COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	ARMM
1.3 Department	Mechatronics and Machine Dynamics
1.4 Field of study	Mechatronics and Robotics
1.5 Cycle of study	Bachelor's Degree (Licență)
1.6 Program of study/Qualification	Machatronics (in English)
1.7 Form of education	IF – full-time attendance

2. Data about the subject

2.1 Subject name	Chemistry			Subject code	2.00
2.2 Course responsible/lecturer	Prof. Lorentz Jäntschi lorentz.jantschi@chem.utcluj.ro				
2.3 Teacher in charge of seminars/labs/projects	Prof. Lorentz Jäntschi lorentz.jantschi@chem.utcluj.ro				
2.4 Year of study	I	2.5 Semester	I	2.6 Assessment	EX
2.7 Subject category	Formative category				DF
	Optional				DOB

3. Estimated total time

3.1 Number of hours per week	3	of which:	3.2 Course	2	3.3 Seminar		3.3 Laboratory	1	3.3 Project		3.3 Practical traininh	
3.4 Number of hours per semester	42	of which:	3.5 Course	28	3.6 Seminar		3.6 Laboratory	14	3.6 Project		3.3 Practical training	

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	3
(b) Study of textbooks, course materials, bibliography, and lecture notes	14
(c) Additional research in the library, on specialized electronic platforms, and in the field	2
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(e) Tutoring	
(f) Other activities	0
3.8 Total hours for individual study and evaluation (sum (3.7(a)...3.7(f))	33
3.9 Total hours per semester (3.4+3.8)	75
3.10 Number of credit points	3

4. Pre-requisites (if applicable)

4.1 Curriculum	-
4.2 Competence	-

5. Requirements (if applicable)

5.1. for the course	-
5.2. for the seminar/lab/project	-

6. Subject-specific learning outcomes

Professional competencies	Knowledge and understanding of the basic concepts, models, theories, and methods of chemistry and their appropriate use in professional communication; Utilizing basic knowledge of chemistry for explaining and interpreting specific concepts, situations, and processes; Applying basic principles and methods to solve well-defined problems and situations, typical for the field of study; Using evaluation criteria and methods to assess the quality, advantages, and limitations of certain processes, concepts, methods, and theories; Elaborating activity sheets following the performance of laboratory experiments and obtaining results by applying the described principles and methods.
Transversal competencies	Responsible execution of laboratory activities under autonomy conditions and with assistance from the supervisor; Familiarization with the specific roles and activities of teamwork and the distribution of tasks within the team during experiments conducted in working groups; Awareness of the need for continuous training; Efficient use of resources (course support; laboratory manual; lab notebook; list of questions and answers; individual documentation) and learning techniques (reading; writing; communication; exercise; problem-solving; problem construction) for personal and professional development.

7. Expected learning outcomes

Knowledge	• Knowledge and understanding of the basic concepts, models, theories, and methods of general and applied chemistry (chemical bonds, stoichiometry, equilibria in aqueous solutions). • Understanding the chemical and electrochemical phenomena and mechanisms that form the basis of corrosion processes of metallic materials used in machine building. • Acquiring the fundamental principles of anticorrosive protection, surface preparation (degreasing, pickling, phosphating), and the application of coatings (metallic and organic). • Identifying the chemical structure and behavior of industrial polymers, elastomers, adhesives, and lubricants, as well as their degradation mode under the action of environmental factors. • Knowledge of laboratory safety regulations, hazard pictograms (GHS), and how to interpret Safety Data Sheets (SDS).
Skills	• Correct operation with the minimal useful chemical language, formulas, and chemical reactions to explain and interpret specific processes in machine building technology. • The capacity to perform stoichiometric and concentration calculations (molar, mass, dilutions) necessary for the preparation of industrial solutions (cleaning, pickling, inhibitors). • Executing practical laboratory experiments (measuring pH and conductivity, determining corrosion rate via gravimetric and volumetric methods, performing nickel electrodeposition). • Elaborating activity sheets and technical reports following experiments, through the correct processing of data and interpretation of measurement errors. • Critical selection of optimal materials, coatings, or lubricants based on chemical criteria of compatibility with the operating environment.
Responsibility and autonomy	• Responsible and safe execution of laboratory analyses and experimental determinations, with strict compliance with occupational safety and chemical waste management regulations. • Conscious assumption of specific teamwork roles (in groups of 2-5 students) and efficient distribution of tasks to achieve common experimental objectives. • Self-assessment of training needs and efficient use of documentation resources (course support, laboratory manual, databases) to solve engineering problems with a chemical component.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	Understanding and familiarization with the general concepts of applied chemistry
8.2 Specific objectives	Understanding and correctly operating with the concepts: chemical compound, chemical structure, chemical process, chemical reaction, and chemical equilibrium

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
C1. Chemical Structure and Relationships with Properties	2	Publication of the course materials and bibliography, detailed course topics, the assessment rubric, and at least one model set of examination questions.	
C2. Solutions and Properties of the Chemical Environment	2		
C3. Thermodynamics and Kinetics of Chemical Processes	4	The course is delivered as a Thinking Workshop, featuring a fixed weekly Error Clinic session (analysis of 2-3 typical mistakes) and live demonstrations/simulations.	
C4. Electrochemistry and Energy Sources	4		
C5. Corrosion and Component Protection	4		
C6. Polymers and Elastomers for Robotic Components	4		
C7. Surfaces and Adhesive Joints	2		
C8. Chemistry of Lubricants and Technical Fluids	2		
C9. Chemical Transformations in Manufacturing and Assembly	2		
C10. Chemical Compatibility and Ageing in Service	2		
Bibliography L. Jäntschi, Curs de chimie aplicată, 2026. http://lori.academicdirect.org/courses/			

9.2 Seminar / laboratory / project / practical training	**No. of hours**	**Teaching methods**	**Notes**
L1. Calculated dilution; pH and conductivity table; interpretation of differences	2	Lecture/exposition, front-end experiment, and discussions	
L2. Process kinetics / Temperature-time curves during the curing of a resin	2		
L3. Electrochemistry / Characterization of a cell and commercial accumulators	2	Applied activity, conversation, teamwork in groups of 2-5 students	
L4. Gravimetric and volumetric corrosion on exposed specimens	2		
L5. Polymers and elastomers / Measurement of mass and dimensional variation after exposure	2		
L6. Surface chemistry / Wetting and preparation of adhesive joints	2		
L7. Technical fluids / Viscosity and flow time at controlled temperature	2		
Bibliography L. Jäntschi, Laborator de chimie aplicată, 2026. http://lori.academicdirect.org/courses/			

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

In order to corroborate the contents with the expectations of the academic and economic environment, emphasis is placed on forming practical skills and abilities to use the basic concepts of chemistry to explain phenomena that manifest themselves in the students' field of training, respectively the construction and development of chemical experiments that highlight phenomena whose direction and magnitude of development is of interest; established examples and applications in the field are used, as well as problems gathered from the current concerns of employing companies; the contents and especially their usage examples are updated annually following the experience gained from exchanges with scientific and professional communities.

11. Evaluation

Type of activity	**11.1 Assessment criteria**	**11.2 Assessment methods** (and type of assessment: continuous/summative)	**11.3 Weight in the final grade**
11.4 Course	Knowledge assessment - 3 topics	Written exam - max. 1 hour	50%
11.5 Seminar/Laboratory /Project / Practical training	Laboratory evaluation (tests / notebook)	Chemical formula test, end-of-laboratory test, correctness of calculations in the lab notebook	25%
	Essey	Case study analysis	25%
11.6 Minimum performance standard At least grade 5 in both tests.			

Completion date:	**Faculty members**	**academic rank, title, First Name SURNAME**	**Signature**
20.05.2026	Course	Prof. Lorentz Jäntschi	
	Practical activities	Prof. Lorentz Jäntschi	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head Department Physics and Chemistry Prof. Petru PAȘCUȚĂ

Date of approval by the MDM Department Council 28.05.2026_____	Head of Department MDM Pro.dr.eng. Mircea Bara
Date of approval by the ARMM Faculty Council 16.09.2026_____	Dean, Prof.dr.eng. Nicolae Filip