SYLLABUS

1. Information about the study programme

1.1 Institution of higher education	West University of Timisoara
1.2 Faculty	Faculty of 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 / according to COR: • Physicist – code ESCO 2111.3 • Research Assistant in Physics – code COR 211103 • Research Assistant in Physics-Chemistry – code COR 211105 • Research Assistant in Technological Physics – code COR - 211107

2. Information about the subject/discipline

2.1 Name			**Rheological characterization of materials**				
2.2 Course coordinator			Professor Dr. Daniela SUSAN-RESIGA				
2.3 Seminar coordinator			Professor Dr. Daniela SUSAN-RESIGA				
2.4 Year of study	2	**2.5 Semester**	3	**2.6 Type of assessment**	E[1]	**2.7 Type of discipline**	**DS, DOP** ARMP 2303

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**	**1/0**
3.4 Total hours in the curriculum	**42**	**3.5 course**	**28**	**3.6 seminar/laboratory**	**14/0**
Distribution of time:					**hours**
Study based on Instructions, course materials, bibliography and notes					60
Additional documentation library, specialized electronic platforms / field					32
Training seminars / laboratories, homework, essays, portfolios and essays					31
Tutoring					5

[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.

Examinations[3]	5
Other activities	-

3.7 Total hours of individual study	**133**
3.8 Total hours per semester[4]	**175**
3.9 Number of credits	**7**

4. Prerequisites (where applicable)

4.1 of curriculum	• Solid physics • Electricity and magnetism • Chemistry • Differential and integral calculus
4.2 of skills	• General competencies: the ability of analysis and synthesis; accumulation of basic general knowledge; proper use of terminology in physics and computer science in written and oral communication in English; Basic Skills PC operating; ability to work independently and in teams. • Professional Skills: identification and proper use of the main physical laws and principles in a given context; use of software packages for data analysis and processing.

5. Conditions (where applicable)

5.1 for the course	• Laptop + projector
5.2 for the seminar	• Magnetorheometer • PC

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

[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.

Skills	• to compare the theoretical results provided by the specialized literature with those of an experiment carried out within a professional project • to deduce the working formulas for calculations with physical quantities, using appropriately the principles and laws of physics • to describe physical systems using specific theories and tools (experimental and theoretical models, algorithms, schemes, etc.) • 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: **e-learning**

7.1 Course – 28 hours	**Teaching methods**	**Comments**
1. Introduction – 2 hours. 2. Flow behaviour and viscosity – 2 hours. - Definitions of terms: shear stress, shear rate, viscosity. 3. Flow behaviour and viscosity – 2 hours. - Flow and viscosity curves. - Model function for flow curves 4. Flow behaviour and viscosity – 2 hours. - Time-dependent behaviour of materials - Temperature-dependent behaviour of materials 5. Rotational tests – 2 hours. 6. Elastic behaviour and shear modulus – 2 hours. 7. Viscoelastic behaviour – 2 hours.	Lectures, introductory conversation, heuristic conversation, illustration, use of analogies and algorithms, conversation retaining and deepening knowledge conversation.	• The lecture will be interactive, directing learning is facilitated by engaging of students in conversation episodes - to capture their attention, for updating of knowledge previous acquired and to systematization / fixing of new knowledges. • It will track the formation of general competence: ability to analyze and synthesize; accumulation of basic general knowledge; proper use of terminology in physics and computer science in written and oral communication in English.

8. Creep test – 2 hours 9. Relaxation test – 2 hours. 10. Oscillatory tests – 2 hours. - Amplitude sweep test - Frequency sweep test 11. Measuring systems – 2 hours. 12. Magnetizable fluids – 2 hours. 13. Rheology of magnetizable nanofluids – 2 hours. 14. Rheology of magnetizable composites – 2 hours.		• It will cultivate a scientific environment based on values and quality.

Bibliography:

- ppt presentations for each course (posted on the e-learning platform in the My Courses section).
- Hackley, V.A., Ferraris, Chiara F., *Guide to Rheological Nomenclature: Measurements in Ceramic Particulate Systems,* NIST Special Publication 946, January 2001.
- Ferguson, J., Kemblowski, Z., *Applied fluid rheology*, Elsevier Applied Science, London, 1991.
- Larson, R.G., *The Structure and Rheology of Complex Fluids*, New York – Oxford, Oxford University Press, 1999.
- Mezger, T.G., *The Rheology Handbook*, Curt R. Vincentz Verlag, Hannover, 2002.
- Daniela Resiga, L. Vékás, Doina Bica, Adrian Chiriac, *Comportarea reologică a fluidelor magnetizabile*, Editura Orizonturi Universitare, Timişoara, 184 pag., 2002. ISBN – 973-8391-00-8.

7.2. Seminar – 14 hours	**Teaching methods**	**Comments**
It will perform rheological and magneto-rheological tests using a Physica MCR 300 rheometer in Rheology Laboratory – National Center for Ingineerig of Systems with Complex Fluids, Polytehnica University of Timisoara. 1. Shear rate dependence of the viscosity. Interpretation of flow / viscosity curves for different materials – 1 hour. 2. Temperature dependence of the viscosity– 1 hour. 3. Influence of the solid and hydrodynamic volumic fraction on the viscosity of some magnetic fluid samples – 2 hours. 4. Influence of the applied magnetic field on the viscosity of some magnetizable fluids – 1 hour.	Experiment, date processing and interpretation of experimental data; it will use analogies and algorithms.	Students will form / practice / develop: • ability to handle laboratory equipment, to perform measurements, to process data and to interpret experimental results. • teamwork spirit. • organizational ability and investigation. It will also track cultivating a scientific environment based on values and quality.

5. Creep test and relaxation test – 1 hour. 6. Amplitude sweep and Frequency sweep – 1 hour. 7. Static and dinamic yield stress measurements– 1 hour. 8. Influence of the applied magnetic field on the yield stress of some magnetizable fluids – 1 hour. 9. Influence of the volumic fraction on the yield stress of some magnetizable fluids – 1 hour. 10. Application of the time-temperature superposition principle to magnetic nanofluids – 2 hour. Colloquy – 2 hours.		It will consider the appropriate use of numerical methods and statistical analysis in processing of specific data. Experimental data and graphs will be achieved using Excel and Origin. To obtain performance will follow the development of the ability to conceive a right to make a report Laboratory. In the last meeting it will hold a laboratory colloquium.
Bibliography: • Hackley, V.A., Ferraris, Chiara F., *Guide to Rheological Nomenclature: Measurements in Ceramic Particulate Systems,* NIST Special Publication 946, January 2001. • Mezger, T.G., *The Rheology Handbook*, Curt R. Vincentz Verlag, Hannover, 2002. • Laboratory reports (posted on the e-learning platform in the My Courses section).		

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

Rheological characterization of materials gives work skills in almost all domains in which the future graduate can work.

9. Use of tools based on generative artificial intelligence

To complete the tasks defined in the assessment section (to both, the lecture and the seminar), the use of generative AII tools is not permitted.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of the final mark
10.4 Course	Students identify concepts and describe / explain the specific phenomena of this discipline in a given context.	*Summative assessment* Written test.	50 %
10.5 Seminar	Students grouped into teams devise a comprehensive report on a topic specified topic, to show how to make measurements and	*Formative assessment:* • Periodic assessment tests. • Laboratory colloquium.	50 %

	processing / interpretation of data. Teams present and discuss these reports.		

10.6 Minimum performance standards

Mark 5 is corresponds to the minimum accumulated knowledge, i.e. for the student capacity to:

- Define the main terms of rheology
- Describe the types of rheological behaviour
- Describes the main rheological methods of investigation of materials.
- Attendance in class: course - 50% , seminar - 70%.

Date of submission:
15.09.2026

Titular of the course:
Prof. Dr. Daniela SUSAN-RESIGA
Signature:

[redacted]

Date of approval in department:

Seminary titular:
Prof. Dr. Daniela SUSAN-RESIGA
Signature:

[redacted]

HEAD OF THE DEPARTMENT:
Associate Professor Dr. Nicoleta ŞTEFU