

SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-Bolyai University of Cluj-Napoca
1.2 Faculty	Environmental Science and Engineering
1.3 Department	Environmental Analysis and Assessment
1.4 Field of study	Environmental Engineering
1.5 Study cycle	Bachelor
1.6 Study programme / Qualification	Environmental Engineering

2. Information regarding the discipline

2.1 Name of the discipline	Materials Science						
2.2 Course coordinator	Prof.dr.ing. Cristina Rosu						
2.3 Seminar coordinator	Prof.dr.ing. Cristina Rosu						
2.4 Year of study	2	2.5 Semester	4	2.6. Type of evaluation	E	2.7 Type of discipline	Mandatory

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					12
Additional documentation (in libraries, on electronic platforms, field documentation)					12
Preparation for seminars/labs, homework, papers, portfolios and essays					12
Tutorship					4
Evaluations					2
Other activities:					
3.7 Total individual study hours	42				
3.8 Total hours per semester	98				
3.9 Number of ECTS credits	4				

4. Prerequisites (if necessary)

4.1 curriculum	
4.2 competencies	Basic notions of chemistry and physics, information and documentation, team work, computer use

5. Conditions (if necessary)

5.1. for the course	Classroom of 25-30 seats with video projector
5.2. for the seminar /lab activities	Laboratory E.2.5 (40 sqm – max.15 students/group) equipped with water, electricity, glassware and laboratory reagents. Gown, goggles and protective gloves.

6. Specific competencies acquired

Professional competencies	• Application of notions in the field of materials science and engineering • Explanation and interpretation of properties, concepts, approaches, models and notions regarding materials science and engineering • Recognition and description of a material (type of chemical bond, mechanical and physical properties, obtainment, uses, etc.)
Transversal competencies	• Identification of roles and responsibilities in a multidisciplinary team and application of relationship techniques and efficient work within the team • Efficient use of information sources and resources for communication and assisted professional training (portals, Internet, specialized software applications, databases, online courses, etc.) both in Romanian and in an international language

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Knowing, understanding, explaining and interpreting the properties of materials and how to investigate them • Understanding how technological processes can harm the environment
7.2 Specific objective of the discipline	• Recognition of materials using their properties and methods of investigation • Investigation of the characteristics and properties of materials using laboratory methods and equipment

8. Content

8.1 Course	Teaching methods	Remarks
C 1 – Introduction to materials science (definitions, relationship with other branches of technical sciences, correlation composition-structure-properties-uses).	Interactive lecture	Attendance at the course is optional, but it is recommended to attend at least 5 attendees at the course.
C 2 – Structure of the atom and electronic configurations	Lecture	
C 3 – Structure of materials (chemical bonds: ionic, covalent, metallic and physical bonds)	Lecture	
C 4 – Crystal lattices, crystal lattice defects, microstructure, allotropy, polymorphism, isomorphism	Lecture	
C 5 - General properties of materials (physical, mechanical and technological properties).	Problematization	
C 6 – Metallic materials (structure, properties, obtainment, uses, environmental impact)	Problem-based learning	
C 7 – Ferrous metal alloys (structure, properties, obtainment, uses, environmental impact).	Presentation of case studies	
C 8 – Non-ferrous metal alloys (structure, properties, obtainment, uses, environmental impact).	Presentation of case studies	
C 9 – Ceramic, vitreous and binders (structure, properties, obtainability, uses, environmental impact)	Presentation of case studies	
C 10 – Polymeric materials (structure, properties, obtainment, uses, environmental impact)	Presentation of case studies	
C 11 – Composite materials (structure, properties, obtainment, uses, environmental impact).	Presentation of case studies	

C 12 – Biomaterials / eco-materials (structure, properties, procurement, uses, environmental impact).	Presentation of case studies	
C 13 – Corrosion of materials. Case study: metallic materials and their alloys	Presentation of case studies	
C 14 – Review and Exam Preparation		
Bibliography 1. Cristina Rosu, „ <i>Stiinta si ingineria materialelor</i> „, suport electronic de cursuri (site-ul facultatii), editia 2020 si 2022 2. Daniela Lucia Manea, <i>Materiale speciale pentru constructii</i> , UTPRESS, Cluj-Napoca 2011		
8.2 Seminar 1 h / week	Teaching methods	Remarks
S 1 – Organization of seminar teaching activities.	Conversation	Attendance at seminar activities is 80% MANDATORY
S 2 – Electronic configurations (theoretical recapitulation)	Exercises and problems	
S 3 – Ionic chemical bond and percentage of ionic bond	Exercises and problems	Topic 1 (T 1)
S 4 – Covalent chemical bond	Exercises and problems	
S 5 – Metal Tie	Exercises and problems	
S 6 – Coordination link	Exercises and problems	
S 7 – Crystal lattices and types of defects	Exercises and problems	
S 8 - Crystal lattices and density of a material	Exercises and problems	Topic 2 (T 2)
S 9 – Mechanical properties of materials	Exercises and problems	
S 10 – Absolute, apparent and bulk volume for various materials	Exercises and problems	
S 11 – Elongation and hardness for various materials	Exercises and problems	Topic 3 (T 3)
S 12 – Absolute, apparent and bulk density for various materials	Exercises and problems	Topic 4 (T 4)
S 13 - Material moisture / water absorption	Exercises and problems	Topic 5 (T 5)
S 14 – Recap: Teaching the 5 Solved Assignments		
8.3. Laboratory 2 h / week		
L 1 - Norms of labor protection in the laboratory of materials science.	Conversation	Attendance at laboratory activities is 90% MANDATORY
L 2 – Determination of density (absolute and apparent) for various materials	Individual student experiment	Lab Sheet 1 (FL 1)
L 3 – Determination of humidity (absolute and relative) for various materials	Individual student experiment	Lab Sheet 2 (FL 2)
L 4 - Behavior of various materials in relation to freshwater – water absorption / voids volume	Individual student experiment	Lab worksheet 3 (FL 3)
L 5 - Behavior of various materials in relation to saline water – water absorption / voids volume	Individual student experiment	Lab Sheet 4 (FL 4)
L 6 – Behavior of various materials in relation to inorganic acid corrosive solutions. Calculation of corrosion rate	Individual student experiment	Lab Sheet 5 (FL 5)
L 7 - Behavior of various materials against organic	Individual student experiment	Lab worksheet 6 (FL 6)

acid corrosive solutions. Calculation of corrosion rate		
L 8 – Behavior of various materials in relation to inorganic basic corrosive solutions. Calculation of the corrosion velocity	Individual student experiment	Lab Sheet 7 (FL 7)
L 9 - Behavior of various materials in relation to organic basic corrosive solutions. Calculation of the corrosion velocity	Individual student experiment	Lab worksheet 8 (FL 8)
L 10 – Industrial Wastewater Copper Recovery	Individual student experiment	Lab Sheet 9 (FL 9)
L 11 - Industrial Wastewater Nickel Recovery	Individual student experiment	Lab worksheet 10 (FL 10)
L 12 – Completion of previous practical work (measurement of final experimental data)	L4, L5, L6, L7, L8, L9, L10 and L11	
L 13 – Recovery of max. one practical work / student	Individual student experiment	
L 14 – LABORATORY COLLOQUIUM		Lab grade = arithmetic average of the 10 lab sheets
Bibliography 1.Cristina Roșu, „ <i>Indrumar de seminar si de lucrari practice de laborator de stiinta materialelor</i> ” suport de lucrari practice de laborator (format electronic) pe site-ul facultatii, editia 2020 si 2022 2. Alexandru Netea, Daniela Manea, Claudiu Aciu, <i>Materiale de constructii si chimie aplicata</i> , UTPRESS, Cluj-Napoca 2010		

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The course, seminar and practical work present many examples of calculation and exercises with the aim of familiarizing students with the characterization and identification of the chemical behavior of various materials.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Theoretical knowledge gained	Oral exam	40 %
10.4 Course	10 practical laboratory papers	Each practical laboratory work has a laboratory sheet, which must be completed with the individual experimental data + the calculations/interpretation results for each experiment	40 %
	5 seminar topics	There will be five topics with individual problems to solve	20 %
10.6 Minimum performance standards			
- Participation in at least 90% of the practical laboratory work and timely delivery of the 10 laboratory sheets (individual practical work). - Participation in at least 80% of the seminars and timely delivery of the 5 seminar topics.			

Date

Signature of course coordinator

Signature of seminar coordinator

20.11.2024



Date of approval

Signature of the head of department

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