SYLLABUS

Approved,
DEAN
Prof. univ. dr. ing. Gilbert-Rainer Gillich

1. Program Data

1.1. Institution of Higher Education	**Babeș-Bolyai University**
1.2. Faculty	**Faculty of Engineering**
1.3. Department	**Department of Engineering Science**
1.4. Field of Study	**Electrical Engineering**
1.5. Course of Study	**Bachelor**
1.6. Study Program	**Electromechanics**

2. Discipline Data

2.1. Discipline Name			**Electrotechnical materials**				
2.2. Course Coordinator			Univ. Prof. Dr. Eng. Doina Frunzăverde				
2.3.1. Seminary Coordinator			-				
2.3.2. Laboratory Coordinator			Univ. Prof. Dr. Eng. Doina Frunzăverde				
2.3.3. Project Coordinator			-				
2.4. Year of Study	II	2.5. Semester	I	2.6. Evaluation Type	E	2.7. Discipline Regime	Obl

3. Estimated Total Time (hours per semester of teaching activities)

3.1. Number of Hours per Week	**4**	from which: 3.2. Course	**2**	3.3. Laboratory	**2**
3.4. Total Hours from the Curriculum Plan	**56**	from which: 3.5. Course	**28**	3.6. Laboratory	**28**
Time fund distribution - hours					**44**
Study of handbook, course materials, bibliography & notes					28
Additional documentation in library, on special E-learning platforms & on site					-
Preparation of seminaries/laboratories/ projects, topics, reports, portfolios & essays					14
Mentoring					-
Examination					2
Other activities					-
3.7. Total Time of Individual Study	**44**				
3.8. Total Hours per Semester	**100**				
3.9. Number of Credits	**4**				

4. Pre-conditions (where is the case)

4.1. of Curriculum	• Not the case
4.2. of Competences	• Not the case

5. Conditions (where is the case)

5.1. of Course Progress	• Course support in electronic format; • Classroom equipped with blackboard, computer and overhead projector.
5.2.2. of Laboratory Progress	• Laboratory support in electronic format; • Classroom with access to the water network, equipped with PC and laboratory equipment

6. Acquired Specific Competences

Professional Competences	• PC1: Application and adequacy of specific knowledge of mathematics, physics, informatics in the field of electrical engineering; • PC2: Operating with specialized concepts in the field of computer and information technology; • PC6: Organizing the maintenance activities for the electromechanical systems.
Transversal Competences	• TC1: Identification of the objectives to be achieved, the available resources, the conditions for their completion, the work stages, the related deadlines and risks; • TC2: Identify roles and responsibilities in a multidisciplinary team and apply effective relationship and work techniques within the team; • TC3: Efficient use of information resources and assisted communication and training resources (internet portals, specialized software applications, databases, online courses, etc.) both in Romanian and in a language of international circulation.

7. Discipline Objectives (coming out from the Checklist of Acquired Specific Competences)

7.1. General Objective of Discipline	• knowledge of the structure and properties of materials used in electrical engineering; • developing the ability to collaborate in a team.
7.2. Specific Objectives	• knowledge of the crystalline structure of metallic materials, of structural defects and their influence on the properties of metallic materials; • knowledge of the material laws governing the behavior of materials used in electrical engineering; • knowledge of the structure and properties of conductive materials; • knowledge of the structure and properties of semiconductor materials; • knowledge of the structure and properties of electrical insulating materials; • knowledge of the structure and properties of magnetic materials; • application of methods for highlighting the structure of materials; • application of methods for measuring electrical conductivity, penetration voltage and magnetic permeability; • developing the competence to work collaboratively; • developing the competence to communicate in the specialized field; • developing the competence of critical reflection.

8. Content

8.1. Course	**Teaching methods**	**Observations**
1. THE CRYSTALLINE STRUCTURE OF METALLIC MATERIALS 1.1. Introduction 1.2. Crystalline systems and networks 1.3. The crystalline structure of metallic materials 1.4. The real structure of the crystals. Network defects (Point defects. Linear defects. Surface defects.)	Lecture	4 hours
2. MATERIAL LAWS IN ELECTRICAL ENGINEERING 1.1. Laws and material parameters 1.2. The law of electrical conduction 1.3. The law of temporary electric polarization 1.4. The law of temporary magnetization	Lecture	4 hours
3. CONDUCTIVE MATERIALS 3.1. Electrical conduction in metals 3.2. Factors influencing the electrical conductivity of metals 3.3. High conductivity materials 3.4. High resistivity materials 3.5. Applications of conductive materials 3.6. Superconducting materials	Lecture	6 hours
4. SEMICONDUCTIVE MATERIALS 4.1. Electrical conduction in semiconductors 4.2. Intrinsic electrical conduction 4.3. Extrinsic electrical conduction 4.4. Factors influencing the conductivity of semiconductors 4.5. Properties and fields of use of semiconductive materials	Lecture	6 hours
5. ELECTRIC INSULATING MATERIALS 5.1. General characteristics 5.2. Electrical conduction processes in electrical insulating materials 5.3. Electrical polarization processes in electrical insulating materials 5.4. Polarization in harmonic electric fields 5.5. Electric breakthrough phenomena	Lecture	4 hours
6. MAGNETIC MATERIALS 6.1. Magnetization state 6.2. Behavior of materials in the external magnetic field 6.3. Experimental methods for studying electrotechnical panels 6.4. Interpretations of the ferrous and ferromagnetic state 6.5. Losses in magnetic materials 6.6. Properties and fields of use of magnetically soft materials	Lecture	4 hours
Bibliography 1. Doina Frunzăverde, *Electrotehnical Materials. Course support for students use (in electronic format), 2020*; 2. Petru V. Notingher, Laurentiu Marius Dumitran, *Materiale electrotehnice*, Editura: Matrixrom, 352 pagini, ISBN:		

9786062500955, 2015 3. Adela Gabriela Husu, Maria Ioana Olariu, Nicolae Olariu, *Materiale electrotehnice*, Editura: Biblioteca, 220 pagini, ISBN: 9789737125217, 2010		
8.2. Laboratory	**Teaching methods**	**Observations**
1. Specific problems of laboratory work safety technique	*I know — I want to know — I found out*	A6
2. Preparation of metallographic samples for microscopic analysis	Experiment	A6
3. Knowledge of the metallographic optical microscope	Experiment	A6
4. Study of the structure of steels	Experiment	A6
5. Study of the structure of copper	Experiment	A6
6. Study of the structure of aluminum	Experiment	
7. Study of the structure of silumines	Experiment	A6
8. Determination of the electrical characteristics of the winding conductors-Part I	Experiment	D12
9. Determination of the electrical characteristics of the winding conductors-Part II	Experiment	D12
10. Determination of the characteristics of solid electrical insulating materials	Experiment	A1.1
11. Determination of the characteristics of electrical insulating oils	Experiment	A1.1
12. Determination of magnetic properties-Part I	Experiment	D12
13. Determination of magnetic properties-Part II	Experiment	D12
14. Completion of the laboratory activity	*Discussion network*	A6
Bibliography 1. Frunzăverde D., Brandl W., *Metalografie practică*, Editura Orizonturi Universitare, Timişoara, 2007; 2. Frunzăverde D., Liuba Ghe., *Electrotehnical Materials. Laboratory support for students use (in electronic format),2020*; 3.Petru V. Notingher, *Materiale pentru electrotehnica. Culegere de probleme*, Editura: Matrixrom, Colectia: Electrotehnica, ISBN: 973685907X; 4. Laurentiu Marius Dumitran, Cristina Stancu, *Sisteme de izolatie. Lucrari de laborator si aplicatii numerice*, Editura: Matrixrom, 102 pagini, ISBN: 9786062501013, 2014		

9. Corroborating the Discipline's Contents with the Expectation of the Epistemic Community Representatives, the Professional Associations and the Employers' Representatives from the Program Corresponding Field

- They have been established with the main employers by previous discussions at the study program substantiation.

10. Evaluation

Type of activity	10.1. Evaluation criteria	10.2. Evaluation methods	10.3. Weight from the final grade
Course	**Student participation in debates** Students' participation in the recapitulative debates at the beginning of each course will be noted	Evaluation along the semester	15%
	Acquired knowledge level	Written exam	70 %
Laboratory	**The level of transversal skills acquired** The student's involvement in solving the problems formulated by the professor will be evaluated, as well as the way in which she/he collaborated and communicated in the team	Evaluation along the semester	5 %
	Gained competence level in practice	Evaluation along the semester	10 %

10.4. Minimum Performance Standard

- The maximum number of **recoverable absences**, motivated or unmotivated, for practical activities (laboratory) is **two absences.** The absences can be recovered, for a fee, until the end of the semester, according to the recovery program established by the laboratory coordinator;
- Completion of the laboratory activities by the minimum grade of 5;
- Completion of the written exam by the minimum grade of 5.

10.5. Recognition of previous activities

- All activities previously performed by students in the same subject (participation in the course/laboratory, successfully promoted assessments) are recognized.

Completion Date: 16.05.2022

Course Coordinator's Signature: .....

Laboratory Coordinator's Signature: .....

Department Endorsement Date: .....

Chief of Department Signature: .....