SYLLABUS

1. Program information

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Bases of Electronics
1.4 Field of study	Electronic engineering, telecommunications and information technologies
1.5 Cycle of study	Bachelor of Science
1.6 Study program / Qualification	Electronic engineering, telecommunications and information technologies/ Engineer
1.7 Form of education	IF – full-time education

2. Course information

2.1 Course title	Materials for Electronics				Course code	18.00
2.2 Course coordinator	*Lect. Alexandra FODOR, Ph.D. – alexandra.fodor@ael.utcluj.ro*					
2.3 Seminar/ laboratory/ project/ practical activity coordinator	*Lect. Ionut CIOCAN, Ph.D. – ionut.ciocan@ael.utcluj.ro*					
2.4 Year of study	II	2.5 Semester	1	2.6 Type of assessment		E
2.7 Course status	Formative category					DD
	Optionality					DOB

3. Estimated total time

3.1 Hours per week	3	of which:	3.2 Lecture	2	3.3 Seminar	0	3.3 Laboratory	1	3.3 Project	0	3.3 Practical training	0
3.4 Hours per semester	42	of which:	3.5 Lecture	28	3.6 Seminar	0	3.6 Laboratory	14	3.6 Project	0	3.3 Practical training	0

3.7 Time distribution (hours per semester) for individual study and assessment:	
(a) Assessment	3
(b) Study using textbook, course materials, bibliography, and notes	24
(c) Additional documentation in the library, on specialized electronic platforms, and in the field	12
(d) Preparation for seminars/laboratories, assignments, reports, portfolios and essays	14
(e) Tutoring	5
(f) Other activities	
3.8 Total hours of individual study and assessment (sum of (3.7(a)...3.7(f))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credits	4.0

4. Prerequisites (where applicable)

4.1 curriculum	
4.2 competencies	Relations and theorems for electric circuits; physics; chemistry;

5. Requirements (where applicable)

5.1. for the development of the lecture	Amphitheatre, projector.
5.2. for the development of the seminar/ laboratory/ project	Laboratory, equipment.

6. Specific competencies acquired

Professional competencies	C1 Use of fundamental elements related to electronic devices, circuits, systems, instrumentation and technology C1.1 Description of the operation of electronic devices and circuits and of the fundamental methods for measuring electrical quantities C1.2 Analysis of low-/medium-complexity electronic circuits and systems for their design and measurement C1.4 Use of electronic instruments and specific methods to characterize and evaluate the performance of electronic circuits and systems C1.5 Design and implementation of low-/medium-complexity electronic circuits using CAD-CAM technologies and standards in the field C4 Design and use of low-complexity hardware and software applications specific to applied electronics C4.1 Definition of the concepts, principles and methods used in: computer programming, high-level and specific languages, CAD techniques for creating electronic modules, microcontrollers, computer-system architecture, programmable electronic systems, graphics and reconfigurable hardware architectures C5 Application of basic knowledge, concepts and methods from: power electronics, automatic systems, electrical energy management and electromagnetic compatibility C5.1 Definition of the specific elements that characterize electronic devices and circuits in the fields of: power electronics, automatic systems, electrical energy management, medical electronics, automotive electronics and consumer goods C5.2 Qualitative and quantitative interpretation of the operation of circuits in the fields of: power electronics, automatic systems, electrical energy management, medical electronics, automotive electronics and consumer goods; analysis of operation from the standpoint of electromagnetic compatibility C6 Solving technological problems in the fields of applied electronics C6.1 Definition of the principles and methods underlying the manufacture, adjustment, testing and troubleshooting of devices and equipment in the fields of applied electronics C6.5 Design of manufacturing and maintenance technology (specifying the necessary components and operations) for low- and medium-complexity products in the fields of applied electronics

Transversal competencie	

7. Expected learning outcomes

Knowledge	- The student/graduate describes, identifies and summarizes elementary concepts and methods related to electronic devices, circuits and instrumentation, as well as their application in concrete problems.
Skills	- The student/graduate uses fundamental methods for measuring electrical quantities and assesses electronic devices and circuits, as well as linear and digital integrated circuits of low/medium complexity. - The student/graduate design, measures, evaluates performance, diagnoses and troubleshoots functional blocks composed of low/medium-complexity electronic devices and/or circuits.
Responsibility and autonomy	- The student/graduate carries out project management processes in electronics, telecommunications and information technologies, taking on different team roles and clearly and concisely describing the results, both orally and in writing.

8. Course objectives (based on the grid of specific competencies acquired)

8.1 General objective of the course	Development of competences in the field of materials used in electronics.
8.2 Specific objectives	1. Assimilation of theoretical knowledge regarding the materials used in electronics. 2. Acquiring skills for the use of laboratory equipment.

9. Contents

9.1 Lecture	**No. of hours**	**Teaching methods**	**Remarks**
1. Course description. An overview of electronic materials.	2	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative	Use of .ppt presentation, projector, blackboard
2. Matter structure and bonding	2		
3. Electronic band theory of solids	2		
4. Classification of materials - conductors, insulators, semiconductors	2		
5. Dielectric materials – definitions, classifications and general aspects	2		
6. Fundamental properties of dielectrics	2		
7. Applications of dielectrics	2		

9.1 Lecture	No. of hours	Teaching methods	Remarks
8. Breakdown of dielectrics. Dielectric materials used in electronics.	2		
9. Semiconductor materials – definitions, classifications and general aspects	2		
10. Intrinsic semiconductors	2		
11. Extrinsic semiconductors	2		
12. PN junction. Some semiconductors used in electronics.	2		
13. Conductors	2		
14. Magnetic materials. Preparation for the final exam.	2		

Bibliography
1. Fărcaş Cristian – Materiale pentru electronică, Ed. Risoprint, Cluj-Napoca, 2009
2. Angus Rockett - The Materials Science of Semiconductors, 2008.
3. William D Callister, Jr David G Rethwish - Materials Science and Engineering An Introduction, 2018.
4. Jaeger, Richard C Travis N Blalock, Microelectronic circuit design 4 th ed., 2010.
5. Ashcroft, N W and Mermin N D Solid State Physics, Saunders, 1976

9.2 Seminar /laboratory /project /practical training	No. of hours	Teaching methods	Remarks
1. Introduction. Labour protection	2	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, white/
2. Electrical conductor materials	2		
3. Ferromagnetic materials	2		
4. Solid dielectric materials	2		
5. P-N junction barrier capacitance	2		
6. Temperature dependence of resistivity (conductors and semiconductors)	2		
7. Lab recovery and finalization of laboratory activity	2		

Bibliography
1. Fărcaş Cristian – Materiale pentru electronică, Ed. Risoprint, Cluj-Napoca, 2009
2. Creţ Rodica – Materiale pentru electronică, U.T. Press, Cluj-Napoca, 2004
3. Pitică Dan, Radu Mihaela - Componente electronice pasive, Litografia UTC-N, 1994
4. Schroder D. – Semiconductor Material and Device Characterization, John Wiley & Sons, 2006
5. Yu P., Cardona M. – Fundamentals of Semiconductors. Physics and Materials Properties, Springer, 2010.
6. Pop V., Chicinaş, Jumate N. – Fizica materialelor. Metode experimentale, Presa Universitară Clujeană, 2001
7. Drăgulinescu M., Manea, A., Materiale pentru electronică, Ed. Matrix Rom, Bucureşti, 2002.
8. Noţingher, P., Materiale pentru electrotehnică, Ed. Politehnica Press, Bucureşti, 2005.
9. Popovic, R.S., Hall Effect Devices - 2nd ed., Bristol; Philadelphia: Institute of Physics, 2004.
10. Zeghbroeck, B., Principles of Semiconductor Devices and Heterojunctions, Paperback - Nov 25, 2008.

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

The course content and the teaching-learning-assessment methods are aligned with the current requirements of the Electronics, Telecommunications, and Information Technology Engineering field, considering the expectations of the academic and professional community, representative employers, as well as the national quality assurance standards in higher education. The course helps prepare students in line with employer expectations and the quality requirements set for engineering study programs.

11. Assessment

Activity type	**11.1 Assessment criteria**	**11.2 Assessment methods** (and type of assessment: continuous/ summative)	**11.3 Weight in final grade**
11.4 Lecture	The level of acquired theoretical knowledge and practical skills	Summative evaluation written exam (theory and problems)	80%
11.5 Seminar/ Laboratory/ Project /Practical activity	The level of acquired knowledge and abilities	- Continuous formative evaluation - practical lab test	20%
11.6 Minimum performance standard **Quality level:** Minimal knowledge: ✓ Knowledge of the main properties of conductive, semiconductor, insulating and magnetic materials. ✓ Knowledge of the main materials used in electronics. Minimal competences: ✓ To be able to list the main properties of materials used in electronics. ✓ To be able to specify the main advantages and disadvantages of the materials used in electronics. **Quantitative level:** ✓ To perform all laboratory work. ✓ The exam and laboratory marks must be at least 5. The final mark for the subject is calculated with the relation: 0.8 * Exam mark + 0.2 * Lab mark			

Completion date:	**Course coordinators**	**teaching rank, title First name LAST NAME**	**Signature**
23.06.2026	Lecture	Lect. Alexandra FODOR, Ph.D.	
	Applications	Lect. Ionut CIOCAN, Ph.D.	

Approval of the Head of the Department coordinating the course, only if this differs from the department organizing the study program	Head of the Applied Electronics Department Prof. Dorin PETREUȘ, Ph.D.

Date of approval by the Council of the Department of Bases of Electronics 26.06.2026	Head of the Bases of Electronics Department Prof. Sorin HINTEA, Ph.D.
Date of approval by the Council of the Faculty of Electronics, Telecommunications and Information Technology 30.06.2026	Dean, Prof. Ovidiu-Aurel POP, Ph.D.