SYLLABUS

1. Information about the study programme

1.1 Institution of higher education	West University of Timisoara
1.2 Faculty	PHYSICS and MATHEMATICS
1.3 Department of	PHYSICS
1.4 Field of study	PHYSICS
1.5 Study cycle	MASTER
1.6 Study programme	METODE AVANSATE DE CERCETARE IN FIZICA/ ADVANCED RESEARCH METHODS IN PHYSICS

2. Information about the subject/discipline

2.1 Name			**Synthesis and Characterization of Nano and Micromaterials** ARMP 2305				
2.2 Course coordinator			CS2 Dr. Maria Poienar				
2.3 Seminar coordinator			CS2 Dr. Maria Poienar				
2.4 Year of study	2	**2.5 Semester**	1	**2.6 Type of assessment**	E[1]	**2.7 Type of discipline**	DS, DOP

3. Total estimated time (hours of teaching per semester)[2]

3.1 Number of hours per week	3	**3.2 course**	2	**3.3 seminar/laboratory**	1
3.4 Total hours in the curriculum	**42**	**3.5 course**	**28**	**3.6 seminar/laboratory**	**14**

Distribution of time:	**hours**
Study based on Instructions, course materials, bibliography and notes	**42**
Additional documentation library, specialized electronic platforms / field	**32**
Training seminars / laboratories, homework, essays, portfolios and essays	**30**
Tutoring	**20**
Examinations[3]	**2**
Other activities	**7**

3.7 Total hours of individual study	**133**
3.8 Total hours per semester[4]	**177**
3.9 Number of credits	**7**

[1] According to article 37, paragraph (1) of the Higher Education Law no. 199/2023, with subsequent amendments and additions, "the academic success of a student during a study program is determined by verifying the acquisition of the expected learning outcomes through exam-type evaluations and evaluation throughout the semester".

[2] The total number of contact hours and individual study hours will be aligned with the number of credits allocated to the course. One credit corresponds to a total between 25 and 30 hours of teaching activities and individual study. At the level of academic departments may establish, by discipline categories, the exact equivalence between one credit and the number of hours.

[3] The hours corresponding to examinations are added only to the point 3.8 – The total hours per semester, not to be added to the point 3.7 – Total hours of individual study.

[4] Total hours per semester = total hours in the curriculum + total hours of individual study + hours allocated to examinations.

4. Prerequisites (where applicable)

4.1 of curriculum	• Chemistry • Solid-State Physics • Electricity and Magnetism • Numerical data analysis
4.2 of skills	• Basic knowledge in solid state physics and chemistry • Basic knowledge in numerical data analysis

5. Conditions (where applicable)

5.1 for the course	Laptop + projector, notebooks
5.2 for the seminar	Laptop + projector, notebooks Laboratory equipments.

6. Discipline objectives - expected learning outcomes which contribute to the completion and passing the discipline

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. Contents

The platform through which the course materials in electronic format and other learning/bibliographic resources can be accessed:-

7.1 Course	Teaching methods	Comments
1. Introduction to materials sciences	exposition	**2 hours**
2. Synthesis methods to obtain nano and micro materials: Part 1	exposition	**2 hours**
3. Synthesis methods to obtain nano and micro materials: Part 2	exposition	**2 hours**
4. Phase identification. The use of X-Ray and neutron powder diffraction	exposition	**2 hours**
5. The investigation of the materials morphology	exposition	**2 hours**
6. Thermogravimetric analysis	exposition	**2 hours**
7. The magnetic properties of nano and micromaterials	exposition	**2 hours**
8. The electric properties of nano and micromaterials	exposition	**2 hours**
9. Spectroscopy analysis: UV-Vis-NIR, Raman and FT-IR	exposition	**2 hours**
10. Photocatalytic properties of nano and micromaterials	exposition	**2 hours**
11. Electrochemical properties of nano and micromaterials	exposition	**2 hours**
12. Materials applications	exposition	**2 hours**
13. The analysis of a scientific article-Part 1	exposition	**2 hours**
14. The analysis of a scientific article-Part 2	exposition	**2 hours**
Bibliography: **[1] B. D. Cullity, C. D. Graham, Introduction To Magnetic Materials, IEEE Press, Wiley, 2009** **[2] HANDBOOK OF HYDROTHERMAL TECHNOLOGY A Technology for Crystal Growth and Materials Processing by K. Byrappa, Masahiro Yoshimura** **[3] Nicola Spaldin, Magnetic Materials, Fundamentals And Applications, Cambridge University Press, 2011** **[4] SOLID STATE CHEMISTRY, An introduction, L.E. Smart and A.A. Moore, Taylor and Francis**		
7.2. Seminar	**Teaching methods**	**Comments**
1. Presentation of the synthesis protocols in air: reactives, crucibles, analytical balance, furnaces.	exposition, experiment	**2 hours**
2. X-Ray diffraction experiments.	exposition, experiment	**4 hours**
3. Identification of phases from X-Ray diffraction patterns. Rietveld refinement.	exposition, experiment	**2 hours**
4. Investigation of the samples morphology by microscopy	exposition, experiment	**2 hours**
5. The data treatment for the magnetic and electric properties.	exposition, experiment	**2 hours**

6. The influence of the external parameters (temperature, magnetic field or pressure) upon the physical properties.	exposition, experiment	**2 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.
- [4] How To Correctly Determine the Band Gap Energy of Modified Semiconductor Photocatalysts Based on UV–Vis Spectra, J. Phys. Chem. Lett. 2018, 9, 23, 6814–6817

8. Corroboration of the course contents with the epistemic expectations of the community representative, professional associations and representative employers of the programme itself

9. Use of tools based on generative artificial intelligence

To complete the tasks defined in the assessment section (the lecture/seminar), the use of generative AII tools is permitted for generating ideas, editing/reviewing.
The most well-known examples of generative AII tools include, but are not limited to: ChatGPT, Google Gemini, Copilot for text, or MidJourney for images.
Each student will specify, in a statement written separately for each assignment, according to the model in Annex 3 of the Regulation on the use of generative artificial intelligence in the educational process at UVT, the tool they used, how it was used, and the part of the assignment in which it was used. The statement will be included by the student at the beginning of the submitted assignment.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of the final mark
10.4 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;	Summative assessment - Oral examination: power point presentation in English based on a subject from the course.	70%

	- the ability of explaining the theoretical aspects.		
10.5 Seminar	- 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.	30 %
10.6 Minimum performance standards			
Fulfillment of 50% of the abovementioned criteria.			

Date of submission: 16.09.2026

Titular of the course: CS II. Dr. Maria Poienar

Signature:

Date of approval in department:

Seminary titular:

Signature:

HEAD OF THE DEPARTMENT: