sub>2</sub> crystals (4 hr.)		
7. Study of the optical properties of the Yb <sup>3+</sup> doped CaF <sub>2</sub> crystals (2 hr.)		
8. Study of the charge conversion of rare-earth ions doped crystals (4 hr.)		
9. Medical applications of optical spectroscopy (2 hr.)		
10 Medical applications of lasers (2 hr.)		

### Recomanded literature

1. J.G. Sole, L.E. Bausa, D. Jaque, "An introduction to the optical spectroscopy of inorganic solids", John Wiley&Sons Ltd., England 2005;
2. N.V. Tkachenko, "Optical spectroscopy. Methods and Instrumentation", Elsevier, Amsterdam, Boston 2006;
3. Peter F. Bernath, "Spectra of Atoms and Molecules", Oxford University Press, 1995;
4. Demtroder W., "Laser Spectroscopy. Basic Concept and Instrumentation", Springer, Berlin, 1988
5. Joeseph R. Lakowicz, "Principles of Fluorescence Spectroscopy", Springer, 2006.
6. O. Svelto, D.C. Hanna, „Principles of Lasers”, Plenum Press, New-York, 1989

8.2. Seminar / Laboratory	Teaching methods	Remarks, details
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1. Labor protection. Optical spectroscopy instruments (2 hr)	<p>Demonstrative experiments in order to illustrate the phenomena or processes, verification of laws and assumptions. It will call on analogies and algorithms.</p>	<p>Students will form / practice / develop:</p> <ul style="list-style-type: none"> <li>• Ability to handle the laboratory equipment in order to perform measurements, to process data and to analyse the experimental results (O.ap2).</li> <li>• teamwork spirit (O.at6).</li> <li>• Ability to organize and to investigate (O.ap5).</li> </ul> <p>Students will use appropriate statistical and numerical methods for analysis of physical processes (O.ap3). Experimental data and graphs will be done using Excel, Origin and MathCad.</p>
2. Crystal growth methods (2 hr)		
3. Symmetry elements and operations. (2 hr)		
4. Recording, processing and analysis of the UV-VIS absorption spectra of some advanced materials (4 hr)		
5. Recording, processing and analysis of the IR absorption spectra of some advanced materials (4 hr)		
6. UV-VIS emission and excitation spectra of some advanced materials. (4 hr)		
7. Multi-peaks fit methods of optical spectra decomposition. (4 hr)		
8. Gaussian multi-peak fit for identifying emission characteristic bands (4 hr)		
9. Recovery lab. (2h)		

### 9. Relation between subject content and the expectations of employers

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### 10. Assessment

Activity	10.1 Assessment criteria	10.2 Assessment method	10.3 Percent in final mark
<b>10.4 Course</b> will take place online using the GoogleMeet and Moodle application - WUT e-learning platform - <a href="https://elearning.e-uvt.ro/">https://elearning.e-uvt.ro/</a>	answers at exams (final evaluation)	oral	50%
<b>10.5. Seminar/labs</b> will take place face to face	answers at laboratory activities	oral	25%
	tests along the laboratories	oral	25%
<b>10.6 Minimum performance standards</b>			
• correct formulation of the proposed subject without demonstrations			

Completion date:

September, 1<sup>st</sup> 2021

Subject teacher's signature:

Conf. univ. dr. Marius STEF

Subject applications teacher's  
signature:

Conf. univ. dr. Marius STEF

Department Director' Signature:  
Conf. univ. dr. Nicoleta ȘTEFU