SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Applied Electronics
1.4 Field of study	Electronic Engineering, Telecommunications and Information Technologies
1.5 Cycle of study	Bachelor of Science
1.6 Program of study / Qualification	Applied Electronics / Engineer
1.7 Form of education	Full time
1.8 Subject code	18.00

2. Data about the subject

2.1 Subject name	**Materials for Electronics**						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Lecturer Alexandra Fodor, PhD eng.						
2.4 Teacher in charge with seminar / laboratory / project	Lecturer Ionuţ Ciocan, PhD eng.						
2.5 Year of study	II	2.6 Semester	1	2.7 Assessment	E	2.8 Subject category	DID/DI

3. Estimated total time

3.1 Number of hours per week	3	of which: 3.2 course	2	3.3 seminar / laboratory	1
3.4 To Total hours in the curriculum	100	of which: 3.5 course	28	3.6 seminar / laboratory	14

Distribution of time	hours
Manual, lecture material and notes, bibliography	24
Supplementary study in the library, online specialized platforms and in the field	12
Preparation for seminars / laboratories, homework, reports, portfolios and essays	14
Tutoring	5
Exams and tests	3
Other activities:	

3.7 Total hours of individual study	58
3.8 Total hours per semester	100
3.9 Number of credit points	4

4. Pre-requisites (where appropriate)

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

5. Requirements (where appropriate)

5.1. for the course	Amphitheatre, Cluj-Napoca

5.2. for the seminars / laboratories / projects	Laboratory, Cluj-Napoca

6. Specific competences

Professional competences	C1 - To use the fundamental elements regarding electronic devices, circuits, systems, instrumentation and technology C4 - To design and use low complexity hardware and software applications, specific to applied electronics C5 - To apply knowledge, concepts and basic methods from power electronics, automated systems, electric energy management, electromagnetic compatibility C6 - To solve technological problems, specific to applied electronics
Cross competences	

7. Discipline objectives (as results from the key competences gained)

7.1 General objective	Development of competences in the field of materials used in electronics.
7.2 Specific objectives	1. Assimilation of theoretical knowledge regarding the materials used in electronics. 2. Aquiring skills for the use of laboratory equipments.

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
Course description. An overview of electronic materials.	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
Matter structure and bonding		
Dipole moment. Metallic bond		
Band theory of solids. Materials classification		
Dielectric materials. Classification		
Dielectric materials. Properties		
Dielectric breakdown. Dielectric materials used in electronics		
Semiconductor materials. Classification		
Semiconductor materials. Properties		
Semiconductor applications		
PN junction. Semiconductors used in electronics.		
Conductor materials. Properties		
Conductor materials. Applications		
Magnetic materials. Preparation for the final exam.		
Bibliography		

8.2 Seminar / laboratory / project	Teaching methods	Notes
Introduction. Labour protection	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, white/ magnetic
Electrical conductor materials		
Ferromagnetic materials		
Solid dielectric materials		
P-N junction barrier capacitance		
Temperature dependence of resistivity (conductors and semiconductors)		
Lab recovery and finalization of laboratory activity		

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. James F. Shackelford – Introduction to Materials Science for Engineers, 8th edition, Pearson, 2014.
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. William D. Callister, Jr., David G. Rethwish - Materials Science and Engineering - An Introduction, Wiley, 2018.
10. Angus Rockett, The Materials Science of Semiconductors, Springer, 2008.

9. Bridging course contents with the expectations of the representatives of the community, professional associations, and employers in the field

The discipline content and the acquired skills agree with the expectations of the professional organizations and the employers in the field, where the students carry out the internship stages and/or occupy a job (in the field of *electronics and telecommunications engineering*), and the expectations of the national organization for quality assurance (ARACIS).

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The level of acquired theoretical knowledge and practical skills	Summative evaluation written exam (theory and problems)	80%
10.5 Seminar/ Laboratory	The level of acquired knowledge and abilities	- Continuous formative evaluation - practical lab test	20%
10.6 Minimum standard of performance			

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 works*
- ✓ *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*

Date of filling in:	Responsible	Title Surname NAME	Signature
21.09.2022	Course	Lecturer Alexandra Fodor, PhD eng	
	Applications	Lecturer Ionuţ CIOCAN, PhD eng	

Date of approval in the Department of ……..

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Head of Department
Prof. Dorin PETREUŞ, PhD eng

Date of approval in the Council of Faculty of Electronics, Telecommunications, and Information Technology

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Dean
Prof.Ovidiu Aurel POP, PhD eng