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	METODE AVANSATE DE CERCETARE IN FIZICA/ ADVANCED RESEARCH METHODS IN PHYSICS

2. Subject matter information

2.1. Subject matter			**Synthesis and Characterization of Nano and Micromaterials** ARMP 2305				
2.2. Subject teacher			CS2 Dr. Maria Poienar				
2.3. Subject applications teacher (seminar / laboratory)			CS2 Dr. Maria Poienar				
2.4. Study year	2	2.5. Semester	1	2.6. Assessment type	**E**	2.7. Subject type	DS, DOP

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

Time distribution:	**hours**
Study after lecture notes, bibliography or notes	20
Additional documentation in the library, electronic specialty platforms/ field	34
Seminar / laboratory preparations, homework, portfolio and essays	30
Tutoring	6
Exams	4
Other activities...	-

3.7. **Total number of personal study hour**	94
3.8. **Total number of hours in semester**	150
3.9. **Number of credits**	6

4. Preconditions (where appropriate)

4.1. curriculum	• Chemistry • Solid-State Physics • Electricity and Magnetism • Numerical data analysis

4.2. Competences	• Basic knowledge in solid state physics and chemistry • Basic knowledge in numerical data analysis

5. Conditions (where appropiate)

5.3 for course	• Laptop + projector, notebooks
5.4 for laboratory	• Laptop + projector, notebooks • Laboratory equipments.

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	• to critically analyze a specialized report, scientific communication with a medium degree of difficulty in the field of physics • 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. Table of content

7.1 Course – 28 hours	Teaching methods	Observations
Lecture 1. Introduction to materials sciences	exposition	2 hours
Lecture 2. Synthesis methods to obtain nano and micro materials: Part 1	exposition	2 hours
Lecture 3. Synthesis methods to obtain nano and micro materials: Part 2	exposition	2 hours
Lecture 4. Crystal and magnetic structure of the materials	exposition	2 hours
Lecture 5. The use of X-Ray and neutron powder diffraction	exposition	2 hours
Lecture 6. The Rietveld method	exposition	2 hours
Lecture 7. Thermogravimetric analysis	exposition	2 hours
Lecture 8. The investigation of the materials morphology	exposition	2 hours
Lecture 9. The magnetic properties of nano and micromaterials	exposition	2 hours
Lecture 10. The electric properties of nano and micromaterials	exposition	2 hours
Lecture 11. Spectroscopy analysis: UV-Vis-NIR, Raman and FT-IR	exposition	2 hours
Lecture 12. Photocatalytic properties of nano and micromaterials	exposition	2 hours
Lecture 13. Electrochemical properties of nano and micromaterials	exposition	2 hours
Lecture 14. The analysis of a scientific article	exposition	2 hours

Bibliography

1. B. D. Cullity, C. D. Graham, **Introduction To Magnetic Materials**, IEEE Press, Wiley, 2009
2. Peter Mohn, **Magnetism In The Solid State,** An Introduction, Corrected Second Printing, 2006, Springer
3. Nicola Spaldin, **Magnetic Materials, Fundamentals And Applications,** Cambridge University Press, 2011
4. J.M.D. Coey, **Magnetism and magnetic materials**, Cambridge University Press, 2010.

7.2 Labs	Teaching methods	Observations
Laboratory 1. Presentation of the synthesis protocols in air or in controlled atmosphere: reactives, crucibles, analytical balance, furnaces.	exposition, experiment	4 hours
Laboratory 2. Presentation of the equipment used in the laboratory and in the Large-Scale Facilities for the X-ray diffraction.	exposition, dialog	2 hours
Laboratory 3. Identification of crystal phases from X-Ray diffraction analysis.	exposition, data analysis	2 hours
Laboratory 4. Visualisation of crystal and magnetic structures by using different software.	exposition, data analysis	2 hours

Laboratory 5. Rietveld refinement of X-Ray diffraction pattern. Practical case: transition metal oxide.	exposition, data analysis	2 hours
Laboratory 6. Rietveld refinement of X-Ray diffraction pattern. Practical case: transition metal fluoride.	exposition, data analysis	2 hours
Laboratory 7. Rietveld refinement of X-Ray diffraction pattern: Microstructural effects and quantitative phase analysis.	exposition, data analysis	2 hours
Laboratory 8. The data treatment for the magnetic and electric properties.	exposition, data analysis	4 hours
Laboratory 9. The influence of the external parameters (temperature, magnetic field or pressure) upon the physical properties.	exposition	4 hours
Laboratory 10. How to write a scientific article (research paper): general structure of a research paper; steps to organizing an article; examples; discussion.	exposition, dialog	4 hours

Bibliography

[1] "FULLPROF: A Program for Rietveld Refinement and Pattern Matching Analysis", by J. Rodríguez-Carvajal.
[2] J. Rodríguez-Carvajal, Study of MicroStructural Effects by Powder Diffraction Using the Program, 2003, Materials Science;
[3] Barbara J. Hoogenboom, and Robert C. Manske, How to write a scientific article, Int J Sports Phys Ther. 2012 Oct; 7(5): 512–517.

8. Relation between subject content and the expectations of employers

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9. Assesment

Activity type	9.1 Assesment criteria	9.2 Assesment method	9.3 Percent in final mark
9.4 Course	- the scientific level of the presentation will be evaluated; - the clarity in presentation the data; - the level of knowledge will be evaluated based on the given answers; - the ability of explaining the theoretical aspects.	*Summative assessment* - Oral examination: power point presentation in English based on a subject from the course.	50%
9.5. Labs	- activity during the experiments and interpretation of data - answers and discussions during the seminars - ability to use the programs (FullProf, Origin, Vesta etc)	*Formative assessment:* - continuous in the course of the semester	50%

9.6 Minimum performance standards
• Fulfillment of 50% of the abovementioned criteria.

Completion date:15.09.2024

Subject teacher's signature:
CS2 Dr. Maria POIENAR,
[redacted]
Subject applications teacher's signature:
CS2 Dr. Maria POIENAR,
[redacted]
Department Director' Signature:
Associate Professor Dr. Nicoleta STEFU,