COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automotive Engineering, Mechatronics and Mechanics
1.3 Department	Mechatronics and Machine Dynamics
1.4 Field of study	Mechatronics and Robotics
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Mechatronics /Engineer
1.7 Form of education	Full time

2. Data about the subject

2.1 Subject name	Materials Technology				Subject code	14.00
2.2 Course responsible/lecturer	Associate professor Bogdan Viorel Neamtu, Bogdan.Neamtu@stm.utcluj.ro					
2.3 Teacher in charge of seminars/labs/projects	Assistant professor Gabriel Batin, Gabriel.Batin@stm.utcluj.ro					
2.4 Year of study	1	2.5 Semester	2	2.6 Assessment		E
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	0	3.3 Laboratory	1	3.3 Project	0	3.3 Practical training	0
3.4 Number of hours per semester	42	of which:	3.5 Course	28	3.6 Seminar	0	3.6 Laboratory	14	3.6 Project	0	3.3 Practical training	0

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	5
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	9
(e) Tutoring	2
(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	General knowledge in Physics, Chemistry and Materials Science and Engineering
4.2 Competence	To synthesise their knowledge concerning the correlation structure-property to solve problems concerning the selection and use of materials and technologies.

5. Requirements (if applicable)

5.1. for the course	N/A
5.2. for the seminar/lab/project	Presence at Technical University of Cluj-Napoca at Materials Science and Engineering Department is mandatory

6. Subject-specific learning outcomes

Professional competencies	• Relates the properties and behaviour of engineering materials to the manufacturing processes used to produce components for mechatronic systems. • Describes and compares the main manufacturing processes covered in the course: metal extraction and refining, production of ferrous alloys, casting, plastic deformation, machining, powder metallurgy, welding, composite manufacturing and additive manufacturing. • Identifies factors that influence the choice of a material and a manufacturing process for a component, including geometry, required properties, production volume, quality and cost. • Performs basic laboratory tests and measurements concerning the mechanical and technological properties of materials, following the prescribed procedures. • Records and interprets laboratory results and recognises the purpose and limitations of the non-destructive testing methods introduced in the course.
Transversal competencies	• Application of ethical principles and professional standards in engineering activities. • Effective communication and teamwork in multidisciplinary environments. • Critical thinking and problem-solving abilities in materials and manufacturing engineering. • Awareness of quality, safety and sustainability requirements in industrial processes. • Ability to independently acquire and update professional knowledge.

7. Expected learning outcomes

Knowledge	After completing the course, students will be able to: • describes the relationships between material structure, properties, and manufacturing technologies; • explains the principles of casting, metal forming, powder metallurgy, and welding processes; • identifies the main mechanical and technological properties of engineering materials; • describes destructive and non-destructive methods used for materials characterization; • explains the criteria used for selecting engineering materials and manufacturing processes.
Skills	Students will be able to: • carry out the prescribed laboratory tests and activities under supervision, using equipment and specimens correctly; • record measurements, perform basic calculations and present experimental results in a laboratory report; • interpret results from mechanical tests and relate them to material behaviour and potential applications; • compare basic manufacturing options for a given component using its material, shape, required properties and production requirements; • identify a suitable non-destructive testing approach for a simple inspection task and explain what information it can provide.

Responsibility and autonomy	Students will be able to: • complies with safety regulations and good laboratory practices during experimental activities; • assumes responsibility for selecting appropriate materials and manufacturing processes; • collaborates effectively within multidisciplinary engineering teams; • evaluates engineering solutions considering technical, economic, and quality requirements; • works independently to acquire and apply knowledge for solving practical engineering problems

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

8.1 General objective of the discipline	To provide students with fundamental knowledge regarding engineering materials, their properties and characterization methods, and to develop the ability to select and correlate materials with appropriate manufacturing technologies and industrial applications.
8.2 Specific objectives	Upon successful completion of the course, the student: • explain the main stages through which raw materials are transformed into metals and alloys; • describe and compare the manufacturing processes presented in the course, including their applications and principal limitations; • relate a component's material, geometry and functional requirements to feasible manufacturing processes; • perform the prescribed mechanical and technological laboratory activities safely and correctly; • record, analyse and report experimental data, drawing conclusions supported by the results; • explain how destructive tests and non-destructive testing contribute to the assessment of materials and manufactured components; • make and justify an introductory choice of material and manufacturing process for a simple component relevant to mechatronics.

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
Materials Technology: Fundamental Concepts	2	Interactive lectures supported by multimedia resources, heuristic discussions, conceptual explanations and case studies, using digital learning platforms.	Multimedia Blackboard
From Natural Resources to Metals and Alloys: Extraction and Refining	2		
Production of Ferrous Alloys	4		
Casting of Metals and Alloys	4		
Shaping Materials by Plastic Deformation	4		
Machining: From Stock Material to Finished Part	2		
Manufacturing Parts from Metal Powders	2		
Welding and Related Processes	2		
Manufacturing Technologies for Composite Parts	2		
Introduction to Additive Manufacturing	2		
Non-Destructive Testing Techniques	2		

9.1 Course	No. of hours	Teaching methods	Notes
Bibliography [1]. Callister, W.D., Rethwisch, D.G., *Materials Science and Engineering: An Introduction*, 10th Edition, John Wiley & Sons, Hoboken, NJ, USA, 2018. [2]. Mikell P. Groover, Fundamentals of Modern Manufacturing. Materials, Processes, and Systems, 4th edition, Willey, 2010 [3]. KALPAKJAN, S. - Manufacturing Processes for Engineering Materials, Addison –Wesley Publ.Co, NY, 1993. [4]. Neamtu, B.V. – Learning Materials Processing – The Technology Behind Everyday Products, U.T. Press, Cluj-Napoca, Romania, 2025, ISBN 978-606-737-795-8 (available online). [5]. G. Thalmaier, B. V. Neamțu, Materials Technology: Course Materials (Romanian and English), 2026, available online. [6]. NANU, A. - Tehnologie mecanică, Ed. III, EDP, Bucureşti, 1997.			

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
Tensile and compression test of materials	2	Experimental demonstrations, guided practical activities, learning through experimentation, analysis and interpretation of results, supported by formative assessment.	
Shear, bending and Charpy impact test	2		
Determination of the materials hardness	2		
Sand casting	2		
Technological properties of metallic powders.	2		
Determination of workability by plastic deformation of metallic materials	2		
Non-destructive testing of materials.	2		
Bibliography 1. BRANDUŞAN, L., PAVEL, C., MUREŞAN, R. - Îndrumător pentru lucrări de laborator la Tehnologia materialelor, UT Pres, 1994. 2. Different national and international standards.			

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

The course contents are consistent with the expectations of the academic community, professional associations, research institutions, and employers in the field of materials engineering. The knowledge and competencies acquired enable students to select engineering materials, analyse manufacturing technologies, perform materials characterization, and evaluate engineering solutions for industrial applications. The course reflects current trends in advanced manufacturing, quality assurance, sustainability, and technological innovation, ensuring the relevance of the acquired competencies to the needs of the labour market.

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	Understanding of the topic. Ability to solve problems. Final verification of knowledge.	Written test (C) - 2 hours	80%

11.5 Seminar/Laboratory /Project / Practical training	Achievement of the practical tasks. Tests during the semester	Reports, Written test - L	20%
11.6 Minimum performance standard			

Completion date:	**Faculty members**	**academic rank, title, First Name SURNAME**	**Signature**
25.05.2026	Course	Assoc.prof. Bogdan Viorel NEAMTU	
	Practical activities	Assist.prof. Gabriel BATIN	

Avizul Directorului departamentului care coordonează disciplina, doar dacă acesta diferă de departamentul organizator al programului de studii	Director Departament SIM Conf.dr.ing. Traian Florin MARINCA

Date of approval by the Department Council 28.05.2026	Head of Department MDM Prof.dr.ing. Mircea BARA
Date of approval by the Faculty Council ARMM 16.09.2026	Dean, Prof.dr.ing. Nicolae FILIP