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			Defects in crystals				
2.2. Subject teacher			Assoc. prof. dr. Marius Ștef				
2.3. Subject applications teacher (seminar / laboratory)			Assoc. prof. dr. Marius Stef				
2.4. Study year	2	2.5. Semester	3	2.6. Assessment type	**E**	2.7. Subject type	**Op-PTAM2304**

3. Study time distribution

3.1. Nr. of hours/week	3	In which: 3.2 course	2	3.3. seminar/laboratory	1
3.4. Total hours in educational plan	42	In which: 3.5 course	28	3.6. seminar/laboratory	14

Time distribution:	**hours**
Study after lecture notes, bibliography or notes	20
Additional documentation in the library, electronic specialty platforms/ field	14
Seminar / laboratory preparations, homework, portfolio and essays	14
Tutoring	8
Exams	14
Other activities...	-

3.7. **Total number of personal study hour**	84
3.8. **Total number of hours in semester**	42
3.9. **Number of credits**	6

4. Preconditions (where appropriate)

4.1. curriculum	• Complements of solid state physics and statistical physics • Fizica solidului si a semiconductorilor
4.2. Competences	•

5. Conditions (where appropiate)

5.3 for course	• laptop • projector
5.4 for seminar/lab	• laptop • projector • experimental set-up

6. Specific skills gained

Professional competences	• Capacity of analyze and synthesize (adaptability to new situation, realization of synthesis and comparisons, correlations and propinquity). • Basic knowledge (thermodynamics of crystallization) • Basic knowledge necessary to profess (presentation, dialog) • Knowledge of foreign languages (English) • Theoretical understanding (of evolution of basic concepts in physics of crystallization) • Deep understanding (of basic notions, of physical parameters) • Experimental skills (the understanding of experiments) • Computational skills (PC uses for research, data acquisition) • Culture in Physics domain • Bibliography investigation • Learning skills • Skills for team working • The capacity to transfer the acquired knowledge in practical applications • Capacity to plan and organize experimental or theoretical applications • Capacity of solving characteristic problems for real physical systems. • Capacity of critical evaluations and auto evaluation. • Capacity of communication inside a group
Transversal competences	• 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).

7. Course Objectives

7.1 Main Objective	• 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.
7.2 Specific objectives	O.c1: Students to define the specific notions of this discipline and to describe the phenomena O.ap2: Students to use correct laboratory equipment to perform measurements.

	O.ap3: Students to process experimental data using software packages and correctly interpret the experimental results. O.ap5: Students to develop their organizational capacity O.at6: Students to develop their spirit of teamwork. O.at7: Students to appreciate and cultivate a scientific environment based on values and quality

8. Table of content

8.1. Lecture	**Teaching methods**	**Remarks, details**
1. Introduction. Classification of defects in crystals. (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. Types of point defects		
3. Thermodynamics of crystallization processes. Gibbs-Thomson equation. Wulf theorem. Crystal shapes. (2 hr.)		
4. Homogeneous and heterogeneous nucleation (2 hr.)		
5. Crytsalization of multicomponent materials (2 hr.)		
6. Phase diagrams. Segregation (2 hr.)		
7. Impurities centers. (2 hr.)		
8. Dislocations (2 hr.)		
9. Crystal growth models. Jackson model (2 hr.)		
10 Crystallization interface stability. (2 hr.)		
11. Color centers (2 hr.)		
12. F color ceters (2 hr.)		
13. F_A color ceters. (2 hr.)		
14. Laser color centers. (2 hr.)		

Recomanded literature

1. I. Nicoară, *Defecte de structură în cristale*, Ed. Mirton, Timișoara, 2003
2. M. Ștef, I. Nicoară, *Caracterizarea defectelor de structură cristalină*, Ed. Marineasa, Timișoara, 2009
3. S. Amelinckx, *The direct observations of dislocations*, Acad. Press, N.Y. 1964
4. A.A.Kaminskii, *Laser Crystals, Their Physics and Properties*, Springer-Verlag, Barlin, 1981
5. I.Nicoară, D.Nicoară, *Cristale artificiale*, Ed.Mirton, Timișoara, 1999
6. Y. Quere, *Physics of materials*, Gordon and Breach Science Publishers, 1998.
7. 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

8.2. Seminar / Laboratory	**Teaching methods**	**Remarks, details**
1. Crystalline structures. (2 hr)	Demonstrative experiments in order to	Students will form / practice / develop:
2. Point defects in various crystals. (2		

hr)	illustrate the phenomena or processes, verification of laws and assumptions. It will call on analogies and algorithms.	• Ability to handle the laboratory equipment in order to perform measurements, to process data and to analyse the experimental results (O.ap2). • teamwork spirit (O.at6). • Ability to organize and to investigate (O.ap5). 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.
3. Direct observation of the dislocations. (2 hr)		
4. Determination of dislocation's density in crystals. (2 hr)		
5. Electrolytic coloration of the crystals. (2 hr)		
6. Optical characterization of F centers. (2 hr)		
7. Impurities in CaF_2 crystals; modeling of crystal field symmetry. (2 hr)		

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2. I. Nicoară, *Defecte de structură în cristale*, Ed. Mirton, Timișoara, 2003
3. S. Amelinckx, *The direct observations of dislocations*, Acad. Press, N.Y. 1964

9. Relation between subject content and the expectations of employers

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10. Assesment

Activity	10.1 Assesment criteria	10.2 Assesment method	10.3 Percent in final mark
10.4 Lecture. will take place face-to-face.	answers at exams (final evaluation)	oral	50%
10.5. Seminar/labs will take place face to face	final answers at laboratory activities	oral	25%
	tests along the laboratories	oral	25%
10.6 Minimum performance standards			
• correct formulation of the proposed subject without demonstrations			

Completion date:	Subject teacher's signature:	Subject applications teacher's signature:
September 15th 2022	Assoc. prof. dr. Marius STEF	Assoc. prof. dr. Marius STEF

Department Director' Signature:
Assoc. prof. dr. Catalin MARIN