

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	Advanced Research Methods in Physics

2. Information about the subject/discipline

2.1 Name	Crystal Growth Methods		ARMP1201				
2.2 Course coordinator	C.S.III Dr. Gabriel Raoul BUȘE						
2.3 Seminar coordinator	Conf. Dr. Octavian Mădălin BUNOIU						
2.4 Year of study	1	2.5 Semester	2	2.6 Type of assessment	E	2.7 Type of discipline	DS/DOP

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

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					30
Additional documentation library, specialized electronic platforms / field					30
Training seminars / laboratories, homework, essays, portfolios and essays					30
Tutoring					5
Examinations					3
Other activities					10
3.7 Total hours of individual study	105				
3.8 Total hours per semester	150				
3.9 Number of credits	6				

4. Prerequisites (where applicable)

4.1 of curriculum	<ul style="list-style-type: none"> Complements of Atom and Molecule Physics Complements of Solid-State Physics
4.2 of skills	<ul style="list-style-type: none"> scientific communication (presentation, dialogue) in English language

5. Conditions (where applicable)

<p>5.1 for the course</p>	<ul style="list-style-type: none"> • expositions are frontal, dialogue is conducted within collective group discussions; • students must make use of the institutional (@e-uvt) address in electronic communication and, if requested to do so, use online educational platforms (Google Meet). Specifically, the platform used for the dissemination of support materials is Google Classroom; • laptop + projector, notebooks.
<p>5.2 for the seminar</p>	<ul style="list-style-type: none"> • tasks are assigned either individually or in group, under the supervision of the instructor; • students must make use of the institutional (@e-uvt) address in electronic communication and, if requested to do so, use online educational platforms (Google Meet). Specifically, the platform used for the dissemination of support materials is Google Classroom; • laptop + projector, notebooks, experimental installations.

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

<p>Knowledge</p>	<ul style="list-style-type: none"> • know the advanced notions in the field of Physics, which involves a critical understanding of theories and principles; • know the working formulas for calculations with physical quantities using properly the principles and laws of physics; • know the language specific to the field; • know physical phenomena and interpret them by formulating hypotheses and operationalizing key concepts and the appropriate use of laboratory equipment; • know the constructive and operating principles of the equipment for obtaining and characterizing materials and to explain how to use it; • define advanced physical concepts, theories, and methods; • be familiar with the main types of analyses and techniques used; • understand the concepts and phenomena underpinning specific methods and the instrumental methods of analysis and measurement specific to physics; • understand procedures used in materials physics; • investigate methods for the analysis of materials.
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Skills	<ul style="list-style-type: none"> • compare the theoretical results provided by the specialized literature with those of an experiment carried out within a professional project; • deduce the working formulas for calculations with physical quantities, using appropriately the principles and laws of physics; • describe physical systems using specific theories and tools (experimental and theoretical models, algorithms, schemes, etc.); • apply the principles and laws of physics in solving theoretical or practical problems, under conditions of qualified assistance; • use the computer and calculation programs for the numerical simulation of the physical processes; • analyze physical systems and provide order-of-magnitude estimates of quantities; • characterize the specific properties of some materials taking into account the field in which they are used; • use experimental techniques for obtaining and characterizing materials through optical and spectroscopic methods; • identify the most appropriate methods to develop new materials with well defined properties; • properly operate measuring instrumentation to carry out the investigations required for a concrete application.
Responsibility and autonomy	<ul style="list-style-type: none"> • assume responsibility for managing professional development; • to be autonomous in the context of handling laboratory equipment, including in situations requiring an interdisciplinary approach; • to critically analyze a specialized report, scientific communication with a medium degree of difficulty in the field of physics.

7. Contents

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

7.1 Course	Teaching methods	Comments
1. Phase transformation. Solidification	exposition	2 hours [1] p.67
2. Crystal growth process		2 hours [1] p.171
3. Crystal growth methods (from solutions, from melt, etc.)		2 hours [4], [1] p.419
4. Verneuil method		2 hours [4]
5. Czochralski method		2 hours [6] p.49
6. Bridgman method. General consideration		2 hours [6] p.6
7. Bridgman method. System without isolation		2 hours [1] p.117, p.125
8. Bridgman method. System with isolation		2 hours [1] p.131
9. Bulk crystal growth (HEM, GSM methods)		2 hours [6] p.78
10. Shaped crystal growth. Stepanov method		2 hours [6] p.19
11. Shaped crystal growth. EFG method		2 hours [6] p.20

12. Growth stability for EFG method		2 hours [6] p.24
13. Shaped crystal growth. LHPG and NCS methods		2 hours [4]
14. Melting zone method		2 hours [6] p.70
Bibliography:		
[1] I. Nicoară – Tehnologia materialelor cristaline, Tipografia Univ. de Vest, 1998.		
[2] W. Kurz, D. Fischer – Fundamentals of solidification, Trans Tech Publications, 1985.		
[3] Y.A. Tatarchenko – Shaped Crystal Growth, Kluwer Academic Publishers, 1993.		
[4] D.T.J. Hurle (editor) – Handbook of crystal growth, Elsevier, 1993.		
[5] J. Villain, A. Pimpinelli – Physique de la croissance cristalline, Alea Saclez, 1995.		
[6] D. Vizman, I. Nicoară – Curs de tehnologia materialelor cristaline, Ed. Eurobit, 2008.		
7.2. Seminar	Teaching methods	Comments
1. Crystal growth	exposition, dialogue	1 hour [1] p.11
2. Temperature. Thermocouple. Pyrometer	exposition, experiment	2 hours [1] p.77
3. Thermocouple gauges		1 hour, notes
4. Determination of temperature gradient for Zn crystal growth by Bridgman method	exposition, experiment/ simulation	2 hours [1]
5. Growth of Zn crystals by Bridgman method		2 hours [1]
6. Growth of BaF ₂ crystals by Bridgman method		2 hours [1]
7. Growth of CaF ₂ crystals by EFG method		1 hour [1]
8. Growth of sapphire crystals by EFG method		2 hours [1]
9. Growth stability for EFG method		1 hour [1]
Additional bibliography:		
[7] I. Nicoară, D. Nicoară – Cristale artificiale, Editura Mirton, 1999.		

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

The students gain skills useful for jobs in research or industry, specifically relating to crystal growth processes, metallurgy, study of growth processes, operation and physical engineering of crystal growth installations.

9. Use of tools based on generative artificial intelligence

To complete the tasks defined in the assessment section, the use of generative AI tools is permitted for generating ideas / slogans / designs / images /text rewriting, editing / reviewing. The most well-known examples of generative AI 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	knowledge of the theoretical notions	final evaluation (written)	35%
	homework, reports, essays, translations	in the course of the semester (written)	15%
10.5 Seminar	final answers at seminar activities	in the course of the semester (orally)	10%
	tests during the seminars	in the course of the semester (written)	35%
	activity during seminars	in the course of the semester (orally/written)	5%
10.6 Minimum performance standards			
Fulfillment of 50% of the abovementioned criteria.			

Date of submission:
30.01.2026

Titular of the course: C.S.III Dr. Gabriel Raoul BUȘE
Signature:

Date of approval in department:

Seminary titular: Conf. Dr. Octavian Mădălin BUNOIU
Signature:

HEAD OF THE DEPARTMENT:

Conf. Dr. Nicoleta ȘTEFU