SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Field of study	**Computers and Information Technology**
1.5 Study cycle	**Undergraduate**
1.6 Study programme / Qualification	**Information Engineering**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)			**Materials for electronics** **Materiale pentru electronică**				
2.2 Course coordinator			**Assoc. Prof. Dr. Habil. Andrei Rotaru**				
2.3 Seminar coordinator			**Assoc. Prof. Dr. Habil. Andrei Rotaru**				
2.4. Year of study	**III**	2.5 Semester	**II**	2.6. Type of evaluation	**C**	2.7 Type of discipline	**Optional DS**
2.8 Code of the discipline		MLE5186					

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 laboratory	2 LP
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					28
Additional documentation (in libraries, on electronic platforms, field documentation)					-
Preparation for seminars/labs, homework, papers, portfolios and essays					11
Tutorship					2
Evaluations					3
Other activities:					-

3.7 Total individual study hours	44
3.8 Total hours per semester	100
3.9 Number of ECTS credits	4

4. Prerequisites (if necessary)

4.1. curriculum	• Not the case.
4.2. competencies	• Not the case.

5. Conditions (if necessary)

5.1. for the course	• Lecture notes in electronic format; • Lecturing room with blackboard, computer and video-projector.
5.2. for the lab activities	• Laboratory notes in electronic format; • Laboratory room with access to the water network, with computer and laboratory equipment.

6. Specific competencies acquired

Professional competencies	C5.1 Appropriate use of the operating principles of electronic devices and circuits, as well as methods of measuring electrical quantities C5.2 Analysing, designing, executing and measuring of electronic circuits of low/ medium complexity C5.3 Diagnosis / troubleshooting of electronic circuits and instruments C5.4 Use of electronic tools to characterize and evaluate the performance of electronic circuits C5.5 Designing electronic circuits of low / medium complexity and implementing them using CAD techniques
Transversal competencies	CT1 Honorable, responsible, ethical behavior, in the spirit of the law, to ensure the professional reputation CT3 Demonstrating initiative and pro-active behavior for updating professional, economical and organizational culture knowledge

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

7.1 General objective of the discipline	• knowledge of the structure and properties of materials used in electronics.
7.2 Specific objective of the discipline	• knowledge of the crystalline structure of metallic materials, structural defects and their influence on the properties of materials; • knowledge of material laws governing the behavior of materials used in electronics; • knowledge of the main types of materials used in electronics: metallic, semimetallic, semiconductor, ceramic and polymeric; • 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	Remarks
1. CRYSTALLINE STRUCTURE OF METAL MATERIALS 1.1. Getting started 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 AND ELECTRONICS 2.1. Laws and material parameters 2.2. The law of electrical conduction 2.3. Law of temporary electric polarization 2.4. 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. SEMICONDUCTOR MATERIALS 4.1. Semiconductor electrical conduction 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 semiconductor materials	Lecture	6 hours
5. ELECTROINSULATING 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. Behaviour of materials in the external magnetic field 6.3. Experimental methods for studying electrical panels 6.4. Interpretations of the ferrous and ferromagnetic state 6.5. Losses in magnetic materials	Lecture	4 hours

6.6. Properties and fields of use of magnetic soft materials		

Bibliography

1. Edward L. Purcell, *Cursul de fizica Berkeley, Electricitate si Magnetism*, Vol II, 1982 – Editura Didactică şi Pedagogică, 1982
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
4. Constantin Stănescu, *Materiale pentru electronică şi electrotehnică*, Editura Universităţii din Piteşti, ISBN: 973-690-617-5, 2006
5. Marius Catalin Criveanu, Andrei Rotaru, *Methodologies for obtaining carburized steels by powder metallurgy*; Capitol in: Advanced Engineering Materials. Recent Developments for Medical, Technological and Industrial Applications, Academica Greifswald, 978-3-940237-38-5, Germania, 50 pags., 2016
6. Andrei Rotaru, *Tetragonal Tungsten Bronzes. Relaxor dielectric niobates-report on a case study*, SITECH, 978-606-11-4970-4, Romania, 192 pags., 2015.

8.2 Laboratory	Teaching methods	Remarks
1. Specific problems of laboratory work safety technique	Presentation	-
2. Preparation of metallographic samples for microscopic analysis. Knowledge of the metallographic optical microscope	Experiment	-
3. Study of the structure of copper	Experiment	-
4. Study of the structure of steels	Experiment	-
5. Study of the structure of metal oxides	Experiment	-
6. Study of the structure of polymers	Experiment	-
7. Thermal and calorimetric analysis of metals	Experiment	-
8. Thermal and calorimetric analysis of polymers	Experiment	-
9. Determining of the electrical characteristics of the winding conductors	Experiment	-
10. Determining the characteristics of solid electrical insulating materials	Experiment	-
11. Determining the characteristics of electrical insulating oils	Experiment	-
12. Determining the magnetic properties-Part I	Experiment	-
13. Determining the magnetic properties-Part II	Experiment	-
14. Evaluation of laboratory activity	Examination	-

Bibliography

1. D. Frunzăverde, W. Brandl, *Metalografie practică*, Editura Orizonturi Universitare, Timişoara, 2007 – îndrumătorul de laborator, în format pdf, se pune la dispoziția studenților în grupul generat pe platforma TEAMS pentru formațiunea de studii;
2. D. Frunzăverde D., G. Liuba, *Materiale electrotehnice. Îndrumar pentru lucrări de laborator,* 2020 (format electronic);
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
5. Marius Catalin Criveanu, Andrei Rotaru, *Methodologies for obtaining carburized steels by powder metallurgy*; Capitol in: Advanced Engineering Materials. Recent Developments for Medical, Technological and Industrial Applications, Academica Greifswald, 978-3-940237-38-5, Germania, 50 pags., 2016

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

- They were established with the main employers in the discussions prior to the substantiation of the study program.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	**The level of transversal skills acquired** Students' participation in the recapitulative debates at the beginning of each course will be marked	Continuous examination	15 %
	The level of specialized knowledge achieved	Written examination	70 %
10.5 Lab activities	**The level of transversal skills acquired** The student's involvement in solving the problems formulated by the teacher will be evaluated, as well as the way in which he collaborated and communicated in the team.	Continuous examination	5 %
	The level of practical skills acquired	Continuous examination	10 %
10.6 Minimum performance standards			
➢ Passing the applicative activities with the mark 5; ➢ Passing the exam with the mark 5.			

Date 24.05.2022.

Signature of course coordinator

Signature of seminar coordinator

Date of approval

24.05.2022

Signature of the head of department

Prof. dr. Laura Dioşan